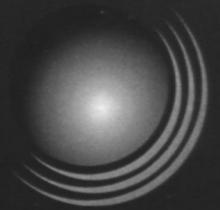


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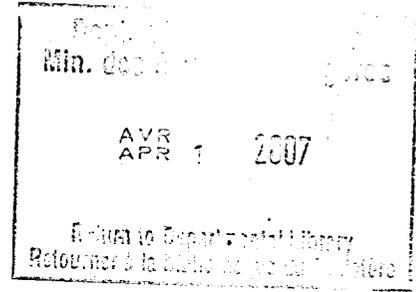


Weapons of Mass Destruction Verification and Compliance: The State of Play, Challenges, and Responses

ISROP
INTERNATIONAL
SECURITY
RESEARCH AND
OUTREACH
PROGRAMME



PRISI
PROGRAMME
DE RECHERCHE ET
D'INFORMATION
DANS LE DOMAINE
DE LA SÉCURITÉ
INTERNATIONALE



**WEAPONS OF MASS DESTRUCTION
VERIFICATION AND COMPLIANCE:
THE STATE OF PLAY, CHALLENGES,
AND RESPONSES**

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A research study prepared for the
International Security Bureau of the Department of Foreign Affairs

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PREFACE

This volume represents a two-part study by the International Security Research and Outreach Programme (ISROP) within Foreign Affairs Canada in the field of verification and compliance. This study proceeds from the explicit assumption that the verification of and compliance with WMD prohibitions and restrictions matters a great deal to the dynamics of the current international security environment. Indeed, the role this cross-cutting set of issues has come to play in global politics suggests that the accurate and reliable determination of 'who does or does not have weapons of mass destruction capabilities and programmes', and what this means in terms of their international obligations and commitments, will be a subject of great importance and attention for the foreseeable future.

The first part of the study entitled *WMD Verification and Compliance: The State of Play* (October 2004) was completed for ISROP by the Verification Research, Training and Information Centre (VERTIC). The experts engaged in producing this study include Dr. Trevor Findlay with Mr. Erik Asplund, Mr. Andreas Persbo and Ms. Angela Woodward. It was designed to provide a baseline analysis of the principal WMD agreements and the mechanisms by which compliance with their obligations is verified and, when required, suspected and verified non-compliance issues are resolved.

Building on VERTIC's analysis, the second portion of the study entitled *Weapons of Mass Destruction Verification and Compliance: Challenges and Responses* (November 2004), was commissioned from 59 Canadian and international experts by ISROP and addresses two forward looking questions. What are the challenges currently facing our WMD verification and compliance mechanisms? What are some of the practical and potentially achievable responses to these challenges? To develop responses to these questions, ISROP utilized an integrated consultation process which combined an expert questionnaire of 72 questions on general WMD-related verification and compliance issues, nuclear and radiological-, chemical-, and biological weapons verification and compliance issues, and missile verification and compliance issues. Following the questionnaire, a series of 5 conference calls took place and a two-day workshop with approximately 20 Canadian and international government and non-government experts was held. Details on the expert participants in this study and the methodology used to seek their views on these issues are provided in Annex A. A summary of the expert questionnaire results is provided in Annex B.

The findings from both parts of this study were presented to the third meeting of the Weapons of Mass Destruction Commission (WMDC) in Vancouver, Canada in November 2004. For further information on the WMDC or VERTIC, visit <http://www.wmdcommission.org> or <http://www.vertic.org>.

The ISROP would like to thank the many Canadian and international experts who contributed to this study, in particular, those who played a central role in its development, execution and final production: **Dr. Jane Boulden**, Canada Research Chair in International Relations and Security Studies, Royal Military College of Canada; **Dr. Trevor Findlay**, Executive Director, Verification Research, Training and Information Centre; **Ms. Rita Grossman-Vermaas**, Research Associate, International Security Research and Outreach Programme, Non-Proliferation, Arms Control and Disarmament Division, Foreign Affairs Canada; and **Dr. James Keeley**, Associate Professor of Political Science, Centre for Military and Strategic Studies, University of Calgary.

The analysis and recommendations of this two-part study do not necessarily reflect the views of the Government of Canada or Foreign Affairs Canada.

EXECUTIVE SUMMARY

I -WMD VERIFICATION AND COMPLIANCE: THE STATE OF PLAY

The following study considers the current state of play of verification and compliance arrangements in respect of multilateral arms control and disarmament agreements relating to so-called weapons of mass destruction (WMD). It covers the principal WMD agreements and the means by which compliance with them is monitored and verified, along with the means by which compliance is ensured in case of a suspected violation. It will provide a snapshot of the current state of the art and science of verification and compliance not just for its own sake, but as background to consideration of future needs in the evolving international security environment.

It is assumed that WMD comprise nuclear, radiological, chemical and biological weapons and their means of delivery. The study does not deal with export/import controls on WMD or their components, international controls on ballistic or other types of missiles, or multilateral treaties dealing with the deployment of weapons in outer space.

Verification

Verification is the process of gathering and analyzing information to make a judgement about compliance or non-compliance with a treaty or agreement. It aims to build trust between the parties or participants, assuring them that their agreement is being implemented effectively and fairly. Verification achieves its objectives by three means: detection; deterrence; and confidence-building. Monitoring, which is sometimes equated with verification, is in this study meant to refer to the technical process of gathering information, whether by technology or by humans.

Compliance

When a party is abiding by its obligations under an agreement it is said to be in compliance. 'Compliance' is also used to describe the process used to deal with questions relating to compliance and non-compliance, which, for some, runs the whole spectrum from monitoring at one end through to attempts to enforce compliance at the other. A compliance process should enable parties to successfully address all types of compliance issues and be able to take action or recommend the taking of action to deal with them.

The relationship between verification and compliance

Verification and compliance processes cannot always be clearly separated. A verification mechanism may be used to verify ongoing compliance by parties. It should also be able to inform or trigger a compliance process, as well as providing information to confirm or refute an allegation of non-compliance.

Above all, verification and compliance processes should be mutually reinforcing. If conducted well, they should give states increasing levels of confidence about treaty implementation and about the commitment of other parties to the fulfillment of their obligations. As in the case of an effective

verification system, the existence of a credible compliance system can be an incentive to states to join a treaty (although in a small number of cases it may be a disincentive).

Multilateral WMD verification is currently better governed, organized, funded and supported by the requisite technical and technological means than ever before. Enormous advances have been made since 1972, when the NPT, the first major multilateral WMD treaty with a matching verification system, entered into force. Compliance mechanisms for multilateral WMD regimes, in contrast, are underdeveloped, untested and subject to doubt and confusion. There remains much work to be done to clarify how non-compliance cases should be dealt with and to broaden the range of incentives and disincentives that may be employed to bring a recalcitrant state back into compliance.

The regimes

Multilateral WMD verification today is a substantial international enterprise. Recurrent annual expenditure on multilateral verification currently totals more than \$300 million. More than 3,000 people are employed by international verification bodies, not counting the hundreds more employed by national implementing authorities and regional organizations. The number of full-time arms control/disarmament inspectors employed by multilateral agencies exceeds 700, while a further 380 are on UNMOVIC's roster (in addition to a notional number on the roster of the UN Secretary-General for CBW use investigations).

The great lacuna here is BW: attempts to provide the BWC with a verification agency have failed utterly. Only UNMOVIC has anything approaching what would be needed for BW and it is mandated only to deal with Iraq, while the UN Secretary-General's mechanism is hyper-virtual. Without strong US support and advocacy there is currently no prospect of this situation changing dramatically despite the earnest discussion among BWC states parties.

Governance and organization

Much has been learned by now about the organizational structures required for effective verification, especially when a comprehensive system is envisaged. There is now a standard model of a conference of states parties, an executive body and a technical secretariat, including where necessary a standing inspectorate. International verification organizations still, however, rarely adopt best management practices, as used in business or in the more effective national governments. There would appear to be no a priori reason why the highest managerial standards—including those relating to finance and human resources—should not be expected of our verification systems. International security is too important to be waylaid by distracting organizational problems that have ready solutions.

Funding

The question of the funding of verification is perennially fraught. While no one expects verification systems to be given a blank cheque, verification cannot be expected to be done on the cheap lest it discredit the whole enterprise. All of the multilateral verification organizations are experiencing funding challenges as more effective and intrusive verification is demanded of them and

technological possibilities grow. Verification regimes themselves, where possible, should seek for new funding possibilities, including foundations and commercial spin-offs.

Techniques and technologies

The extent to which the latest and most appropriate techniques and technologies can be used in multilateral verification systems is, perhaps surprisingly, often controversial. To begin with, there is always a trade-off between effectiveness and cost. States parties will naturally want to keep the costs of verification as low as possible, while still giving the verification system the requisite degree of credibility.

Another difficulty is that verification technology can be so specialised that it must be researched and developed by verification bodies themselves: no commercial company will invest in research for such a limited market and potentially low profit. This can be a heavy burden on verification organisations, although creative partnerships with universities and less commercially-driven organisations should be possible.

National technical and technological incapacity for self-monitoring and for implementing treaty commitments is also a major issue in many regimes. Many developing countries, especially in Africa, and those that used to be part of the Soviet empire, struggle to report on their own compliance with international treaties and to adopt national implementation measures.

As a multilateral verification technique, on-site inspections have come a long way. There are now bodies of professional on-site inspectors, detailed protocols, procedures and technologies for on-site inspections, and a useful corpus of experience in making them effective. UNSCOM and UNMOVIC vastly increased our experience of the power and challenges of OSIs. The difficulties that the CTBTO is facing in reaching agreement on its OSI manual indicate, however, the sensitivities surrounding on-site inspections and the need for an educational process about them.

Use of information

One of the most pleasing verification developments in recent years has been the realization that multilateral verification organizations can and should use the vast array of open source material to their advantage. Commercial satellite imagery and the internet are just the most obvious of the new information tools available.

Similarly, the use of information provided by states from their national technical means (NTM) is a significant development. The experience of UNMOVIC, however, should be a warning for the standing verification bodies. The intelligence information provided to UNMOVIC and the IAEA about Iraq was late and much of it was of dubious character. While there are clearly enormous difficulties in states obtaining credible information from closed, autocratic regimes through NTM, those states that are able to provide NTM-derived information should be more honest and transparent in doing so.

Building the international verification community

One of the critical lessons that can be drawn from the experience of multilateral verification and compliance regimes over recent years has been the need to sustain political support and relevance. Political support can, naturally, wax and wane after a verification system has been put in place. While this might seem to be an unavoidable fact of international political life, there are steps that verification bodies can take to cushion themselves. They could start by cultivating stakeholders elsewhere, including in civil society and among NGOs, the general public, the media and the philanthropic foundation world, and even in business. The multilateral organizations need to do better at promoting an appreciation of the contribution they make to international peace and security.

EXECUTIVE SUMMARY

II - WEAPONS OF MASS DESTRUCTION VERIFICATION AND COMPLIANCE: CHALLENGES AND RESPONSES

The following provides the major conclusions and recommendations of the integrated expert consultations on WMD-related verification and compliance issues, organized thematically rather than by weapons type.

Expanding the Scope of WMD Verification and Compliance Mechanisms

Well planned and fully resourced efforts should be undertaken to universalize existing WMD verification and compliance regimes. (Recommendations 1 and 11)

UN verification and compliance capabilities should be reinforced by creating a new independent WMD investigative unit designed to complement existing WMD verification and compliance mechanisms. (Recommendation 2)

The UN Security Council should ensure effective implementation of UN Security Council Resolution 1540, which mandates compliance with WMD obligations at the national level related to preventing the proliferation of WMD to non-state actors. (Recommendation 3)

Options for expanding the application of verification and compliance mechanisms to WMD related activities should be explored, including measures applying to cooperative threat reduction efforts, nuclear export control guidelines, the security of chemical and biological relevant facilities, the end-use of exported missiles and related technology, and the Hague Code of Conduct. (Recommendations 1, 14, 23, 32, 35, 36, and 37)

All states that have not yet signed and ratified the Comprehensive Test Ban Treaty (CTBT), a key element in the global nuclear verification and compliance regime, should do so immediately. This applies especially to states listed in the treaty's Annex II. Meanwhile, work should continue, with urgency, to prepare all elements of the CTBT's verification system. (Recommendation 11)

Nuclear weapons states should consider contributing to global nuclear verification and compliance efforts by submitting all of their civilian nuclear activities to International Atomic Energy Agency (IAEA) and extending their Additional Protocols to all domestic civilian activities. They should also move forward on the removal of fissile material from weapons programmes under IAEA verification (e.g., implementation of the trilateral initiative) and ensure that nuclear disarmament agreements/arrangements, including existing bilateral agreements, are subject to effective verification mechanisms, including multilateral involvement. (Recommendation 12)

Consideration should be given to encouraging states outside the Nuclear Non-Proliferation Treaty (NPT) to accept more comprehensive multilateral commitments and safeguards relating to their civilian nuclear cycles, including negotiation of a full-scope safeguards agreement and an Additional Protocol with the IAEA. (Recommendation 13)

To support UN Security Council Resolution 1540 and strengthen the Organization for the Prohibition of Chemical Weapons (OPCW) verification capabilities, Chemical Weapons Convention (CWC) states parties should be required to report to the OPCW on the measures they are taking to meet their 1540 obligations as they relate to chemical weapons. To the extent possible, the Secretariat of the OPCW should, in cooperation with the 1540 Committee, monitor compliance with Sections 2 and 3 of 1540 insofar as they are related to chemical weapons. (Recommendation 24)

Renewed efforts to develop an effective verification and compliance regime for biological weapons should be high priority. Support should be provided to proposals to strengthen the UN Secretary-General's power to verify alleged use of biological and toxin weapons as well as suspect biological facilities. States should release publicly their confidence building measures, and the establishment of a small secretariat to monitor BTWC confidence building measures should be considered. This secretariat could also monitor reports submitted by states in accordance with Security Council Resolution 1540, as they relate to biological weapons. States parties to the Biological and Toxin Weapons Convention (BTWC) should be encouraged to hold annual meetings between review conferences beyond the 2006 Review Conference to address 'compliance management' issues and important biological weapons-related developments. (Recommendations 29, 30, 31, and 33)

States should be urged to consider the negotiation of regional measures on missile-related non-proliferation, arms control and disarmament, focusing initially on confidence-building measures including transparency and voluntary mutual monitoring of commitments. (Recommendation 38)

The UN should be encouraged to continue its efforts in the missile field, with special attention to norm-building and confidence building measures, as a first step towards fully developed verification and compliance mechanisms. (Recommendation 39)

Addressing Emerging Verification Challenges

The IAEA Additional Protocol should become the new compulsory standard for nuclear safeguards. States should not receive nuclear technology or materials transfers unless they conclude such agreements. (Recommendation 15)

The adoption of higher standards for verifying nuclear accounting, safety and physical protection should be given a high priority. Negotiations on strengthening the Convention on Physical Protection should be concluded as soon as possible. The Code of Conduct on the Safety and Security of Radioactive Sources, including sections relating to the import and export guidelines, should be made obligatory and legally binding. The IAEA should verify compliance with both the Physical Protection Convention and the Code of Conduct. (Recommendation 16)

The IAEA should commission an expert study to develop a standardized system of accounting for all fissile material for all states (Recommendation 17).

To enhance the verifiability of peaceful nuclear programmes, consideration should be given to the internationalization of all uranium reprocessing and enrichment capabilities, beginning with any new

facilities and progressively encompassing all reprocessing and enrichment facilities. (Recommendation 18)

The Conference on Disarmament (CD) should re-start negotiations towards a fully verified Fissile Material Cut-off Treaty (FMCT) as soon as possible. In the meantime, the CD should establish a group of experts to review and develop mechanisms and procedures for effectively verifying compliance with such a treaty. (Recommendation 19)

The CWC Scientific Advisory Board should study the impact of recent scientific and technological developments in order to make recommendations to the Conference of States Parties on new chemicals that should be added to the schedules of chemicals subject to verification and compliance. (Recommendation 25)

The OPCW should explore new techniques to monitor CW stockpile destruction, such as non-human monitoring arrangements, freeing resources for verification of production of CWC Schedule 2 and 3 chemicals and discrete organic chemicals. (Recommendation 27)

An independent expert study should examine the implications of the development of new biochemical agents, including "non-lethal" biochemicals, for the effectiveness of verification and compliance measures under the CWC, including aspects related to the "law enforcement" exemption. (Recommendation 26)

An independent expert study should examine scientific and technological advances in the biological sciences and related fields and their implications for BTWC verification and compliance. (Recommendation 34)

Compliance Management

There is a need to develop "rules of the road" for dealing with difficult compliance issues at both treaty regime and UN Security Council levels, including greater commitment to verification assessments by independent professional bodies. (Recommendation 4)

Greater focus should be placed upon WMD compliance management issues, including the development of more nuanced assessments of compliance situations and efforts to explore a wider range of options to restore compliance, including greater utilization of existing compliance management mechanisms. (Recommendations 5 and 14)

The 2005 NPT Review Conference should mandate a standardized formal reporting, consultation and clarification mechanism for all states regarding their status of compliance with the NPT. (Recommendation 21)

Investing in Smart WMD Verification and Compliance Mechanisms

Periodic independent expert reviews of the performance of WMD verification and compliance implementation agencies should be undertaken, and recommendations for reforms prepared for the consideration of states parties. (Recommendation 6)

A world-class centre of excellence focused on the analysis of WMD verification and compliance issues should be established to encourage cross-fertilization of experience and expertise within and between existing and emerging WMD verification and compliance mechanisms. (Recommendations 10)

States, private donors and foundations should be called upon to invest more resources in WMD verification and compliance capacities, including UN and treaty implementing organizations, national programs and non-governmental organizations active on these issues. (Recommendation 8)

In cooperation with treaty implementing institutions, greater resources should be devoted to financial and technical assistance for capacity-building within selected states to assist them in fulfilling their WMD verification and compliance commitments and obligations. (Recommendations 10, 21, 28, and 35)

Non-governmental organizations should be actively encouraged, where appropriate, to assist in the development and implementation of WMD verification and compliance mechanisms, particularly through track II type contacts and initiatives. (Recommendation 9)

I - WMD VERIFICATION AND COMPLIANCE: THE STATE OF PLAY

Introduction

This study considers the current state of play of verification and compliance arrangements in respect of multilateral arms control and disarmament agreements relating to so-called weapons of mass destruction (WMD). The study covers the principal WMD agreements and the means by which compliance with them is monitored and verified, along with the means by which compliance is ensured in case of a suspected violation. It is assumed that WMD comprise nuclear, radiological, chemical and biological weapons and their means of delivery. The study does not deal with export/import controls on WMD or their components, international controls on ballistic or other types of missiles, or multilateral treaties dealing with the deployment of weapons in outer space.

Verification

Verification is the process of gathering and analyzing information to make a judgement about compliance or non-compliance with a treaty or agreement. It aims to build trust between the parties or participants, assuring them that their agreement is being implemented effectively and fairly. Verification achieves its objectives by three means: detection; deterrence; and confidence-building. Increasingly verification systems are being expected to take account of the non-compliant activities of non-state actors, whether they base themselves in the territory of a state party or engage in activities which have an impact on a state party. Monitoring, which is sometimes equated with verification, is in this study meant to refer to the technical process of gathering information, whether by technology or by humans.

The role that judgement plays in any verification process is often murky, sometimes deliberately so. In some systems verification clearly involves verification professionals making a judgement about the evidence obtained by their monitoring systems or other means such as inspections. These conclusions are then passed to a higher, political body which makes the definitive judgement about compliance or non-compliance, in addition to considering what steps might be necessary to bring a non-compliant state into compliance. In other cases professional staff simply forward the information they have obtained to a higher treaty authority to make the compliance judgement. Even here, however, there will usually be some sorting and selection of data, which may involve judgements, explicit or implicit, about the likelihood that non-compliance has occurred.

Compliance

When a party is abiding by its obligations under an agreement it is said to be in compliance. 'Compliance' is also used to describe the process used to deal with questions relating to compliance and non-compliance, which, for some, runs the whole spectrum from monitoring at one end through to attempts to enforce compliance at the other. Complicating the picture, a non-compliance case may require verification additional to that which exposed the non-compliance question in the first place. For instance a more targeted inspection might be necessary. At the other extreme, a compliance process may simply involve consultations between the parties to resolve the question at issue. Such questions can include:

- a suspicion of non-compliance;
- an allegation of non-compliance; or
- a discovery or finding of non-compliance.

A compliance process should enable the parties to successfully address all types of compliance issues and be able to take action or recommend the taking of action to deal with them. In particular, it should be able to:

- distinguish between genuine allegations of non-compliance and those based on ambiguous or misleading information or which are made for political or other purposes;
- determine that actual non-compliance has occurred;
- differentiate between minor (sometimes known as 'technical') non-compliance and substantial non-compliance; and
- determine what non-compliance is unintentional and what is deliberate.

The relationship between verification and compliance

As indicated above, verification and compliance processes cannot always be clearly separated. A verification mechanism may be used to verify ongoing compliance by parties. It should also be able to inform or trigger a compliance process, as well as providing information to confirm or refute an allegation of non-compliance. On-site inspection techniques used regularly in a continuous treaty verification process in one context (such as the taking of samples) may be used in other contexts during a fact-finding mission or challenge inspection to prove or disprove a specific allegation of non-compliance.

Above all, verification and compliance processes should be mutually reinforcing. If conducted well, they should give states increasing levels of confidence about treaty implementation and about the commitment of other parties to the fulfillment of their obligations. As in the case of an effective verification system, the existence of a credible compliance system can be an incentive to states to join a treaty (although in a small number of cases it may be a disincentive).

A verification and compliance system cannot legally deal with states that have chosen not to become party to a treaty. It also cannot substitute for credible enforcement measures. Verification and compliance systems are reliant on continuing political, financial and technical support from treaty parties. Verification, which in large part is a technical undertaking, is only as good as the tools it is provided with. Just as military technology and technology that might be used for both peaceful and non-peaceful purposes (dual-use) constantly advances, verification is also dependent on advances in monitoring and other relevant technologies and techniques in order to remain effective.

This study will provide a snapshot of the current state of the art and science of verification and compliance not just for its own sake, but as background to consideration of future needs in the evolving international security environment.

Nuclear Weapons

Among the current verification systems relating to nuclear weapons are those that verify the ban on nuclear testing; those that verify the nonproliferation of nuclear weapons and those that deal with nuclear reductions or nuclear disarmament (to date by particular states only).

The Comprehensive Nuclear Test Ban Treaty (CTBT)

The 1996 Comprehensive Nuclear Test Ban Treaty, which bans nuclear tests in all environments, envisages the creation of a Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) to verify compliance. Although the treaty has not yet entered into force,¹ its verification system is being steadily developed and progressively implemented by a Preparatory Commission (Prepcom), established in November 1996, and located in Vienna, Austria. The Prepcom will transform itself into the permanent CTBTO at entry into force of the treaty.

The PrepCom comprises a plenary body of all states that have signed the treaty and a Provisional Technical Secretariat (PTS). The Plenary has two working groups: Working Group A deals with budgetary and administrative matters, while Working Group B deals with verification issues. There is also an Advisory Group of experts to advise the Commission and its subsidiary bodies on financial, budgetary and administrative matters. The PTS is responsible for establishment and operation of an International Monitoring System (IMS) and an International Data Centre (IDC); preparing the on-site inspection (OSI) regime; and for the administration and legal affairs of the PrepCom. Created in March 1997 with only nine staff members, the PTS had by April 2004 grown to 274 staff members from 70 states.²

The verification regime

In terms of its global reach and interconnectedness, the CTBT verification system the most ambitious envisaged for a multilateral arms control or disarmament agreement. With at least a notional goal of 2007 for its completion, the system is already exceeding the verification capabilities envisaged by its designers and when finished is likely to be significantly more powerful.

International Monitoring System

The International Monitoring System (IMS) will eventually comprise 321 monitoring stations and 16 radionuclide laboratories located in some 90 countries. Two hundred and one of the stations belong to the system's primary network, which will provide data to the IDC on a continuous basis. Four types of stations are being set up: seismic, infrasound, hydroacoustic (the three waveform technologies) and radionuclide. These are able to detect tests in different environments and contribute synergistically to verifiability.³

¹ As of 29 September 2004 there were 173 signatories, of which 118 had ratified. Of the 44 Annex 2 states required to ratify before entry into force, 33 have done so, leaving 8 that have signed but not ratified and three (India, Pakistan and North Korea) which have not yet signed. The US Senate rejected ratification in 1999 and the current administration of President George W. Bush is opposed to pursuing ratification.

² Annex IV to the Report of the Twenty-Second Session of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization: Report of the Executive Secretary for the Period January-April 2004, CTBT/PC-22/1/Annex IV, 29 June 2004, p. 13.

³ Seismic monitoring is most capable of detecting underground tests, although it might also be able to discern atmospheric tests conducted at low altitudes. Hydroacoustic technology primarily monitors the oceans for

The establishment of the IMS poses management and engineering challenges unprecedented in arms control verification, with stations scattered around the globe, many in remote and inaccessible locations. Some of the stations already existed when the IMS was envisaged, but most have had to be constructed from scratch or substantially upgraded.

The PTS has made excellent progress towards making the IMS fully functional, estimating that the system will be approximately 83% complete by 2006.⁴ By early 2004 site surveys had been completed for 91 percent of the planned stations and laboratories (293 out of 321). In addition 81 monitoring stations (26 primary seismic, 11 auxiliary seismic, 4 hydroacoustic, 17 infrasound and 23 radionuclide)⁵ and 4 radionuclide laboratories had been certified as satisfying all technical specifications.⁶ Another 80 stations are under construction or are the subject of contract negotiations. Currently some 85 stations are contributing data to the IDC. The first system-wide performance test will take place in April-June 2005.

The IMS will perform better than the conservative estimates of the Group of Experts (GSE) during the CTBT negotiations in the early 1990s. Even in its unfinished state the probability of detecting a one kiloton explosion by seismic means is very high (militarily significant tests are likely to have yields of at least 5-10 kilotons). Overall the IMS may detect explosions as low as 10-25 tons.

The non-seismic verification technologies will increase verifiability further, while OSIs will be used to resolve doubts about highly suspicious events. The global network of scientific seismic stations which are not part of the IMS will add further substantial capability to CTBT verification worldwide (some observers, including those at the Washington-based Incorporated Research Institutes for Seismology (IRIS), maintain that the non-IMS system's capability exceeds that of the IMS).⁷

Added to these verification capabilities are the National Technical Means (NTM) of individual countries, in particular those of the United States, which runs its own network of seismometers, radionuclide detectors and satellite-based sensors for detecting nuclear tests. US laboratories are currently working on a second-generation satellite system to replace the original Vela system (which detected the purported characteristic nuclear 'flash' in the south Atlantic in September 1979 that was alleged to be a South African and/or Israeli nuclear test). Satellite photographs may also reveal nuclear test preparations such as the drilling of shafts, as occurred in the cases of Brazil and South Africa (even though the CTBT does not ban test preparations, in practice convincing evidence of a likely future violation is unlikely to be ignored).

underwater nuclear tests. Infrasound is most effective in detecting atmospheric tests, but may also discern some underwater and shallow underground events. Seismic and acoustic detection technologies might not, however, in certain cases, provide enough conclusive data to reveal whether a large conventional explosion or a small nuclear test has taken place. Radionuclide stations, by detecting radioactive particles emanating from a nuclear explosion, could then be the most powerful tool in clarifying the nature of an event.

⁴ Annex II to the Report of the Twenty-Second Session of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization: Report of Working Group B, CTBT/PC-22/1/Annex II, 28 June 2004, p. 6.

⁵ Information from the PTS, Vienna.

⁶ At Seibersdorf, Austria, Helsinki, Finland, Bruyeres-le-Chatel, France, and Christchurch, New Zealand.

⁷ 'Global Seismographic Network (GSN)', Incorporated Research Institutes for Seismology, www.iris.edu/about/GSN/.

International Data Centre and Global Communications Infrastructure

The International Data Centre (IDC) was inaugurated in January 1998 and started to transmit data in May that year. It receives, collects, processes, analyses, reports on and archives data from the IMS, including from the certified radionuclide laboratories. The IDC seeks to associate various signals from a common source (an 'event'); to estimate the parameters of the source (such as time, location and magnitude) and to highlight uncertainties associated with them; to identify or distinguish the nature of the event; and, if the event is suspicious, to attribute it to a particular party.

The CTBTO's dedicated satellite-based Global Communications Infrastructure (GCI), functional since mid-1999, transmits data from the IMS monitoring stations, in near real time, to the IDC in Vienna and, in turn, transmits IDC data to national authorities. The data received by the IDC is processed immediately, with the first automated products released within two hours. An automatic Standard Event List is produced through the automated processing of seismic, hydroacoustic and infrasound data, which is analysed and revised to generate a Revised Event Bulletin (REB). An REB can be compiled between four and six days after the event. The radionuclide data takes up to two weeks due to the need to physically collect samples from the stations for appraisal. The aim is increasingly to automate this process using new technology. States signatories may request either the raw data or information in bulletin format.

On-site inspections

Once the CTBT has entered into force, any state party may request an OSI in the event that a suspected nuclear explosion is detected either by the IMS or by NTM. The purpose of an OSI is to clarify whether there has been a nuclear explosion and to gather information that might help to identify the violator. The CTBTO will not have a permanent inspectorate, but will draw on experts, pre-nominated by states parties, who have received prior training, periodically upgraded, by the CTBTO. The CTBTO will have its own equipment and Operational Manual for conducting inspections. Training, testing and procurement of equipment, tabletop exercises and field experiments are continuing in preparation for entry into force.

Slow progress is, however, being made on the Operational Manual, despite the Prepcom according it its 'highest priority'. Significant disagreement remains about the level of detail that should be included. Some states, which fear that OSIs will be used to spy on installations and activities irrelevant to the CTBT, wish to constrain the rights and options of the inspectors. Others believe that tying the hands of the inspectors too much will reduce their effectiveness in undertaking their verification tasks. Attempts by the working group that is negotiating the manual to shorten the draft, which is hundreds of pages long, have made little headway. Negotiations have been hampered by US withdrawal from the CTBTO's OSI work after the Bush Administration decided not to ratify the treaty.⁸ Some observers argue that should entry into force of the treaty become imminent, political backing will materialise to permit agreement on the manual.

Organizational evolution

Significant organizational change will occur at the nascent CTBTO in the near future:

- the scheduled retirement in July 2005 of the inaugural Executive Secretary of the Prepcom, Wolfgang Hoffmann of Germany; discussions have begun among state signatories about a

⁸ In addition the US has withheld funding from the work, although it continues to participate in and pay its assessed contributions for all other aspects of the Prepcom's operations.

successor, marked by pressure from developing states for a candidate from their group to be appointed

- new appointments to directorships of the On-Site Inspection and International Data Centre Divisions
- a mass loss of experienced PTS personnel from 2005 onwards due to the 7-year service limit designed to ensure a 'non-career' service.

As a result of these changes and the fact that the organization is now seven years old, the Prepcom has commissioned an external review of the organization's structure to be completed by May-June 2005. This will be an opportunity to recalibrate the CTBTO for a new phase of its life-cycle: moving from the establishment and build-up phase into one of testing and evaluation and towards provisional operation and maintenance.

Finance

The CTBTO's budget has risen from US\$27.7 million in 1997 to US\$88.5 million in 2003. A steep rise in the first few years reflected the rapid growth of the new organisation and the high establishment costs of a global verification system. Since 1999 the budget has remained relatively steady when corrected for inflation, falling to zero real growth in 2003. The rate of collection of assessed contributions from member states remains unusually high for an international organization, with approximately 90–97 percent of the budget collected annually (94.5% in 2003).

The planned budget for 2005 is currently approximately US\$51.5 million and €42.5 million (due to the fall in the US dollar, the Prepcom has adopted a split budget, making precise comparisons with previous years difficult). The budget envisages zero real growth and includes no provision for staff increases or expansion of programmes.

Non-entry into force and verification and compliance

As a result of its non-entry into force, the CTBT faces the unusual prospect of being a treaty with a fully-fledged verification system, but without the legally binding character that would permit compliance with its provisions to be officially verified.

The effect that non-entry into force may have on the CTBT's verification system and vice versa is complex. Article IV provides that at entry into force of the treaty, 'the verification regime shall be capable of meeting [its] verification requirements'. Taken literally, this means that the IMS and other components of the verification system should be ready on the day that the accord enters into force. There has thus been a natural inclination, both on the part of the Prepcom and the PTS, towards completing the verification system as soon as it possible.

However, some states are now beginning to question whether, in light of the protracted, and perhaps indefinite delay in achieving entry into force, work should continue at the same pace as in the past. Counter to this argument is the view that the regime is providing constantly improving verifiability as well as increasingly valuable scientific and civil benefits (which the Prepcom is intent on encouraging). Moreover, the costs are likely to drop when the system is fully operational and efficiencies resulting from synergies can be identified.

Some observers have called for consideration to be given to provisional entry into force of the CTBT, both for its own sake and to allow the verification system to become fully functional and useable. From a verification perspective it would be preferable for the verification system to be used in an official, legally binding way. Provisional entry into force would, however, relieve the pressure on states which have not signed and/or ratified.

In a sense a formal move towards provisional implementation is unnecessary as significant elements of the regime are already being provisionally implemented. The nascent verification body is in place, the monitoring system is largely functional and states are already receiving data from the system. States can use such information unilaterally or collectively to help determine that a nuclear test has taken place.

Compliance mechanisms

The CTBT is unusual among multilateral arms control regimes in that a compliance issue may only be triggered by a state party (or parties), not by the verification organization itself.⁹ In comparison, the International Atomic Energy Agency (IAEA) and the Organisation for the Prohibition of Chemical Weapons (OPCW) may, on the basis of the verification information they obtain, raise concerns about a state party's compliance.

There is no evidence that any signatory state has violated the CTBT, so a non-compliance case has yet to arise.¹⁰ Until the treaty enters into force it would not be possible in any case to trigger the formal consultation, clarification and compliance mechanisms provided using the Executive Council. Yet even without entry into force, there is nothing to prevent any state from seeking bilateral consultations with another state or states about a compliance question or requesting a meeting of the PrepCom if it believes that a nuclear test has been carried out by a state signatory. The PrepCom could decide to become involved in a compliance issue if enough signatories so wished. If that did not work, any state could apprise the UN Security Council of the matter. So strong is the taboo against nuclear testing that entry into force of the treaty—while highly desirable—may not be absolutely necessary for the verification and compliance system to function virtually as planned.

The Nuclear Non-Proliferation Treaty (NPT)

Unlike the CTBT, which is to be verified by a purpose-built verification organization, compliance with the 1968 Nuclear Non-Proliferation Treaty is largely verified by an organization—the IAEA—which was founded before the NPT was concluded. Moreover, the IAEA is not involved in verifying compliance with all of the NPT's obligations: notably the disarmament obligations of the nuclear weapon states (NWS) parties. Periodic NPT review conferences, and latterly annual preparatory meetings for such conferences, are the sole forum for collective monitoring of compliance by all parties with all of their obligations under the treaty.

⁹ Article IV, Section C of the treaty on consultation and clarification lays out the process, stressing that states must attempt to clarify and resolve compliance issues among themselves first before seeking the assistance of the organization.

¹⁰ States that sign a treaty are expected not to undermine its object and purpose—in this case that surely means refraining from conducting a nuclear test.

The International Atomic Energy Agency

As a verification organization the IAEA, established in 1957, is unique in that its verification role is forced to compete, both politically and in terms of allocation of finances and resources, with another primary role, that of promoting the peaceful uses of nuclear energy. Its assistance to states in the peaceful uses field has actually made its verification task more difficult, by at best increasing its verification task and at worst contributing to the proliferation of nuclear weapons. The Agency is also unusual in being involved in verifying compliance with several arms control and disarmament agreements simultaneously, including those that have established nuclear weapon-free zones in various regions.

The IAEA has faced more serious cases of non-compliance than any other multilateral arms control or disarmament regime. Its most serious failure was its inability to detect Iraq's massive violation of its NPT and safeguards obligations before 1989. This led to a seachange in the concept of nuclear safeguards although one which has yet to be universally applied. Institutionally the Agency is currently in better shape than for some years. It has performed creditably in Iraq since the first Gulf War and is better funded and more proactive than ever before.

The Agency is governed by a powerful 35-member Board of Governors, comprising member states most advanced in nuclear technology as well as those that are the principal producers of nuclear source material. It has a Secretariat, based in Vienna, headed by a Director General, and a General Conference of all member states which meets once a year. It also has operational and offices in Toronto and Tokyo and runs or supports research centres and scientific laboratories in Vienna and Seibersdorf, Austria, Monaco and Trieste, Italy. The Standing Advisory Group on Safeguards Implementation (SAAGSI) provides technical advice. The regular budget for 2004 is US\$285.5 million, of which US\$102 million is for nuclear verification. Nuclear safety and security, which today is closely associated with nonproliferation efforts and is gaining increasing attention, is allocated, in addition, US\$22.4 million. The Agency currently has 2200 multidisciplinary professional and support staff from more than 90 countries. There are currently 556 inspectors, the largest number in the Agency's history.

Full-scope safeguards

Each non-nuclear weapon state (NNWS) party to the NPT is required by the treaty to conclude a 'comprehensive' or 'full-scope' safeguards agreement with the IAEA.¹¹ As of July 2004, a surprisingly large number—42 out of 189 states parties—did not have such agreements in force.¹² (The non-NPT states parties, India, Israel and Pakistan, all have non-comprehensive safeguards agreements that apply only to certain facilities and/or materials).

Under such agreements, non-nuclear weapon state (NNWS) parties declare to the IAEA all their nuclear facilities (which, by definition, are assumed to be for peaceful purposes) and inventories of all nuclear materials. These are subject to verification ('safeguarded') by the IAEA to ensure timely

¹¹ Based on a model provided in a 1972 IAEA document. See 'The structure and content of agreements between the Agency and states required in connection with the Treaty on the Non-Proliferation of Nuclear Weapons', INFCIRC/153 (Corrected), IAEA, Vienna, June 1972.

¹² Safeguards current status, 30 July 2004, www.iaea.org/worldatom.

detection of the diversion to non-peaceful purposes of a 'significant quantity' of nuclear material.¹³ Traditional safeguards focus on accountancy and control of nuclear materials, through which the IAEA confirms that quantities of declared nuclear materials remain at safeguarded sites or can otherwise be accounted for. In addition to nuclear accountancy, the Agency uses routine on-site inspections (OSIs) and passive 'containment and surveillance' measures such as tamper-resistant seals and surveillance cameras. States parties recognised as nuclear weapon states (NWS) by the NPT (China, France, Russia, the UK and US) are not required to accept comprehensive safeguards, but all have made 'voluntary offers', accepting safeguards on certain facilities as a token of goodwill.

Shortcomings of classical safeguards

When agreed in the 1970s classical safeguards were considered an adequate political compromise in balancing intrusiveness and comprehensiveness with cost and respect for national sovereignty. While never regarded as foolproof, the passage of time has revealed serious shortcomings. The most fundamental was that the IAEA could only inspect or monitor materials and facilities declared to it by states parties, allowing would-be proliferators to develop substantial undeclared nuclear capabilities undetected, either co-located with declared facilities or completely separately. While a so-called special inspection (the equivalent of a 'challenge' inspection in other disarmament regimes) could be requested in cases where there was strong suspicion of malfeasance, political expediency rendered these impossible to invoke. The Board of Governors has done so only once, in 1993, in regard to North Korea, which refused to cooperate.

A second limitation is that nuclear safeguards permit states to assemble many of the elements of a future nuclear weapons programme, such as a uranium enrichment capability, as long as they declare them to be for peaceful purposes and subject them to safeguards. Having mastered all of the relevant technologies, a state can legally withdraw from the NPT on three months' notice and begin to produce nuclear weapons perfectly legally. This is what it is feared Iran is currently attempting to do.

A third weakness of classical safeguards stemmed from the assumption that the intensity of verification of any state party should be determined by the size of its nuclear industry, not by the likelihood of its non-compliance. This has led to the expenditure of considerable resources on verifying states with large, well-developed nuclear industries, like Canada, that are not of proliferation concern, while distracting attention from those that are, such as Iran.

Strengthened safeguards

While there had been debates about strengthening safeguards since their inception, the greatest catalyst of reform was the discovery after the 1990 Gulf War of just how close Iraq had come to acquiring nuclear weapons—despite nuclear safeguards. In reaction, in December 1993 the Board of Governors launched the '93+2' programme, so-called because it was expected to be completed within two years. Part 1 involved enhancements that could be initiated by the IAEA within its existing mandate and legal authority, while Part 2 comprised measures that would be possible only

¹³ The IAEA defines a 'significant quantity' as eight kilograms of plutonium and uranium-233, 25 kilograms of uranium-235 enriched to 20 per cent or more, 75 kilograms of uranium-235 enriched to less than 20 per cent, 10 tonnes of natural uranium and 20 tonnes of depleted uranium and thorium. See IAEA, *The Evolution of IAEA Safeguards*, International Nuclear Verification Series, no. 2, Vienna, 1998, p. 53.

by establishing a stronger legal basis for the Agency to act. Part 2 measures evolved into the Additional Protocol.

IAEA initiatives under its existing authority

The IAEA began to apply so-called Part 1 measures in 1995 to all states with full-scope safeguards agreements. These measures include requesting additional information on facilities that formerly contained nuclear materials subject to safeguards but no longer do so, or which are expected to do so in future; increasing the level of remote monitoring of movements of nuclear material; expanding the use of unannounced inspections; and collecting environmental samples at sites to which the Agency already has access. These efforts have been aided by the greater use of open source information, including commercial satellite imagery, as well as by intelligence provided by third parties and increased information supplied by states parties themselves.

Additional Protocols

In May 1997 the Board of Governors agreed a Model Additional Protocol to Safeguards Agreements.¹⁴ The Protocol provides for increased transparency by extending states parties' declaration and reporting obligations to the entire life cycle of a state's nuclear industries. This stretches all the way from nuclear mining and processing to the storage of nuclear waste, including the activities of private firms involved in the nuclear fuel cycle, as well as sites that house nuclear material intended for non-nuclear purposes. The Additional Protocol requires states parties to report on the production of nuclear-related equipment, nuclear-related imports and exports, nuclear fuel cycle-related research and development, and future plans for nuclear facilities.

The Additional Protocol also expands the IAEA's rights to conduct inspections of states parties' nuclear industries, most importantly through 'complementary access'. This permits the Agency to inspect any part of a declared nuclear facility, instead of only designated 'strategic points' accessible under full-scope safeguards. This can also be applied to nuclear-related sites, such as those that use unsafeguarded nuclear materials. Complementary access may be coupled with short-notice access to all facilities at a nuclear site and with the possibility of collecting environmental samples outside declared locations.

The Additional Protocol increases the IAEA's capacity to ensure that states parties' declarations are complete, as well as significantly improving its prospects for detecting undeclared nuclear material and activities. This offers a vastly improved basis for deterring a state from engaging in prohibited activities.

Integrated safeguards

The increased financial and personnel burden is a potential obstacle to the implementation of strengthened safeguards. Integrated safeguards seek to ease this problem by enhancing the efficiency of safeguards overall and in relation to particular states, thereby enabling the Agency to focus its efforts where they are needed most.¹⁵ The conceptual framework for integrated safeguards was completed in March 2002 and the development of practical approaches to implementation, including in particular countries, is continuing.

¹⁴ See INFCIRC/540 (Corrected), May 1997.

¹⁵ For a comprehensive analysis see Jill N. Cooley, 'Integrated nuclear safeguards: genesis and evolution', in *Verification Yearbook 2003*, VERTIC, London, 2003, pp. 29–44.

Integrated safeguards involve two distinct approaches. The first involves decreasing reliance on traditional labour-intensive OSIs through increased use of remote sensing devices and automated systems, as well as by refining verification modalities and techniques. The second seeks to 'customise' verification for individual states by identifying redundancies and consolidating and rationalising measures, thereby reducing the verification burden for both the state and the IAEA. This includes minimising, wherever possible, the effort expended on verifying previously verified material.¹⁶ For instance, the Agency has decided to reduce the frequency of inspection of Japan's light-water nuclear power reactors from quarterly to annually. Integrated safeguards will only be applied to states that have both a full-scope safeguards agreement and an Additional Protocol, since both are needed before the Agency can identify potential verification synergies, and which annually fulfil other conditions.

Progress and problems in implementing strengthened safeguards

After a decade of efforts, the record of strengthened safeguards is mixed. Enhanced safeguards that fall under the IAEA's existing authority have only slowly supplemented classical safeguards. Progress has also been slow in terms of the negotiation, signing, ratification and entry into force of Additional Protocols. As of August 2004, a decade after '93+2' began, only 90 Additional Protocols had been approved by the Board of Governors, only 84 had been signed and only 59 had been brought into force.¹⁷ Integrated safeguards have proceeded even more slowly: as of June 2004 they were being implemented in only four countries: Australia, Indonesia, Japan and Norway,¹⁸ although the Agency expects to begin implementing them in the near future in Canada, Hungary, Poland, Slovenia and Uzbekistan.

Among the key NPT states parties that do not yet have Additional Protocols in force are two NWS, Russia and the United States, which have signed but not yet ratified (the US Senate approved ratification in March 2004, but ratification is awaiting the passage of national implementation legislation). Iraq and North Korea, which have been found in non-compliance with both the NPT and their nuclear safeguards agreements, have not signed an Additional Protocol. Iran and Libya have now done so, with the former pledging to act as if the agreement were already in force.

The failure of particular states to adopt strengthened safeguards does not necessarily indicate an intent to acquire nuclear weapons. It may simply result from preoccupation with other priorities, legislative or other technical difficulties, political or bureaucratic indifference or incompetence in the state concerned. Some hold-outs, such as Brazil, that are in full compliance with their existing obligations, resent being pressed to accept increased verification when other countries retain nuclear weapons, despite being bound under Article VI of the NPT to work towards their elimination, or when others have attempted to acquire nuclear weapon capabilities under cover of safeguards.

¹⁶ Scope for the harmonisation of safeguards in particular cases will depend on factors like the state's nuclear fuel cycle, the relationship between nuclear facilities, the effectiveness of the state's accounting and control system for nuclear materials and the IAEA's ability to conduct unannounced inspections successfully. See 'Strengthening the effectiveness and improving the efficiency of the safeguards system and application of the Model Additional Protocol', IAEA document GC(45)/23, 17 August 2001, p. 6.

¹⁷ See www.iaea.org/worldatom/programmes/safeguards/sg.protocol.html.

¹⁸ <http://www.iaea.org/Publications/Reports/Anrep2003/safeguards.pdf> and <http://www.iaea.or.at/NewsCenter/Statements/2004/ebsp2004n003.html>.

Another factor in the slow take-up rate of additional protocols is a lack of concern about the dangers of nuclear nonproliferation and the importance of strengthened safeguards. This is most common among states that have relatively minor nuclear activities. However, this attitude may leave such countries vulnerable to unregulated and even undetected nuclear activities being conducted on their territory, including nuclear smuggling. Recognition of this problem has led the IAEA to develop a Small Quantities Protocol, which involves simplified procedures for states that have limited or no amounts of nuclear material to report. The UN Security Council in April 2004 also recognized this problem by adopting Resolution 1540 which mandated all UN member states to adopt national implementation measures to prevent nuclear (and other WMD-related) materials falling into the hands of terrorists and other non-state actors.

There is also resistance to strengthened safeguards from states concerned about the much higher degree of transparency and intrusiveness involved. This is particularly evident among the NWS. In addition to excluding all of their weapon-related nuclear activities from strengthened safeguards (as in the case of traditional safeguards), they have offered little, if anything, in the way of expanded voluntary safeguards on their peaceful nuclear activities. This sets a bad example to the NNWS and reinforces suspicions that the NWS have no intention of ever abandoning their nuclear arsenals. Other countries, like Brazil, are concerned that commercial proprietary information, in its case a new uranium enrichment process invented by the Brazilian Navy, may be at risk from the new measures required by the Additional Protocol.

In December 2003, IAEA Director General Dr Mohamed ElBaradei, in his annual report to the UN General Assembly, argued that the only way, ultimately, to prevent NNWS from illicitly acquiring their own plutonium and high enriched uranium for weapons purposes, whether under putatively peaceful and safeguarded programmes or otherwise, is to restrict enrichment and reprocessing activities by individual states. He suggested examining the merits of producing fissionable materials multilaterally in a limited number of locations. These ventures would be under safeguards and would supply nuclear materials, also under safeguards, for peaceful purposes. President George W. Bush made a less ambitious proposal in February 2004 for denying states which currently do not reprocess plutonium or enrich uranium the right to do so in future, in return for guaranteed supply of such fissionable materials.¹⁹

IAEA verification experience in the 'special cases'

The IAEA has gained verification experience not just in respect of day-to-day safeguards activities in relation to compliant states but also in regard to several special cases, including those involving serious non-compliance. This experience has equipped the Agency to some extent for future verification tasks including the long-proposed Fissionable Material Treaty (FMT) or Fissionable Material Cut-Off Treaty (FMCT), as well as in regard to the verified disposal of fissionable material from dismantled nuclear warheads and ultimately the verification of nuclear disarmament. These are all significant capabilities in terms of the current state of verification.

South Africa: verifying nuclear disarmament

In the early 1990s South Africa declared that it had dismantled its arsenal of six nuclear devices and nuclear weapon production facilities and sought IAEA verification of this fact. This was the first

¹⁹ George W. Bush, 'Address on weapons of mass destruction proliferation', remarks at the National Defense University, Washington DC, 11 February 2004, www.whitehouse.gov/news/releases/2004/02.

time the Agency had been involved in such an exercise, forcing it to develop procedures to deal with information relating to actual nuclear weapons development. The Agency had access to both civilian nuclear facilities and what was left of military nuclear facilities after the South Africans had dismantled them. After a series of inspections of installations and materials and examination of documents the Agency was able to declare in 1994 that the history of South African fissile material production had been established and that all such remaining material had been put under safeguards. In addition the Agency was able to gain insight into advanced South African weapon research projects, such as those for the production of tritium and lithium-6, that had raised proliferation questions.²⁰ The Agency was also involved in verifying the sealing of two shafts drilled for conducting nuclear tests in the Kalahari Desert, a task that today would probably be given to the CTBTO.

Iraq: cooperation with UNSCOM and UNMOVIC

IAEA verification activity in Iraq, in addition to its normal safeguards activity, was even more intensive and ground-breaking than its work in South Africa. After the first Gulf War the Agency was mandated by the UN Security Council to verify, in cooperation with the UN Special Commission (UNSCOM), that Iraq was ridding itself of its nuclear capabilities, for which it established an Iraq Action Team, later the Iraq Nuclear Verification Office (INVO).

Not only did the IAEA conduct wide-ranging inspections to ensure that Iraq had declared all of its nuclear activities, the most intrusive the Agency had ever conducted, but it also engaged in the unprecedented supervised and verified destruction of designated nuclear facilities. Unlike UNSCOM, which dealt with Iraq's chemical, biological and missile capabilities, the IAEA was essentially able to close the file on Iraq's nuclear capability and attest to its verified destruction or control.

When UN inspectors re-entered Iraq in late 2002 under the aegis of the UN Monitoring, Verification and Inspection Commission (UNMOVIC), the IAEA was again mandated to continue with its nuclear brief. Again it was able to verify, with more confidence than UNMOVIC was in regard to CBW, that the nuclear file was essentially closed and that Iraq did not have nuclear weapons or the capability to rapidly produce them.²¹

The IAEA gained invaluable experience from its work in Iraq. It was able to use and refine new techniques, particularly environmental sampling, which have been of benefit in implementing strengthened safeguards generally. It also learned lessons from being involved in the type of hostile verification environment that it does not normally encounter (although it did to some extent in North Korea). In cooperation with the two Security Council-mandated bodies it was also able to develop appropriate verification protocols for intrusive inspection situations, participate in multidisciplinary inspections and training exercises and again get a foretaste of the tasks involved in verifying complete nuclear disarmament. Finally, it was able to professionally and speedily deal with

²⁰ See G. Dillon and Dimitri Perricos., 'Verification and correctness of inventory: experience gained in the verification of the completeness of the inventory of South Africa's nuclear installations and materials', *International Nuclear Safeguards 1994: Vision for the Future*, IAEA, Vienna, 1994, pp. 231-42.

²¹ Since the US invasion of Iraq the Agency has been grudgingly permitted to return for limited periods and has verified that all of the nuclear material remaining there when the war started remains accounted for, although it has also verified that much of the previously inspected and sealed nuclear equipment has been dismantled and found its way into scrap yards in Jordan and the Netherlands.

intelligence information supplied by permanent members of the Security Council which purported to reveal Iraqi nuclear weapons development but which proved false or misleading. This enhanced the credibility of the IAEA's verification judgements in the subsequent cases of Iran and Libya.

North Korea: identifying non-compliance

Unlike the cases of South Africa, Iraq, Iran and later Libya, where the IAEA was as surprised as anyone else about the extent of the nuclear weapon-related activities eventually uncovered, in North Korea the Agency was at the forefront of discovering non-compliance. In 1993, soon after the country's comprehensive safeguards agreement entered into force, the IAEA began routine inspections to verify the initial data declaration submitted by North Korea. The Agency discovered disturbing inconsistencies which the North Koreans were unable to clarify to the Agency's satisfaction. As a result the Agency invoked, for the first and only time to date, its right to request a special inspection. The North Koreans refused, setting off a continuing compliance crisis.

Subsequently the Agency had its first experience of verifying a freeze on a nuclear programme when, under the 1994 US-North Korea Agreed Framework, it was asked to seal the nuclear facility at Yongbyon and safeguard the nuclear materials at the site. However the Agency was never given the opportunity of comprehensively verifying North Korea's purported nuclear freeze and in 2002 its inspectors were expelled, its remote surveillance cameras disabled and the seals at Yongbyon broken. If and when there is a settlement to the current crisis the Agency may be permitted to resume a verification role in the country.

Libya: verifying nuclear dismantlement

The IAEA's role in Libya was carried out in different circumstances again. When Libya announced in December 2003 that it had decided to abandon its WMD capabilities, the US and UK had already been in consultations with the Libyan government for some time and had carried out inspections of Libyan nuclear facilities. There was also apparently an attempt to marginalize the IAEA's involvement in Libya. Following IAEA protests, agreement was reached in January 2004 on a division of responsibilities: while the IAEA would work to verify and dismantle Libya's capabilities, the UK and US would remove and/or destroy the various components. The US at an early stage removed documentation relating to nuclear weapons, as well as equipment such as centrifuges, and materials.

The Libyan experience is adding further to the IAEA's verification repertoire. In addition to inspections, the Agency was again able to use its increasingly powerful environmental sampling techniques, as it has done in the cases of Iran and Iraq. Due to the fact that the Libyan programme, like that of Iran's, was in part supplied by an illegal nuclear smuggling effort led by the 'father' of the Pakistani nuclear weapon programme, A.Q. Khan, the IAEA also has become involved in attempting to track the extent and nature of this activity. This is another first for the Agency.

Iran: attempting to verify non-compliance

To date the IAEA has acquitted its verification role in respect of Iran with professionalism and persistence. It has clearly applied its enhanced verification techniques and technology to the case. This permitted the Agency to reveal, for instance, that centrifuge equipment was contaminated with uranium enriched to a much higher level than the Iranians admitted and forcing them to reveal that the equipment had been imported rather than made in Iran. The Agency was further able to verify

that the source of the enriched uranium was not Iran. If and when Iran's Additional Protocol is implemented, the Agency stands to gain experience for the first time of applying the measures provided for in that agreement to a state that is already widely suspected of non-compliance.

Excess fissionable material verification (IAEA/US/UK Trilateral Initiative)

Moves have been underway for almost a decade to have the IAEA verify fissile material removed from dismantled weapons in both the US and Russia. Launched in 1996, the so-called Trilateral Initiative involved the three parties in examining the technical, legal and financial implications of the Agency assuming the task of verifying that such material was not returned to weapons use and that other fissile material declared surplus to defence programmes was also not diverted. Under its voluntary offer the US already has some such materials under safeguards. A Model Verification Agreement was finalized in September 2002 as the basis for bilateral accords between the Agency and the two states. A deadlock remains, however, over funding for the programme.

Verification funding: increased resource demands

In the past decade the verification burden on the IAEA has increased substantially, leading to increased pressure on resources and finances. New verification burdens have included:

- the placing under IAEA supervision of considerable quantities of fissile material and numbers of nuclear facilities in the Soviet successor states, many of them verification-intensive due to their former military nature
- intensive verification activities in Iraq, Iran and now Libya
- involvement in monitoring US efforts to repatriate poorly protected fissionable material in unstable countries such as the states of the former Yugoslavia and former Soviet Union
- the implementation of strengthened safeguards, including Additional Protocols (while integrated safeguards are intended to cut the costs of strengthened safeguards, and still promise eventually to do so, their introduction necessitates an initial investment of time and resources).

For more than a decade the IAEA operated under zero real growth restrictions imposed by the Western states. In 2003 the Agency at last had the first significant boost to its verification budget since the 1980s when the Board of Governors agreed a \$US15 million increase to \$245 million. The bulk of the increase went to verification. The IAEA budget for 2004 is \$268.5 million. These increases enable the Agency to fund safeguards activities without having to resort to supplemental funding (up to \$19 million in recent years). It will also provide an improved financial basis for strengthened nuclear safeguards. The increase, moreover, as helped de-link verification spending from spending on technical cooperation to developing countries.²²

Compliance mechanisms

Strangely for such an important legal instrument, the NPT makes no mention of compliance and establishes no compliance mechanism of its own. Review conferences are provided for to review the general implementation of the treaty, but no mention is made of convening special sessions in case of non-compliance. This is a major lacuna in such an important treaty and compares unfavourably with, for instance, the nuclear weapon-free zone treaties. Although Canada and others have proposed

²² Another financial challenge was solved recently when Japan agreed to end the withholding of its assessed annual financial contribution to protest the IAEA's decision to stop asking recipients of technical cooperation to contribute 5% of the value of their projects.

a standardized compliance reporting mechanism for all NPT state parties²³ even this modest idea has not met with the approval of the NWS.

In the NPT compliance is also only implied in respect of nuclear safeguards which the treaty delegates to the IAEA. However the IAEA Statute establishes that the compliance body within the Agency is the Board of Governors. Both the Statute and safeguards agreements stipulate that if states violate their safeguards agreements with the Agency the Director-General can refer the case to the Board for 'appropriate action'.²⁴ The Board may also order the state to take certain action if it deems verifiability to be in jeopardy or if the Agency finds itself unable to verify compliance.²⁵ If it finds a state in possible or actual non-compliance with its safeguards agreement with the Agency it may take certain action, such as seeking clarification, complementary access (under the Additional Protocol), a special inspection or punitive action such as the suspension of technical assistance and/or other membership privileges. However, the most powerful sanctions may only be imposed by the UN Security Council, to which the Board of Governors may send a compliance case. One oddity is that the Board of Governors is able to judge non-compliance with agreements to which the IAEA is itself a party.

The compliance role of the IAEA is complicated by the fact that the Agency's membership does not coincide with NPT membership. Non-NPT parties India, Israel and Pakistan are all IAEA members, indeed founder members in 1957, and all have the opportunity to serve on the Board of Governors, as India has done continuously.²⁶ This leads to a surreal situation in which compliance with a treaty is judged by states which themselves have not assumed such obligations. Another difficulty is that states may remain on the Board of Governors even when their non-compliance is being considered, as has occurred in the case of Iran. The US has proposed that states which find themselves in such a situation be suspended from Board membership.

The compliance record of the IAEA has been mixed. In the case of Iraq it missed Iraq's original violations but was then accorded a pivotal role in ensuring Iraq's compliance with its disarmament obligations after the first Gulf War in cooperation with UNSCOM and UNMOVIC. Director-General ElBaradei was outspoken both in publicly assessing the extent of Iraq's compliance in the nuclear area and in rebutting unsubstantiated allegations of non-compliance. In the North Korean case it was the Agency which, with assistance from other states, detected and confirmed North Korea's non-compliance. However further action was then taken out of its hands (and out of the Security Council's) and dealt with through a North Asian multilateral framework. In the case of Libya, the Agency missed the evidence of non-compliance (in the absence of the extra tools that an Additional Protocol would have provided), but has, after an initial US/UK attempt to sideline it, been fully involved in assessing Libyan non-compliance ever since Libya made its admissions public.

²³ See 'Reporting by States Parties: Working Paper submitted by Canada', NPT/CONF.2005/PC.1/Wp.3, 9 April 2002.

²⁴ 'The structure and content of agreements between the Agency and states required in connection with the Treaty on the Non-Proliferation of Nuclear Weapons', IAEA document INFCIRC/153, Vienna, 1971, para. 9.

²⁵ INFCIRC/153, paras 18-19.

²⁶ North Korea was also a member until it withdrew in June 1994.

In contrast, the Iran case has followed a classic non-compliance path so far: using outside information and its own verification tools the Agency has determined that Iran may be in non-compliance and has worked with the Iranians to rectify the situation, while the Board of Governors has pressured Iran to comply and threatened referral of the case to the Security Council if it fails to do so. Exactly what the Council would do if this happens remains to be seen.

Regional nuclear verification (EURATOM)

The European Atomic Energy Community (EURATOM), a regional agency created in 1957, comprises members of the European Union. Its safeguards system is very similar, although not identical, to the IAEA's. Like the IAEA's, it is based on materials accountancy and on-site inspections. The IAEA and EURATOM conduct joint inspections, collaborate in developing, testing and implementing new methods and techniques and have a liaison committee to ensure coordination and cooperation. The IAEA, however, remains the final decision-maker on substantive compliance questions.

Bilateral Nonproliferation Regimes (Argentina/Brazil)

The Argentine-Brazilian Agency for Accounting and Control of Nuclear Materials (ABACC)²⁷ is the only bilateral nuclear verification agency to date. ABACC was established by the 1992 Agreement on the Exclusively Peaceful Use of Nuclear Energy (the Guadalajara Treaty) between Argentina and Brazil. ABACC is responsible for the application of a Common System for Accounting and Control of Nuclear Materials to all nuclear materials and facilities in the two countries. ABACC's safeguards include the standard ones of nuclear material accounting, examination, containment and surveillance. A 1994 Quadripartite Agreement between Brazil, Argentina, ABACC and the IAEA stipulates that Argentina and Brazil are subject to full international safeguards covering all nuclear material. The agreement was modelled on the EURATOM agreement: ABACC implements the safeguards, but the IAEA is responsible for oversight of compliance. ABACC and the IAEA also carry out joint inspections, procedures and training and share information and inspection equipment.

ABACC's secretariat is located in Rio de Janeiro and has an administrative staff of approximately eighteen, including eight professionals. The ABACC Secretary-Generalship alternates between a Brazilian and an Argentinean, with the deputy post taken by the state that does not have the headship. ABACC has access to 88 inspectors, divided evenly between Argentineans and Brazilians. In 2003, 44 inspections were carried out in Brazil and 64 in Argentina, culminating in 400 inspector days in the field. In 2004 ABACC's budget will be US\$2.7 million, a 3% increase over 2003.

ABACC is regarded as one of the most important cooperative mechanisms ever established by Brazil and Argentina and is a potential model for other dyads. The concept has been informally explored by South Korea.²⁸

²⁷ The Spanish name is Agencia Brasileño-Argentina de Contabilidad y Control de Materiales Nucleares. The Brazilian name is Agência Brasileiro Argentina de Contabilidade e Controle de Materiais Nucleares.

²⁸ See paper on 'Applying ABACC Experiences to Korean Peninsula: Possibilities and Action Plans' <http://www.isis-online.org/publications/dprk/cheon.pdf>.

Nuclear Weapon-Free Zones

Extensive areas of the globe have been declared, by treaty, to be nuclear weapon-free zones (NWFZ).²⁹ Negotiated and signed by regional organizations of states, such treaties prohibit parties from acquiring nuclear weapons or other nuclear devices or assisting other states in acquiring nuclear weapons. The treaties all have protocols open for signature by the NWS committing them not to use nuclear weapons against the zone parties, deploy nuclear weapons in the zone or on the territories of the zone member states or in some cases transport nuclear weapons through the zone. While the provisions of the treaties and their verification and compliance arrangements vary, all rely on IAEA safeguards to verify the non-nuclear status of member states and all either establish a new structure or agency to deal with compliance questions or use an existing regional body.

Latin America and the Caribbean

The 1967 Treaty of Tlatelolco established a nuclear weapon-free zone in Latin America and the Caribbean and an Agency for the Prohibition of Nuclear Weapons in Latin America (known as OPANAL from its name in Spanish), to oversee its implementation. OPANAL comprises a General Conference, a Council and a tiny Secretariat, based in Mexico City, headed by a Secretary-General. Although the treaty originally permitted the OPANAL Council to organize the conduct of so-called special inspections in cases of suspected non-compliance, it was amended in 1992 to limit the Council's role to requesting the IAEA to make an inspection. Information obtained during such an inspection will be forwarded to the Secretary General of OPANAL only after it has been sent by the IAEA Director General to the IAEA Board of Governors.

South Pacific

The 1985 Treaty of Rarotonga also uses an existing regional body, the Pacific Islands Forum (PIF) Secretariat, in Suva, Fiji, as its secretariat. Each party is required to report to the PIF Secretariat any 'significant event' on its territory relating to the implementation of the treaty. The treaty also establishes a Consultative Committee, comprising representatives of the parties, to be convened periodically. States may ask the PIF Secretary-General to convene a meeting of the Committee to discuss any matter relating to treaty implementation. A compliance process may also be initiated via the Consultative Committee and the PIF, including the option of OSIs.

Africa

The 1996 Treaty of Pelindaba, which has not yet entered into force, envisages the establishment of an African Commission on Nuclear Energy, apparently to be located in South Africa, to deal with reporting, consultations and exchanges of information. The Commission will meet annually and may also meet in extraordinary session. Parties must provide the Commission with annual reports of any nuclear activities or other activity relating to the treaty. The treaty has quite elaborate compliance provisions. If a party believes that another party is in breach of its obligations, it must bring the matter to the attention of that party. If the matter is not resolved adequately, the complainant may

²⁹ Although the 1959 Antarctic Treaty, the 1967 Outer Space Treaty, the 1971 Seabed Treaty and the 1979 Moon Treaty do not exactly fit the definition of nuclear weapon-free zones, they all prohibit either all military activity or the deployment of nuclear weapons in environments or areas where such activities have not yet commenced. All have provision for some form of on-site inspection, after consultation and clarification, in order to deal with compliance concerns. With the exception of the Antarctic Treaty, such provisions have not been used.

take the issue to the Commission. If the Commission determines that the situation warrants it, it may ask the IAEA to undertake an OSI and may send representatives as part of the inspection team. Based on the IAEA's report, the Commission will determine whether a treaty violation has occurred. If the Commission reaches such a conclusion, the treaty parties will meet in extraordinary session. If necessary, the session may decide to pass the matter to the African Union for further action. The AU may, in turn, decide to pass the matter to the UN Security Council.

South-East Asia

The 1995 Treaty of Bangkok also establishes a commission to oversee implementation. It comprises representatives from all parties and meets as necessary. The Commission has an Executive Committee charged with overseeing the verification process, considering requests for consultation and clarification and fact-finding. Parties have the right to seek clarification from another party about possible non-compliance or request the Executive Committee's assistance. States may ask the Executive Committee to send a fact-finding mission to another party's territory if there is a possible non-compliance situation. If the Executive Committee determines that a violation has occurred, the non-compliant state will be required to bring itself into compliance. If it does not, a meeting of the Commission may submit the issue to the IAEA, the UN Security Council or the UN General Assembly for further action.

Central Asia

The 2002 Treaty of Samarkand, which has not yet entered into force, creates a nuclear-weapon free zone among the former Soviet republics of Central Asia: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. It also requires states parties to uphold nuclear security and safety standards at least as effective as those elaborated in the 1980 Convention on the Physical Protection of Nuclear Material. Annual consultative meetings are envisaged, along with extraordinary meetings if requested by any party, in order to 'review compliance or other questions related to ... implementation'. Otherwise the treaty is silent on how non-compliance is to be handled.

Chemical Weapons

The principal disarmament agreement in the chemical weapons (CW) area is now the 1993 Chemical Weapons Convention (CWC). A previous treaty banning the use of chemical and biological weapons, the 1925 Geneva Protocol, remains in force but it had no verification and compliance mechanisms. What was intended to be a temporary verification mechanism for the Protocol was initiated by the UN General Assembly in 1982. However, given the existence of a comprehensive verification regime for chemical weapons—the CWC's Organization for the Prohibition of Chemical Weapons (OPCW)—the current state of the Secretary-General's mechanism will only be considered in the section relating to biological weapons below. The role of UNSCOM and UNMOVIC in chemical and biological weapons verification in Iraq will be discussed in the section on those two mechanisms, also below.

The Chemical Weapons Convention (CWC)

The 1993 Chemical Weapons Convention, which entered into force in 1997, prohibits states from using, developing, producing, acquiring, stockpiling or retaining chemical weapons, and from

transferring them directly or indirectly. The treaty requires parties to destroy, within ten to fifteen years of the convention entering into force, all their CW and CW production facilities, as well as any chemical weapons abandoned on another party's territory.

Organization for the Prohibition of Chemical Weapons (OPCW)

The OPCW, which began operating in 1997, is located in The Hague, Netherlands. It consists of a Conference of the States Parties, an Executive Council and a Technical Secretariat. The Conference, which oversees the implementation of the treaty, meets annually and may also convene in special session on request. The Executive Council, the executive body, is responsible to the Conference. It has 41 members elected by the parties according to geographic region and meets in regular session three to four times a year. The Technical Secretariat is responsible for implementing the verification regime, including processing declarations and carrying out on-site inspections. The Director-General of the OPCW oversees the Secretariat's daily operations. The current annual budget of the OPCW is approximately €60 million. The organization has a staff of approximately 500, including 200 inspectors.

The CWC established a comprehensive, intrusive multilateral verification system, comprising declarations, various types of OSI, and some off-site sampling, designed to ensure that CW is not produced by military or civilian industrial facilities. Different levels of verification are applied to different chemicals depending on the estimated likelihood that they will be used as or for chemical weapons. Destruction of existing CW occurs at designated facilities subject to the continuous presence of inspectors and continuous on-site monitoring using technical means.

The convention provides for routine and challenge inspections, as well as investigations of alleged CW use. Initial inspections are conducted to confirm the validity of the data provided by parties in their initial declarations of their CW holdings and/or capabilities, whether past or present. Systematic, routine inspections are conducted at declared CW storage, production and destruction facilities, as well as civilian facilities that use chemicals listed in the three schedules and certain non-scheduled chemicals.

Challenge inspections may be carried out at short notice at the request of any party if it suspects that a violation has occurred. A request for a challenge inspection is submitted to the Director-General and the Executive Council. The challenging state must support the request by providing sufficient information. The Council must decide, within 12 hours of the request, whether the request is valid (rather than frivolous or abusive). The inspected party will be notified at least 12 hours prior to the arrival of the inspection team at the designated point of entry. These inspections could potentially be highly intrusive. The inspected state, however, has the right to propose alternative ways of demonstrating its compliance and may take measures to protect sensitive installations, and prevent disclosure of confidential information not related to the convention. Before a challenge inspection, parties may undertake an informal consultation and clarification process either bilaterally or with the participation of the OPCW. The information obtained during a challenge inspection is given to the Director-General who must distribute it to all state parties and to the Council for further action. There have been no challenge inspections to date.

Performance to date

Initially the OPCW appeared to be a model multilateral verification organization. The organization was readily established, a new, purpose-built headquarters building was constructed and occupied and the necessary staff recruited. Several states declared CW stockpiles and the organization began verifying their destruction, while also gearing up for industry inspections. However within a few years the organization began to experience both managerial and financial difficulties. In April 2002 the first Director-General, José Bustani of Brazil, was dismissed; he was replaced in July 2002 by Rogelio Pfirter of Argentina. In 2000-2001 the OPCW faced a financial crisis that had been brewing since entry into force. This was partly due to poor financial governance and management and delayed reimbursement of verification costs by certain states parties. Many of these immediate difficulties have now been remedied.

Although some of the organisation's failings could be attributed to its leadership, the treaty's governing bodies, the Executive Council and the Conference of States Parties, as well as states parties individually, were also responsible. The first Review Conference for the CWC, held in April/May 2003, six years after the treaty's entry into force, provided an opportunity to rectify the problems.³⁰

Given the novelty and complexity of the convention's verification goals, it is not surprising that there were teething problems and that implementation had to confront some harsh realities. One is the inherent difficulty of establishing, from scratch, a verification organization for a type of weapon that had previously been largely unregulated by international law. A second has been the differing and evolving views of states parties on the priorities for the convention. A third reality has been the inability or unwillingness of states parties to carry out in full their obligations under the convention, in terms of declaring and destroying their chemical weapons, declaring, and co-operating in the monitoring of, their peaceful chemical industry and in providing unstinting political, technical and financial support to the OPCW.

Finally, there have been major changes in the way the global chemical industry is organised since the convention was negotiated. While many large-scale single product facilities remain in developed countries, many have moved to developing countries where costs are cheaper. At the same time there has been a trend in the industrialized countries towards smaller facilities able to switch production between various products at short notice to meet the demand of more complex markets. Such flexible facilities also, unfortunately, make it easier to switch to the production of CW or CW precursors.

The verification balance askew

One casualty of these realities has been the balance struck in the convention between the resources and effort devoted to verifying the declaration and destruction of existing CW stockpiles and that devoted to verifying that new CW and CW capabilities do not emerge.

The convention provides for verification of the declarations of CW stockpiles by CW possessor states, of the transportation where necessary of such stockpiles to secured sites and of the retention

³⁰ For a comprehensive report on the OPCW's difficulties and suggested remedies that was prepared for the first review conference see 'Getting verification right: proposals for enhancing implementation of the Chemical Weapons Convention', VERTIC, London, 2002.

of the stockpile at those sites until their destruction. It also provides for continuous monitoring of the destruction process to ensure that no CW is retained or diverted. These provisions come into force immediately a state party declares any CW and continue until the weapons are completely destroyed. Destruction of all declared CW stocks was to begin 2 years after entry into force and be concluded 10 years after entry into force—by the end of April 2007.

At the same time, it was intended that industry and other inspections (such as university, defence research and other laboratories) would commence immediately after state party declarations of relevant production of chemicals listed in Schedules 1, 2 and 3 had been made. In addition, inspections of facilities producing Discrete Organic Chemicals (DOCs), organic chemicals not listed in the schedules to the convention, were set to start in 2001, the fourth year after entry into force. By this stage the industry inspection regime would be expanding as the destruction programme was gearing up towards completion. The industry inspection system would continue in perpetuity: indeed there is no implication in the CWC that at any stage industry verification should be a secondary activity to CWC destruction verification.

Contrary to this vision, in the first five years of the convention, verification activity concentrated largely on existing CW stocks, former CW production facilities and CW destruction plants, while industry inspections were relatively neglected. Since the first review conference there has been some progress in rectifying these imbalances. However destruction of existing stockpiles has been subject to continuing delays and postponement, meaning that the OPCW will be involved in verifying destruction long after it had intended.³¹

One of the other significant issues that has confronted the OPCW is its possible role in reducing the risk of terrorists acquiring and using chemical weapons. To some extent the CWC did encompass measures to deal with this by emphasizing the requirement for national implementation measures by states parties. The OPCW has been active in encouraging and assisting states to have the requisite national measures in place, including penal sanctions for individuals and organizations that flout the goals of the convention. The OPCW closely monitors states' progress and provides legal and other assistance. While the OPCW has a clearly defined role in ridding the world of CW stockpiles that might be seized by terrorists for their ready use, the peaceful global chemical industry is so vast that achieving total security of all chemicals and chemical precursors that might be used by terrorists to make their own chemical weapons is impossible. Such security must be provided by industry itself with the support and encouragement of governments.

Similarly the OPCW is not mandated to be involved in controlling imports and exports of chemicals and dual-use equipment and its verification system is therefore not geared toward this goal. The Australia Group, an informal grouping of like-minded states which coordinate their export control policies, is outside the convention framework. Nonetheless its existence causes some friction with developing country CWC states parties, which argue that as treaty members in good standing they should not be subject to such additional constraints on their economic development. While this is a constant refrain in meetings of states parties, the issue has to date not constrained the operation of the OPCW or its verification regime.

³¹ As of April 2004, only 12.37 percent of the 71,000 metric tons of declared CW had been destroyed. The 6 states that have declared CW are Albania, India, Libya, Russia, South Korea and the US.

Compliance mechanism

The OPCW's Executive Council has the authority to determine whether a situation of non-compliance exists and what action should be taken. The matter may be referred to the Conference of States Parties. In situations of serious non-compliance the Conference may suspend the party in question, recommend collective measures against it, or refer the issue to the UN General Assembly or UN Security Council.

The most egregious example of non-compliance to date has been the lack of progress in the destruction of the Russian and American CW stockpiles, by far the largest. The reasons have been political, organizational, environmental, technical and budgetary. Neither of the two countries, which together account for 95 percent of the world's declared chemical weapons, are likely to meet the extended 2012 deadline for destruction of their entire stockpiles. In this case however it is clear that both states intend to comply eventually. The Council has responded therefore by extending the destruction deadlines rather than attempting to impose sanctions.

A case of deliberate non-compliance, particularly the hiding of substantial stockpiles from OPCW inspectors or the secret manufacture of new chemical weapons would be a much more serious breach of the convention. To date there is no firm evidence that any state party has done so. The US has, however, publicly accused Iran of such a violation, but without producing evidence and without raising the issue in the Executive Council or requesting a challenge inspection (although it did so at the first CWC Review Conference, along with accusing Sudan and Libya, two non-states parties at the time, of having CW). Some observers have argued that without a challenge inspection being called in the near future, the option will atrophy. Others contend that conducting a challenge inspection for the sake of it, without proper evidence to justify it, will jeopardize the future exercise of such an option.

Biological Weapons

Geneva Protocol: the UN Secretary-General's fact-finding mechanism

The 1925 Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare bans the use of chemical and biological weapons (CBW) as a means of warfare, but does not have provisions for monitoring or verifying compliance. The UN Secretary-General has a presumed inherent authority under Article 99 of the UN Charter to conduct fact-finding missions to inform himself of any situation which threatens international peace and security. In 1982³² and 1983³³ the UN General Assembly specifically endorsed this authority in regard to investigating the alleged use of chemical, biological and toxin weapons. This was intended to provide a provisional procedure for verifying compliance with the Geneva Protocol pending the adoption of the CWC. In 1988 the Security Council in 1988³⁴ endorsed the procedure, which significantly, is applicable to all UN member states.

³² UN General Assembly resolution 37/98D, 13 December 1982, A/Res/37/98D (1982).

³³ UN General Assembly resolution 42/37C, 30 November 1987, A/Res/42/37C (1987).

³⁴ UN Security Council resolution 620, S/Res/620, 26 August 1988.

The 'mechanism' itself was essentially a virtual one, comprising lists of experts nominated by states to be available for fact-finding missions; a list of laboratories available to do sample analysis; and guidelines for the conduct of missions agreed by a group of experts in 1989. The UN Department for Disarmament Affairs (UNDDA) was requested to maintain the lists. The guidelines contain information on assessing whether to proceed with a particular fact-finding mission, inspection techniques and modalities, expertise that it would be useful to have on a mission and procedures for accrediting laboratories for analyse samples.

The Secretary-General has made use of the mechanism on several occasions, in relation to alleged chemical, biological or toxin use in Afghanistan and Indochina (1981 and 1982); Iran (1984-1986, 1988); Iran and Iraq (1986), Iraq (1988); Mozambique and Azerbaijan (1992). In the Afghanistan and Indochina cases, as the fact-finding team was not permitted access to the states concerned it could only conduct interviews and sample analysis in neighbouring states. Iran and Iraq each granted access during their eight-year war to allow verification of alleged CW use by the other country. The government of Azerbaijan itself invited a fact-finding mission on its territory to help it to prove its compliance.

The mechanism remains available, but has atrophied. The lists of experts and laboratories were last updated in 1989.³⁵ In advance of the BWC Experts Meeting in July 2004 the UNDDA requested member states to help update them, but few have responded. Meanwhile the UK has proposed several ways of reviving the mechanism, with particular attention to BW, given that verification of allegations of us of CW is now possible under the CWC.

Biological Weapons Convention (BWC)

The 1972 Biological Weapons Convention has no verification system and only weak compliance provisions. Each state party is obliged to take steps nationally to ensure that it complies with the treaty, such as passing national implementation legislation, but there is no multilateral body to encourage and monitor such efforts. Despite decades of efforts these shortcomings have not to date been rectified.

Efforts to close the verification gap

In 1986 the US rebuffed a formal Soviet proposal for a verification protocol to the BWC. In 1991 French-led Western pressure for improved verification led to a compromise, whereby a technical and scientific study of possible verification measures was launched.³⁶ The Ad Hoc Group of Verification Experts (VEREX), which met from 1992-93, identified, examined and evaluated 21 initiatives, concluding that a combination of on-site and off-site measures was worth pursuing. In 1994 a Special Conference of States Parties, after considering the VEREX report, established a new, more political, Ad Hoc Group (the AHG). Open, like VEREX, to all states parties, the AHG was mandated to consider appropriate initiatives, including possible verification measures, and to draft proposals. These would be incorporated, as appropriate, in 'a legally binding instrument', which was assumed would be a protocol to the BWC.

³⁵ UN document A/44/561, 4 October 1989.

³⁶ See Nicholas Sims, 'Verifying biological disarmament: towards a protocol and organisation', in *Verification Yearbook 2000*, VERTIC, London, 2000, pp. 93-94.

The ill-fated BWC protocol

The AHG commenced its work in 1995 and moved into negotiating mode in 1997, producing an unwieldy compilation of 'measures to promote compliance'. At the behest of the US the word verification was avoided, even though the draft contained many of the verification measures that proponents wanted. The chief advocates were Australia, Brazil, Canada, South Africa and the members of the European Union (EU), especially the UK. Sceptics included China, Iran, Pakistan and the US, and on particular issues, Japan, Germany and Russia. Negotiations on the draft took place between 1997 and 2001 and intensified as the deadline of the Fifth BWC Review Conference approached in November 2001. In April 2001 the Chairman of the AHG, Ambassador Tibor Tóth of Hungary, tabled a 200-page compromise draft text.³⁷

The draft envisaged the establishment of an international Organization for the Prohibition of Biological Weapons (OPBW), on a lesser scale than the OPCW, but which would nonetheless be charged with monitoring and verifying compliance with the BWC. States parties would be required to declare certain facilities, such as commercial research and production plants and larger bio-defence establishments. 'Triggers' for such declarations would include the facility's bio-safety level, as well as whether it worked with specified agents that could be used to develop biological weapons. Declared facilities would be subject to non-challenge 'visits' to enhance transparency and to increase confidence in the accuracy of the declarations. Consultations could be held to clarify ambiguous or suspicious information. Field investigations could be instigated in the event of an unusual outbreak of disease or suspected use of BW, while facility investigations could be launched to assess whether production of biological weapons was occurring. The draft also envisaged measures to strengthen technical cooperation and to increase scientific exchanges among states parties.

Although no delegation endorsed Tóth's draft in its entirety, no delegation rejected it either and de facto it became the negotiating text. While less than perfect, the protocol would at the very least have:

- created greater transparency than currently exists;
- increased the possibility of challenge OSIs in the case of suspected manufacture or use of BW;
- provided a standing international forum for any state party to air its compliance concerns; and
- established a relatively cheap verification organisation tasked with keeping global attention focused on the BW threat.

At the July 2001 meeting of the AHG, the last scheduled gathering, the US delegation rejected both the draft protocol and the entire 'approach' that it represented.³⁸ It announced, moreover, that it could not conceive of any changes that would improve the draft text to make it acceptable. It was both too strong and too weak. Paradoxically, the relative weakness of the verification regime was of the United States' own making: it had continuously sought to water down the draft on the grounds that it regarded the BWC as inherently unverifiable.

³⁷ See Oliver Meier, 'A biological weapons protocol: verification lite?', *Trust & Verify*, no. 97, May-June 2001, pp. 1-2.

³⁸ See Trevor Findlay, 'Bush ditches the BW protocol', *Trust & Verify*, no. 98, July-August 2001, pp. 1-3.

The 'new process'

Ultimately the AHG membership was unwilling to proceed with a BW protocol in the absence of the US. Instead they acceded to US wishes and effectively abandoned the negotiations. This suited many other states, such as China, Iran and Russia, which, while unhappy with the protocol, would not have opposed its adoption outright had the US supported it. For their part, many developing countries see the BW problem as irrelevant to them, or at least of low priority, and had been attempting to use their agreement to improved verification as a bargaining chip to obtain increased assistance from the West in biotechnology.

Although the AHG was never been officially terminated, the fifth BW Review Conference in November 2002 agreed on a 'new process' of discussions by annual expert meetings, followed by meetings of states parties to consider their outcome. This process aims to promote 'common understanding and effective action' on five issues. The sixth Review Conference in 2006 is to assess the product of this intersessional work programme and decide on further action. The issues are:

- adoption of necessary national measures to implement the prohibitions set forth in the convention, including enactment of penal legislation;
- national mechanisms to establish and maintain security and oversight of pathogenic micro-organisms and toxins;
- enhancing international capabilities to respond to, investigate and mitigate the effects of alleged use of biological or toxin weapons or suspicious outbreaks of disease;
- strengthening and broadening national and international institutional efforts and existing mechanisms to survey, detect, diagnose and combat infectious diseases that affect humans, animals and plants; and
- the content, promulgation and adoption of codes of conduct for scientists.

The Bush administration is now so averse to any multilateral effort to improve the BWC that it has exerted strong influence over the new process to ensure that discussions do not stray into negotiations and that no substantive outcome materializes.

This was tested in the first of the Expert Meetings, held in Geneva from 18–29 August 2003, which discussed national implementation legislation³⁹ and bio-safety and security. Although the US is strongly in favour of both relatively benign measures, it wishes to pursue even these outside of a multilateral framework, dealing instead with states bilaterally and within groupings of 'likeminded' nations. The first annual Meeting of States Parties to consider the work of an Expert Meeting, held in November 2003, was thus anodyne in its conclusions, simply providing a factual account and no recommendations for future work. The second annual round of Experts Meetings, held in July 2004, saw a better working atmosphere, although the US maintained its previous attitude.⁴⁰

Just how the remaining topics on the list will fare is unclear, but even if all the discussions result in agreed and workable initiatives, collectively they will come nowhere near to effective verification of the BWC. They will increase transparency somewhat, improve national implementation and possibly establish some form of multilateral cooperative endeavour, but it will be a far cry from the CWC

³⁹ See *Time to Lay Down the Law: National Legislation to Enforce the BWC*, VERTIC, London, October 2003.

⁴⁰ See Jez Littlewood, 'Back to basics: verification and the Biological Weapons Convention', in *Verification Yearbook 2003*, VERTIC, London, 2003.

model. A change of heart by the US is the only way that the situation will alter dramatically. Alternatively, like-minded states will need to take initiatives outside the treaty framework.

Confidence-building measures

The second BWC Review Conference in 1986 agreed that states should make annual declarations on various BW-related matters to increase transparency and act as confidence-building measures. These were revised and expanded at the third Review Conference in 1991. The current issues which states are invited to report on are:

- A1: Data on research centres and laboratories
- A2: Information on national biodefence research and development programmes
- B1: Background information on outbreaks of reportable infectious diseases
- B2: Information on outbreaks of infectious diseases and similar occurrences, that seem to deviate from the normal pattern
- C: Encouragement of publication of results and promotion of use of knowledge
- D: Active promotion of contacts
- E: Declaration of legislation, regulations and other measures
- F: Declaration of past activities in offensive and/or defensive biological research and development programmes
- G: Declaration of vaccine production facilities

States parties are obliged to submit a CBM return by 1 April each year to the UNDDA, which collates and distributes the reports only to states parties. So far only two countries, Australia and the US, have made theirs public.

Participation in the CBMs has been poor, with only 53 states parties submitting a return in 1996, the peak year for submissions.⁴¹ In 2003, only 33 states parties submitted declarations. Many states parties have never submitted one. Canada has prepared a guide to assist states to complete the CBM forms,⁴² although the low level of participation is not solely attributable to a lack of understanding. As the data is not publicly reviewed and is unlikely to be substantially studied by states parties themselves there is little incentive for states to fully or accurately report. While the process does marginally increase transparency in regard to states which participate, it can in no sense be described as monitoring or verification.

The US/UK/Russian trilateral initiative

The accidental release of anthrax at Sverdlovsk in the Soviet Union in 1979, combined with the testimony of Soviet defector Vladimir Pasechnik in 1989, increased US suspicions that the Soviets had maintained an offensive BW programme in violation of BWC. After considerable diplomatic pressure from the US and UK, the Soviets reluctantly agreed to allow a joint US-UK team to visit four facilities in January 1991. Rather than allay concerns, the visits heightened suspicions of Soviet non-compliance. The team was denied access to parts of a research facility, identified inconsistencies about smallpox research and heard explanations about purported peaceful purposes of test chambers which lacked credibility. Following a reciprocal visit by a Soviet team to four US

⁴¹ 'Transparency under the BWC: CBMs', *BioWeapons Report 2004* (forthcoming December 2004)

⁴² The Biological and Toxin Weapons Convention Confidence Building Measures: A Guide to Their Completion, DFAIT, Canada, 2004; http://www.opbw.org/cbms/Guide_files/frame.htm

sites, the continuation of visits was formalised under a Joint Statement by the three governments in Moscow on 10 and 11 September 1992 (commonly referred to as the Trilateral Agreement) Described as a CBM rather than verification (with its implication of non-compliance), the agreement provided for reciprocal visits to each others' military biological facilities. The US and UK were first invited to observe a Russian Commission of Inquiry to assess whether work at the Institute of Ultrapure Preparations violated the BWC. Unsurprisingly, the Commission declared that it did not. Agreements were then adopted on protecting proprietary information before another US-UK team visited Russian facilities in May and October 1993 and January 1994. Again, the Russians restricted access to certain facilities. They also failed to provide credible explanations of evidence of large-scale production and of facilities indicative of offensive application, such as excessive containment levels for current operations and aerosol test chambers. A Russian team then visited US commercial facilities and a Department of Agriculture site in February 1994. Further discussions were held in 1994 to 1996 on procedures for future visits ('Rules of the Road'), although these were never concluded as Russia continually failed to cooperate in the discussions. A lack of political will in Russia and the US to continue the process resulted in its demise.

The Trilateral Agreement is the only example of a voluntarily agreed multilateral inspection process to verify BWC compliance. While it was not a success in verification terms, the process was important in demonstrating that even inspections under conditions of limited access and minimal cooperation can identify indicators of an offensive BW programme. When pieced together, such evidence can provide a compelling picture of non-compliance.

The BWC compliance mechanism

Article 5 of the BWC provides for bilateral and/or multilateral consultations between states parties should a non-compliance allegation occur. The procedure was fleshed out by understandings agreed at the treaty's third Review Conference in 1991. The procedure was invoked in 1997, following a Cuban allegation that US aircraft had caused a crop disease outbreak involving *thrips palmi*. Information was sought and received from both Cuba and the US and a two-day meeting was held in Geneva by states parties to hear each side's case. However, no attempt was made to initiate a fact-finding mission, conduct on-site activities, identify and collate open source information or to solicit information from NTM. The chair of the meeting noted that 'the technical complexity of the issue and the lack of further detailed information made it impossible to draw any definitive conclusions'.⁴³ Although under Article 6, states parties may refer compliance matters to the UN Security Council, Cuba made no attempt to do so on this occasion.

No other alleged violation of the BWC has been brought to the Councils' attention. Even outside the BWC compliance framework, any state may bring such a BW matter to the attention of the UN Security Council as a threat to international peace and security, but none has yet done so.

⁴³ Letter from Ambassador Ian Soutar, United Kingdom Permanent Representative to the Conference on Disarmament, dated 15 December 1997 to All States Parties to the Biological and Toxin Weapons Convention.

Security Council-mandated verification regimes

The long crisis over Iraq's actual and presumed WMD capabilities generated not only agonizing dilemmas for the international community but also novel ways of attempting to deal with the problem. In particular it led to the establishment by the UN Security Council of two bodies, UNSCOM and UNMOVIC, charged with monitoring, verifying and assisting in Iraq's disarmament. Both were given powers of inspection and information-gathering vis-à-vis a sovereign member state that are unprecedented in the history of the UN. While both involved unique verification regimes that may not be replicated in future cases, the techniques and technologies they used, and which in some cases they developed to a high art, may be drawn on by the standing multilateral regimes and applied in more or less adversarial circumstances. In addition, as UNMOVIC still exists, consideration needs to be given as to the future of that body and the potential uses of its hard-won capabilities.

The UN Monitoring, Verification and Inspection Commission

UNMOVIC drew heavily on the experience of UNSCOM, as well as acquiring its assets, archives and some of its personnel.⁴⁴ However, it became a more formidable inspection and verification organization, partly because it used the three years between its establishment and the deployment of its inspectors to Iraq to prepare thoroughly. It also implemented many of the recommendations of the Amorim panel, named after Brazilian Ambassador Celso Amorim, which had been established by the Security Council to suggest ways of avoiding the pitfalls encountered by UNSCOM.⁴⁵

The Commission comprises, besides the Executive Chairman and his support office, an Administrative Service and four main divisions—Technical Support and Training; Planning and Operations; Analysis and Assessment; and Information (see figure 1).⁴⁶ Although, unlike UNSCOM,⁴⁷ UNMOVIC actually had an organizational chart, the divisions are permeable, in recognition of the fact that expertise needs to flow where needed and is relevant in several different parts of the organization. For instance, planning and operations is critically dependent on analysis and assessment.

The Division of Planning and Operations is responsible for planning and executing all monitoring, verification and inspection activities, including proposing sites for inspection, planning the objectives and timing of inspections and deciding the composition of inspection teams. The division has four principal units—BW, CW, ballistic missiles and multidisciplinary inspections and operations. The division also has responsibility for the verification and monitoring of any proscribed items imported by Iraq and investigating any dual-use items, as part of an Export/Import Joint Unit

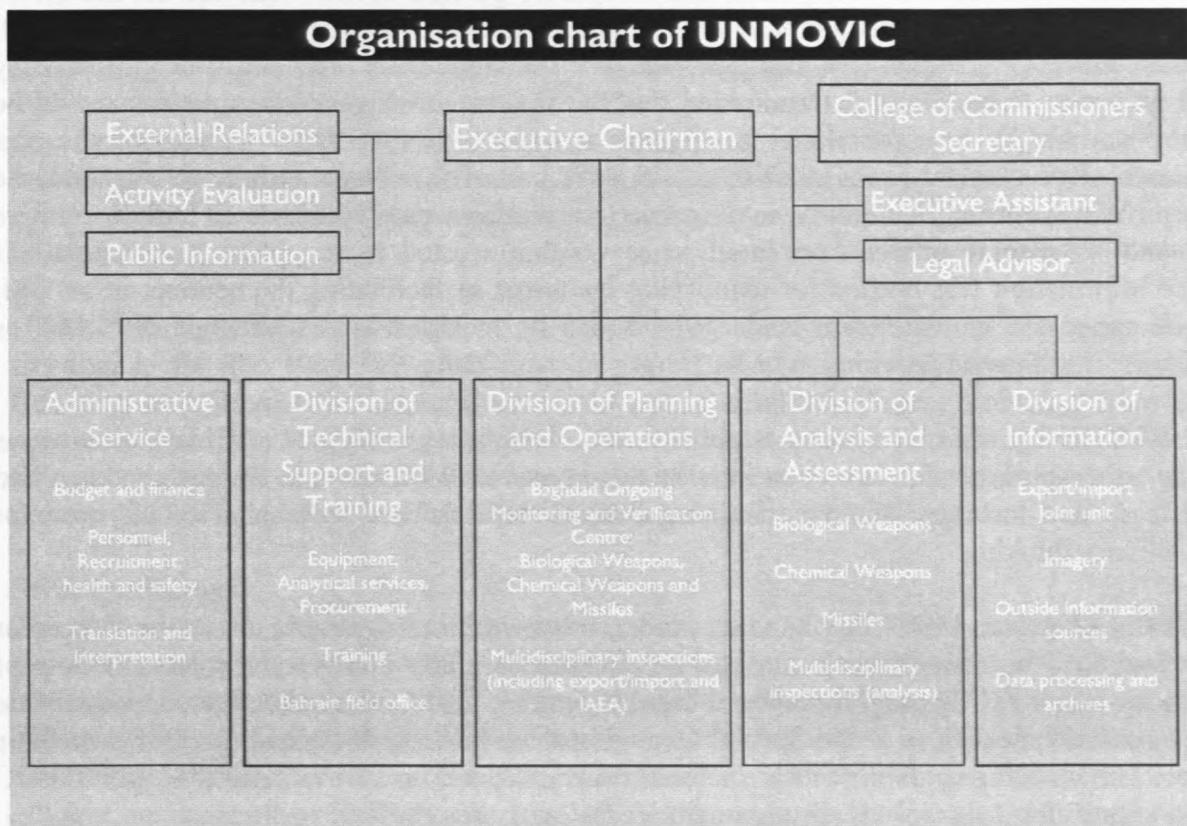
⁴⁴ There were some who argued that UNMOVIC should not employ any UNSCOM personnel. Hans Blix, though, felt strongly that the new body should draw on the wealth of experience and expertise that his predecessors had put so much effort into acquiring.

⁴⁵ 'Report of the First Panel Established Pursuant to the Note by the President of the Security Council on 30 January 1999 (S/1999/100), concerning disarmament and current and future ongoing monitoring and verification issues', UN document S/1999/356, 27 March 1999.

⁴⁶ 'Note by the Secretary General', UN document S/2000/292, 6 April 2000.

⁴⁷ UNSCOM Executive Chairman Rolf Ekéus reportedly deliberately avoided establishing an organizational chart, preferring to maximize his personal control of the body and to minimize interference from Commissioners.

with the IAEA. The division also has responsibility for the Reinforced-Ongoing Monitoring and Verification (R-OMV) programme which was supposed to continue in Iraq indefinitely.



The Division of Information gathers, processes and archives information from several sources, including that garnered from both UNMOVIC and UNSCOM inspections, overhead imagery, open sources (notably from the Monterey Institute and a French research institute) and intelligence provided by UN member states. Because of the long period that elapsed between the end of UNSCOM inspections and the commencement of UNMOVIC inspections, and the resulting paucity of information about Iraq's weapons programmes between 1998 and 2002, information from open sources and intelligence was particularly important during the interregnum.

The Division of Analysis and Assessment is responsible for processing information in order to focus the work of the inspections, provide a basis for the R-OMV and assist the Export/Import Joint Unit. The Division has the same four units as the Division of Planning and Operations and each unit liaises directly with its counterpart to identify new sites for inspection and assess Iraq's compliance.

Finally, the Division of Technical Support and Training provided UNMOVIC with all the equipment and supplies needed for inspections, such as logistics, transport, communications and security. These activities were implemented in Iraq from the Baghdad Ongoing Monitoring, Verification and Inspection Centre (BOMVIC) for both UNMOVIC and the IAEA. It was also responsible for the Larnaca (Cyprus) and Bahrain field offices (the latter now closed) and for running the training programmes for staff and inspectors.

UNMOVIC innovations

Amorim's recommendations included employing all UNMOVIC staff, including inspectors, as UN civil servants, rather than accepting staff on secondment and in the pay of governments. All staff members would henceforth be obliged to act on behalf of and in the interests of the world organization. In part this was an attempt to avoid the possibility of national intelligence agents, still beholden to their national authorities, being planted in inspection teams. This aim was reinforced by Executive Charman Hans Blix's determination that the flow of intelligence information would be strictly 'one-way traffic'—from national intelligence services to UNMOVIC.⁴⁸ In addition the post of deputy executive chairman was abolished, since 'it had always been a direct channel to the authorities in Washington'.⁴⁹ Internally, intelligence information would be restricted to the executive chairman and a 'special officer', an intelligence conduit trusted by supplier governments. If intelligence information was needed for identifying the target or facilitating the conduct of an OSI, the head of operations and the team leader would also be included in the intelligence 'loop', as agreed with the intelligence provider.

Another UNMOVIC innovation was to establish multi-disciplinary analytical and inspection teams to avoid the 'stove-piping' of information into the three types of WMD that, in the past, had resulted in missed leads and lost opportunities. Training courses were devised to emphasize the need for cross-disciplinary thinking.

A key difference between UNMOVIC and its predecessor was that it was able to use the three-year waiting period to determine priority sites for inspection, carefully analyze the huge amounts of information on Iraq's WMD programmes and capabilities that UNSCOM had collected, consolidate and learn from the experiences of the Special Commission, create a well-trained force of inspectors and refine its monitoring and inspection methods. As instructed in resolution 1284, UNMOVIC focused on identifying 'unresolved disarmament issues' and 'key remaining disarmament tasks'. It assembled the unresolved issues into interrelated clusters to paint a better overall picture of Iraq's WMD programmes and to assess the significance of gaps in its knowledge and hence what still needed to be verified.⁵⁰

Staff training—under UNSCOM largely the responsibility of member states—was now organized and conducted solely by UNMOVIC (with some support from governments).⁵¹ As UNSCOM had been accused of cultural insensitivity, the programme included an Iraqi cultural training package that covered the history, economy and politics of Iraq, as well as regional, social and religious themes. With the completion of the first training courses and the recruitment of 42 professional core staff members in New York, UNMOVIC was in a good position by the end of 2002 to commence inspections at short notice. Courses were still running in February 2003, when UNMOVIC was withdrawn from Iraq, bringing the total number of experts on the UNMOVIC roster to 380 from 55

⁴⁸ Hans Blix, *Disarming Iraq: the Search for Weapons of Mass Destruction*, Bloomsbury, London, 2004, p. 50.

⁴⁹ Blix, p. 49.

⁵⁰ 'Unresolved disarmament issues—Iraq's proscribed weapons programmes', UNMOVIC working document, 6 March 2003, presented informally to the Security Council. Paradoxically, a draft work programme was submitted to the Council for its approval on the very day that UNMOVIC completed its last inspection before leaving Iraq ('Draft work programme', UNMOVIC document, 17 March 2003).

⁵¹ UNMOVIC instigated a rolling programme of training on a wide range of topics: the work of UNSCOM; the origins, mandate and legal framework of the commission; the scope and nature of Iraq's weapons programmes; monitoring and inspection techniques; and health and safety.

nations. The over-reliance of UNSCOM on American and other Western experts had been dealt with, removing at least one excuse for future Iraqi non-cooperation.

UNMOVIC also had better technological capabilities than UNSCOM. Surveys and the inspections were greatly assisted by significant improvements in technology after 1998. Detection devices were smaller, lighter, faster and more accurate. They included miniature radiation sensors, portable CBW detectors and ground-penetrating radar.⁵² The IAEA used environmental sampling techniques developed for improved nuclear safeguards to monitor water, air and vegetation.⁵³ Information technology developments also helped UNMOVIC. The IAEA and UNMOVIC databases were connected and cross-disciplinary analysis not previously available was used to look for patterns and linkages.

UNMOVIC's capabilities were also to be enhanced by the establishment of two regional offices, the freedom to fly into Baghdad rather than an airport several hours' drive away, a fleet of British, Canadian and Russian helicopters, access to colour satellite images, including from commercial providers, and the use of Mirage and U-2 aircraft for reconnaissance (although the latter took some time to arrange). It was also planned to obtain data from unmanned aerial vehicles (UAVs), but these could not be deployed before UNMOVIC's premature withdrawal from Iraq.

Strategic lessons

The first strategic lesson to be drawn from the cases of UNSCOM and UNMOVIC, and the experiences of their partner in the nuclear field, the IAEA, is that international verification can work effectively even under the most disadvantageous of conditions. Despite Iraq's non-cooperation and deliberate attempts at sabotage all three bodies broadly succeeded in their verification mission. All demonstrated that international inspection regimes are able to prepare themselves well, deploy quickly, use technology skilfully, organize efficiently, maintain their impartiality and produce sober, balanced reports of a high technical standard. They were also able to follow intelligence leads successfully and reach quick and decisive, albeit suitably caveated, conclusions.

The findings of UNSCOM, the IAEA and UNMOVIC respectively have subsequently been found to be true for the most part. Iraq did destroy the bulk of its WMD assets, either unilaterally before inspections commenced or under international supervision. The IAEA's conclusion that Iraq no longer possessed significant nuclear capabilities and could not rejuvenate them swiftly has proved to be correct. Similarly UNMOVIC determined that Iraq's CW programme had, with a few innocuous exceptions, largely been eradicated. In the BW area, while substantive questions remained after UNSCOM's withdrawal, some of which even now have not been satisfactorily explained, the more outlandish claims made by US intelligence, such as the existence of mobile BW laboratories and pilotless drones for BW dissemination, were credibly rebuffed by UN inspections. In the missile realm, where question marks remained after UNSCOM's departure, UNMOVIC did detect violations and was in the process of removing them when it was extricated.

⁵² Multi-channel analysers (MCAs) were used to detect and assess gamma radiation from radioisotopes and neutron radiation from plutonium, while a gamma spectrometer was utilized to identify high-enriched uranium. Importantly, as nuclear activities often require exotic metals, X-ray fluorescence spectrometers were employed to distinguish between various metal alloys.

⁵³ The equipment employed to survey Iraq's watercourses was so sensitive that it could detect the permitted use by Iraq of radioisotopes for medical applications.

A second strategic lesson follows on from the first. The experience of all three bodies has demonstrated once more that the full support of the Security Council, or at least that of its permanent membership, is essential if a multilateral verification endeavour is to succeed in the face of opposition from the country being verified. In the UNSCOM case, a significant cause of its ultimate failure was French and Russian reluctance to press Iraq to comply and to extend full political support for intrusive inspections. Without a united Security Council, UNSCOM was unable to force the Iraqis to back down.

In the case of UNMOVIC, the re-admission of inspectors to Iraq and the substantive success of the process, even up to the point at which it was pulled out of the country, was undoubtedly due to the steeling of the Security Council's nerve by the UK and the US. The threat of the use of force in the event of continuing Iraqi non-compliance and a growing UK-US military presence on Iraq's doorstep undoubtedly were key factors in forcing Baghdad to yield. In turn, the premature withdrawal of UNMOVIC was caused by the flaunting of the majority view of the Security Council, not by Iraq, but by the UK and the US. Purported growing US impatience with the inspection process, in reality masking a pre-determined preference for military means irrespective of UNMOVIC's performance, split the Security Council irredeemably.

A third strategic lesson is that an international monitoring and verification system backed up by military pressure, especially in combination with economic sanctions and control of militarily significant imports and exports, can result in effective containment of a renegade regime. Having, as it turned out, successfully disarmed Iraq of its WMD assets, it can now be seen that the planned Reinforced Ongoing Monitoring and Verification regime (never fully implemented) would likely have proved effective in detecting any future moves by Iraq to reacquire its lost capabilities. Notwithstanding revelations about Iraq's undermining of the Oil-for-Food Programme, there is little evidence that funds were able to be diverted to the resumption of WMD programmes.⁵⁴

In addition to these strategic lessons there are numerous institutional, operational and technical lessons that have been learned as a consequence of the UNSCOM/UNMOVIC/IAEA experience in Iraq.

Institutional lessons

Institutionally, there was not only a direct lineage between UNSCOM and UNMOVIC, but also some evolution. Both were established by the Security Council and remained under its control and direction, rather than becoming part of the UN Secretariat. This had advantages for the political credibility of the organization, in that there was a direct line of authority to the Security Council. Both UNSCOM and UNMOVIC were headed by executive chairmen with strong powers and who were answerable to the Security Council (although appointed by the UN Secretary-General) and a College of Commissioners.

Finance is critical to organizational independence. UNSCOM had been funded for the first six months from the UN Working Capital Fund and subsequently by individual, mostly Western or pro-

⁵⁴ See Comprehensive Report of the Special Advisor to the Director of Central Intelligence on Iraq's WMD (the Duelfer report), Central Intelligence Agency, Washington DC, 30 September 2004.

Western, UN member states.⁵⁵ By funding UNMOVIC through the Iraq Oil-for-Food programme escrow account (0.8 per cent), the independence of the body, as well as the ready availability of funding, was assured. Had UNMOVIC been set up under the UN Secretariat or by the UN General Assembly, it would have had its budget scrutinized by the Advisory Committee on Administrative and Budgetary Questions (ACABQ) and undoubtedly seen it whittled down by those states that objected politically to its existence. UNSCOM's reliance on seconded staff provided and paid by UN member states (in addition to seconded personnel from various UN agencies) had called into question its independence, as well as being unsatisfactory from a managerial perspective. Independent funding enabled UNMOVIC to hire the necessary staff quickly, an essential requirement when inspections have been urgently mandated by the Security Council.

While the vast majority of its personnel undoubtedly behaved professionally and in the best interests of the international community, UNSCOM was to a certain extent subject to undue influence by some UN member states. This occurred in two ways. First, the nature and pace of inspections may have been shaped without the agreement of UNSCOM's executive chairman. Former US National Security Advisor Richard Clarke claims that he 'set up' the confrontational nuclear inspections under UNSCOM, with British connivance; it is not clear whether these were approved by the executive chairman in advance.⁵⁶ A second misuse of UNSCOM was the reported planting of listening devices by the US on its monitoring equipment and the use of inspections for national intelligence-gathering purposes as a result of inspectors reporting back to capitals.

Compared to UNSCOM, UNMOVIC was more successful in avoiding being taken advantage of by any UN member state. In addition it managed not to offend Iraqi sensibilities unnecessarily and was able to parlay strong Security Council support into achieving Iraqi cooperation, if not proactive engagement and full compliance.

Intelligence information and verification

There are continuing lessons to be learned from both UNSCOM and UNMOVIC with regard to the relationship between intelligence information and multilateral verification. Intelligence information can, in theory, be of great assistance to multilateral verifiers. It may, for instance, be derived from highly sophisticated NTM beyond the reach and budget of international bodies.

But, as in the Iraqi case, national intelligence data can also consist of analysis of information from human intelligence (HUMINT) sources or electronic eavesdropping. As the various inquiries by legislatures in Australia, the UK and the US have revealed, such intelligence information may be based on unreliable, self-interested and/or malicious sources. National intelligence agencies, adopting worse-case scenarios or under political pressure, can dangerously inflate their assessments. By the time such analysis and 'information' is provided to multilateral verifiers it may have lost its qualifiers, its context and often, in an effort to protect the source and collection method, its provenance. International verification bodies thus need to be extremely wary of taking intelligence information provided by states at face value, even when it is supplied in good faith. Rolf Ekéus says that in any event the 'much-hyped intelligence provided [to] UNSCOM by member states was

⁵⁵ Notably Australia, France, Japan, Kuwait, Norway, Saudi Arabia, the UK and the US.

⁵⁶ Richard Clarke, *Against All Enemies: Inside America's War on Terror*, Free Press, New York, 1004, pp. 67-69.

insignificant and highly marginal in the work to identify the WMD programmes and to establish the material balance'.⁵⁷

It appears that UNMOVIC did learn from the difficulties that UNSCOM experienced in regard to what was later seen as too cosy a relationship with national intelligence agencies. There was, however, a price to pay. In seeking to formalize the relationship between UNMOVIC and national intelligence agencies by restricting it to the highest levels and a single designated 'conduit', UNMOVIC may have cut itself off from valuable contacts and information at the working level. This may be a necessary trade-off, though, to keep the intelligence/verification nexus as pristine as possible.⁵⁸ The relationship between any future inspection agency and national intelligence body needs to be subject to thorough review and careful thought. It is encouraging, however, that UNSCOM, the IAEA and UNMOVIC were never accused of leaking classified information and indeed were successful in establishing systems to safeguard it. This should help repudiate critics who claim that UN bodies inevitably 'leak like sieves'.

Verification and public relations

A key lesson for the future that has been identified by the IAEA, but which applies equally to UNMOVIC, is that multilateral verification bodies need to make better use of the media to convey their achievements to the public and decision-makers.⁵⁹ In part because of the multilateral nature of such bodies, but also because traditionally UN bodies have not been adept in defending their case, it was relatively easy for ill-informed and hostile observers to impugn the intentions and capabilities of the inspectors. Naturally there are constraints on how virulently UN bodies can engage in self-defence in these circumstances, especially when critics can be as senior as the US vice-president. Nonetheless, they should have public information and media capacities to enable their case to be injected clearly into the public domain.

Deception and denial

While initially UN inspections in Iraq may have begun in the naive hope that they would be concluded within weeks, if not months, UNSCOM soon found itself on a steep learning curve in terms of the degree of deception and denial that Iraq was willing and able to engage in. UNSCOM, the IAEA and UNMOVIC all ended up participating in a 'deception and denial' race, in which the Iraqis attempted to employ increasingly sophisticated means which the international bodies sought to counter with innovative schemes of their own. Both bodies set up their own special units to deal with the issue. Just one example relates to prior notification of inspections: after realizing that pre-notification allowed the Iraqis the opportunity to clear intended sites of any traces of WMD, the inspectors opted to set off vaguely in one direction, while leaving their actual destination a mystery until the last possible moment. Learning and using such counter-deception techniques is unusual for a UN body, but clearly necessary in the circumstances.⁶⁰ The lessons of such campaigns need to be collated and analyzed so that they can be drawn on when future challenges to verification arise.

⁵⁷ Ekéus, 'Reassessment: the IISS strategic dossier on Iraq's weapons of mass destruction', *Survival*, vol. 46, no. 2, summer, p. 78.

⁵⁸ For further analysis of the verification/intelligence relationship, see Brian Jones, 'Intelligence, verification and Iraq's WMD', in *Verification Yearbook 2004*, VERTIC, London, 2004 (forthcoming).

⁵⁹ Jacques Baute, 'Timeline in Iraq: challenges and lessons learned in Iraq', *IAEA Bulletin*, June 2004, p. 67.

⁶⁰ For the details of UNSCOM's counter-deception and denial techniques, see Ekéus, p. 75.

Technical lessons

The technical lessons that may be gleaned from the UNSCOM/IAEA/UNMOVIC experience are too numerous to be detailed here. Nonetheless, several broad categories of lessons are identifiable. One is the need for rapid deployment. All three verification bodies fared well in this respect, but such endeavours in future would be facilitated by pre-leased airlift, pre-positioned equipment and standing contracts with inspection personnel, rosters of experts and pre-certified analytical laboratories.

A second lesson is that UN verification bodies are clearly capable of rapidly absorbing and even advancing the latest verification techniques and technologies. Examples from the Iraq experience include U-2 overflights, ground-penetrating radar and environmental sampling. This should give pause to those who claim that UN bodies will always be behind the technology curve.

An innovation of UNSCOM and UNMOVIC, one acted on most stridently by David Kay as an IAEA inspection team leader, was the hunt for, and the use of, a paper trail—documents that would reveal WMD assets and intentions—rather than searching endlessly for the capabilities themselves.⁶¹ A further innovation of UNMOVIC was what might be termed ‘verification archaeology’, the digging up of sites to detect buried weapons or weapons components or to determine destruction techniques and timelines. UNMOVIC did this fruitfully both in relation to missiles and CBW. Finally, the role of UNSCOM and UNMOVIC in seeking information from UN member states about Iraqi imports of weapons-related technology and materials and those of a dual-use character, and about the companies and organizations involved, was also unprecedented for a UN body. The IAEA has followed this precedent by attempting to trace the reach of the A.Q. Khan network in facilitating nuclear proliferation in the cases of Libya, Iran and North Korea. Such precedents are valuable for future counter-proliferation efforts.

Perhaps the greatest legacy of the Iraq verification experience, though, is the size of the verification cadre that it has produced. Literally hundreds of inspectors have been trained and have gained field experience in all areas of WMD verification. This has benefited standing verification bodies like the IAEA and the OPCW and will also be useful for any future BW investigations under the mandate of the UN Secretary-General⁶² or by a future BW organization. Such experience and capacity should be retained and nurtured, including by considering establishing a permanent, standing verification body to succeed UNMOVIC, which would be available to meet future Iraq-style non-compliance challenges.

Further lessons relate to health and safety and environmental issues, which may seem minor and parochial, but which can assume great significance. UNSCOM initially underestimated the time that it would take to ensure the safety and security of its personnel in a hostile political and physical environment. If such considerations are not taken into account verification can stop dead in its tracks, with severe political ramifications. Several UNSCOM inspectors suffered damaging

⁶¹ Blix notes that: ‘I came to recognize in 1991 that both David Kay and UNSCOM had a better instinct than I: namely, on the importance of searching for relevant documents ... the rich caches of documents which Kay seized that year showed that such a search could be highly rewarding—providing you had good intelligence on where to look’ (Blix, p. 26).

⁶² See Angela Woodward, ‘BW: revisiting the UN mechanism’, *Trust & Verify*, no. 116, September–October 2004, pp. 3–4.

exposure to toxic chemicals; UNMOVIC was much more careful in this respect, having learned the lessons. Similarly, the UN cannot be seen to be flaunting environmentally sound practices and international conventions in its rush to destroy WMD. In the early days of UNSCOM, for instance, CW shells were simply dynamited in open pits. Criticism of verification activities on environmental grounds can provide yet one more political excuse for opposing multilateral ventures of this sort.

Conclusion

The experiences of the three international bodies involved in verification in Iraq have been both salutary and path-breaking. They have added greatly to the store of verification lore and capacity that can be utilized by similar endeavours in future.⁶³ Lessons learned have already been fed into the standing multilateral verification bodies and were notable in the UNSCOM–UNMOVIC transition. The task for the international community is to ensure that such capacities as have been developed are preserved and strengthened. Providing the UN with the capacity to launch intrusive, highly capable verification operations when required may at the very least give pause to the small number of states that are tempted to violate international treaties and norms relating to WMD.

WMD verification techniques and tools

This section examines some of the generic techniques and tools currently available for multilateral WMD verification.

Transparency

Transparency of information, whether raw, processed or analyzed, is essential for effective verification. For some purposes transparency is required only between the parties to an agreement, while in other cases transparency to the broader international community and indeed the general public is desirable. Verification systems aim to increase the transparency of those states with low levels of existing transparency, including through voluntary measures such as declaration of additional information. Verification systems may also take advantage of the vast amount of information now available about all states from open sources such as the internet, the mass media, academia and non-governmental organizations (NGOs).

There are certain circumstances, however, in which maintaining the non-transparency or confidentiality of certain information is vital for verification. For example, where industrial or commercial facilities are involved, maintaining the confidentiality of commercial proprietary information may be critical. Only if confidentiality is maintained will companies be willing to permit an international organization or its on-site inspectors to have access to their facilities and records. Similarly, governments do not want verification systems to acquire confidential and secret information not relevant to treaty compliance, especially information relevant to national security or defence.

⁶³ For analysis of issues relating to the future role of UNMOVIC post-Iraq, see Trevor Findlay, 'Preserving UNMOVIC: the institutional possibilities', *Disarmament Diplomacy*, no. 76, March/April 2004.

A trade-off must therefore often be made between the confidentiality needs of governments and industry and the verification system's need for information to verify compliance. In some cases this problem is dealt with by strictly limiting the distribution of data gathered during the verification process to the relevant parties or to a designated international body. Within an international verification body itself there will be procedures for handling the confidentiality of certain types of information. Another option is to limit the capabilities of the monitoring equipment being used. Some treaties also establish procedures to prevent on-site inspectors having access to equipment or facilities that are irrelevant to treaty compliance. Such 'managed access' techniques may, for instance, permit equipment to be covered with shrouds or certain computers to be switched off during inspections. Inspectors could be permitted access only to designated areas of a site, perhaps on the basis of random selection.

Monitoring and verification techniques

Monitoring techniques can be categorized as either remote or on-site. 'Remote' refers to any monitoring that takes place at a distance from the object or activity being monitored, usually outside the territorial limits of the country being targeted. Remote monitoring may be done from space, in the air or on the ground at a distance. Methods include satellites, aircraft and remotely-located ground stations. 'On-site' refers to any activity that occurs on the ground near the object or activity being monitored or verified. Such activities include on-site inspections and continuous on-site monitoring.

National technical means

National technical means of verification (NTM) are nationally owned and operated technologies and techniques used to monitor the treaty obligations of another state. NTM include satellites, high-altitude and other aircraft and land-based remote detection systems, electronic signals intelligence (SIGINT) and electronic intelligence (ELINT) collection systems, as well as systems that collect open source information. NTM, therefore, also may be assumed to include the facilities and personnel involved in collating, analyzing and interpreting information from such technologies.

While the 'T' in NTM was originally supposed to emphasize that such means were to be technical, NTM may also be used as a euphemism for all sources of information available to a state, including information obtained by intelligence organizations using all of the methods at their disposal. Treaties often attempt to avoid endorsing espionage by including a proviso that NTM that are permitted for verifying treaty compliance may only encompass methods that are in accordance with international law.

States may use NTM to verify compliance with a treaty in the absence of other measures, or to supplement the level of reassurance they receive from a co-operative verification system. In some instances, states are permitted to submit information obtained from NTM to a multilateral verification organization to support a request for clarification of the activities of another state, including through an OSI.

For most states the verification information they receive from multilateral means far exceeds that which they could obtain unilaterally. However, for the US, NTM remain its primary source of verification information, while for other technically advanced states, notably France, Russia and the

UK, NTM still play an important role in their national assessment of arms control and disarmament compliance.

Increasingly there is a willingness for states to provide NTM-derived information for multilateral verification purposes. For example, the US provided satellite photographs and other information from NTM to the UN Security Council in relation to North Korea and to both UNSCOM and UNMOVIC. In addition it allowed UNSCOM and UNMOVIC the use of an NTM technology, a U-2 reconnaissance aircraft, to enable it to do their own information gathering.

The provision of information from NTM in these situations can create dilemmas for multilateral verification organizations as well as for the states involved. An international body will not want to become reliant on one or a small number of countries, as this may compromise its impartiality. For their part, states need to take great care in revealing information obtained through NTM to avoid revealing confidential information about the scope and capabilities of their NTM. One way around this problem is for NTM-derived information to be used to focus multilateral verification which can then be used to build a non-compliance case that avoids relying directly on or revealing NTM sources or methods.

On-site verification

On-site activities are becoming increasingly sophisticated as the multilateral verification organizations accumulate experience and as non-compliance cases indicate improvements that are needed. On-site activities fulfil a variety of verification functions and occur in a variety of ways. The two main types are continuous on-site monitoring and on-site inspections.

Continuous on-site monitoring is used to monitor activities or facilities which, under the terms of a treaty, are subject to permanent observation. It may be carried out automatically by technical means or by personnel or by a combination of both. An example is the on-site verification of CW destruction carried out by the OPCW, which involves the permanent stationing of personnel and equipment at destruction facilities.

On-site inspections (OSI) involve the presence of personnel for limited periods. They have become almost a routine part of arms control and disarmament verification. Basic procedures and techniques, as well as administrative and logistical precedents have been established. A substantial body of experience has developed, in particular the experience of UNSCOM, UNMOVIC and the IAEA in Iraq, which may be drawn on in establishing new inspection regimes.

On-site inspections are, however, never the only verification tool provided for by a treaty. OSIs are normally triggered by other verification processes. In turn OSIs normally provide information that feeds into a larger verification process, supplementing or helping confirm data from other sources. For example, routine inspection may generate information which, in conjunction with data from an information exchange, may prompt a request for a challenge inspection.

A treaty will normally carefully detail the procedures to be followed for each type of inspection envisaged, including the way in which parties will be notified of an inspection, the rules and procedures for conducting the inspection, the length of time permitted for inspections, the rights and responsibilities of the inspected party and the rights and degree of access that must be given to

inspectors. Such detail is often too great for the treaty text itself and is rendered in annexes or, in some cases, as with the CTBT, left for further negotiations.

After decades of arms control and disarmament verification regime-building, various generic types of on-site inspection are recognizable.

Routine inspections are conducted according to a schedule provided to the inspected party in advance. They are therefore predictable and the inspected party may make advance preparations for them.

Short-notice inspections have an element of surprise, intended to enhance the deterrent effect of the verification regime. Since the state party receiving the inspection may only be notified just before the inspection team arrives, it has less time to hide any serious non-compliance.

Random inspections may also be designed to have an element of surprise. Alternatively, they may be used to permit fewer inspections to be conducted for the same deterrent effect, thereby saving time, money and inspection resources.

Challenge inspections are the most contentious type of inspection as they imply that a violation has occurred. Their goal is to help provide evidence that will confirm or deny an allegation of non-compliance. In theory, the notification period for such inspections should be short, so that parties cannot remove or hide evidence. In practice, the speed with which an inspection can be mounted is limited by the need for the inspectors to travel to the site, gain entry and establish themselves and their equipment. The time that elapses between the announcement of a challenge inspection and the commencement of the inspection is likely to be considerable. Depending on the durability of the likely evidence or 'signals' to be detected this may or may not be critical to verification. It may, for instance, be harder for a violator to clean up evidence of a nuclear test than of BW use.

Multilateral treaties normally require a treaty body to approve, or at least to decide not to oppose, a request for a challenge inspection. Voting rules are established for such circumstances: a 'red light' system means that a challenge inspection will proceed unless a treaty body votes to stop it (hence the 'red light'), while a 'green light' procedure means that a challenge inspection will not proceed unless a treaty body gives its positive endorsement. Such decisions will not necessarily require consensus but varying forms of majority vote. Depending on the treaty provisions, a party asked to receive a challenge inspection may or may not have the right to refuse the request. Even without such a right, there will be many points at which a receiving state can delay an inspection unless the rules are clear. Refusal to receive a challenge inspection may be regarded as an admission of non-compliance.

In practice, challenge inspections have to date never been used in the multilateral WMD regimes indicating that they continue to be regarded as a verification tool of last resort. There is some debate within some regimes, notably the CWC's, as to whether the absence of a challenge inspection to date is good or bad for the credibility of the regime.

Cooperative or facilitation measures

These are measures designed to make verification easier or more effective. They may be voluntary or legally required by a treaty. An example is the CTBT's voluntary provision that states notify the CTBTO of large conventional explosions to assist in discriminating them from nuclear tests. Not only do such measures contribute to verification, but if carried out as agreed they also help engender an overall sense of confidence in the commitment of the parties to the treaty.

Verification technologies

Technology plays a vital role in verification by permitting the rapid and systematic collection, collation, manipulation, analysis, storage, retrieval and dissemination of information. The extraordinary growth in computer power—a standard personal computer today is more powerful than the computers used for designing the first nuclear weapons—has had a significant effect on verification. In determining the role of technology, negotiators must balance its advantages and the disadvantages as well as considering questions of access and cost.

Technology does have advantages over human inspectors. It can operate continuously and at a constant level of observation. Its data is readily comparable. It can be limited to detecting treaty-relevant information, while ignoring other types of information. Inspectors need to be especially recruited, trained and deployed and can be expensive to maintain continuously in the field. Their attentiveness and dedication can vary considerably. They can also obtain information not related to the treaty that might be highly sensitive to the inspected party. On the other hand, the ability of inspectors to see the broader picture and discover information that they have not been briefed to expect can be an advantage to verification in keeping the inspected party uncertain as to what might be detected.

Some states parties may be concerned about equality of access to verification technology. This may be overcome by restricting the system to commercially available, 'off-the-shelf' technology or by making all the technology to be used available to all parties. This was a consideration in designing the 1992 Open Skies Treaty, for which the sensor suite to be mounted on aircraft was carefully defined (an additional motivation was to restrict intrusiveness). Cost must also be taken into account. High technology tends to be expensive to purchase and maintain, although costs tend to fall rapidly once a particular technology comes into general use. In addition, specialized training may be needed for particular types of technology. Tamper-proof mechanisms, redundancies and back-up systems need to be considered to prevent a party tampering with or deactivating monitoring technology. Technology-based monitoring can also generate unnecessary false alarms about non-compliance unless systems are in place to screen and analyze data carefully.

The main verification technologies being used or under consideration or development and the kinds of verification situations in which they may be useful are outlined below.

Space-based

Monitoring by satellite from outer space is one of the most useful remote monitoring tools. One of the major advantages of satellites is that their use does not need permission of the state that is being monitored. Since the first successful launch of the first reconnaissance satellite by the US in 1960, there has been a steady growth in the capabilities of space-based monitoring. In addition to optical

(photographic) capabilities, satellites can now carry an array of sensors, including radar and multi-spectral sensors that can detect heat, soil disturbances, aerosols and gases.

Most satellites are owned and operated by states exclusively for their own purposes, including as part of their NTM. Such states may choose in particular instances to provide limited amounts of information from their satellites for multilateral verification purposes. Increasingly, however, any state wishing to acquire satellite capabilities can pay for design, construction and launch services either commercially or from other states. They will still, however, need to acquire the technical expertise to design and build the satellite sensors themselves (for security reasons), as well as the capability to receive, record and analyze the data received.

Commercial companies with their own satellites or with access to data from government-owned satellites, are increasingly selling images on the commercial market with resolutions as low as one metre for almost any part of the earth's surface. Prices for such images are decreasing as competition increases. However, receiving a continuous stream of images is still expensive and commercial data is currently restricted to photo images rather than the full spectrum available to the most highly sophisticated satellite operators. Recipients still need to determine which images are required and must have the specialized capability for analyzing and interpreting them. Even commercial operators may find themselves unable to supply the whole range of potential customers if particular states block purchase their entire output. One way around this that has long been proposed, is the multilateral ownership and operation of satellites for verification purposes. To date, however, concerns about intrusiveness, the complexities of multilateral ownership and cost have ruled this out.

Satellites are also not the definitive verification tool. They are not suitable for all verification purposes, such as detecting facilities hidden underground or small-scale activities in large building complexes. They are also subject to the vagaries of weather, they may not be available at precisely the time and place required and states may take steps to thwart their capabilities (as India and Pakistan did in hiding their nuclear test preparations from US satellites).

Aerial

Aerial surveillance, using aircraft or helicopters, can be a more powerful verification tool than satellites due to their closer proximity to the objects of verification. Like satellites they can employ cameras, a wide variety of sensors and other monitoring equipment. A possible disadvantage, depending on the sensitivity of particular sites, is that information irrelevant to the verification purpose may be also gathered. Aerial surveillance is also limited by the fact that the permission of the state being overflown is required.

Significant mutual aerial surveillance opportunities are currently available under the 1992 Open Skies Treaty. While the original intention was that this regime only be used for conventional arms control purposes, there is no reason why it could not be used for WMD verification. One use would be the planning of inspections, especially challenge inspections, as in Iraq.

High altitude aircraft, which in theory also need overflight permission but in practice never seek it, can also be useful for verification but are currently owned and operated only by the US. The U-2, which has been operated by the US since the late 1950s, played a crucial role in the discovery of

Soviet nuclear installations in Cuba in 1962. As noted, the US provided UNSCOM and UNMOVIC with a U-2 aircraft for monitoring Iraq.

Unmanned aerial vehicles (UAVs), also known as Remotely Piloted Vehicles (RPVs), have a number of characteristics that make them useful for monitoring arms control and disarmament agreements. Since they are pilotless there is no concern for the loss of military personnel over potentially hostile territory. UAVs can carry a wide variety of sensors, provide high-resolution coverage, cover large and remote areas and can fly continuously for long periods. In addition, their onboard sensors can provide all-weather day-and-night surveillance, and send real time information to ground stations. UAVs are particularly useful for atmospheric monitoring, border monitoring and on-site inspection support. They could be especially useful for collecting air samples to detect testing or use of radiological, nuclear, chemical or biological weapons. Their major drawback is that they are expensive and require considerable expertise to operate.

Ground-based

Ground-based technologies are also common in multilateral verification regimes, either for remote or on-site monitoring. The data from remote monitoring technologies can either be read periodically by humans on site or may, increasingly, be transmitted to central data processing and analysis centres by landline or satellite. The best example of the latter is the CTBTO's IMS.

A wide variety of sensor technologies is available for verification purposes on-site, providing continuous on-site monitoring without the need for human intervention except to periodically check that the equipment is functioning properly. Ground-based sensors can identify the movement of equipment, such as vehicles or personnel, by detecting weight on the ground, shifts in the magnetic or electrostatic fields or optical signatures. Such sensors can be used to monitor military or production facilities and entry and exit points.

Other technologies, such as x-ray machines to determine the contents of containers or canisters require the on-site presence of humans to operate and maintain. Portable or hand-held detection devices are also being increasingly developed—in addition to the traditional Geiger counter for detecting radioactivity. New devices that detect the presence of CBW are adding to the potential capabilities of on-site inspectors. Environmental sampling technology, used to determine what a facility or plant is producing by detecting environmental traces in its effluent or atmospheric discharges, is also reaching new levels of sophistication. Robots, including miniature robots, are being envisaged for dangerous verification tasks such as determining the use of CBW. Such new technologies may not always be usable for verification purposes because they are seen to be too intrusive or because they are not available 'off the shelf' to all treaty parties.

Ground-based monitoring can be facilitated by the use of increasingly sophisticated tags and seals. Tagging involves giving each treaty-limited item a unique tag that specifies that it is permitted under an arms control treaty. Critical to the success of tags is a high degree of certainty that they have not been duplicated or tampered with. Tagging is used for treaties where numerical limits on weapons, rather than outright bans, are to be verified. Any untagged item discovered is automatically a violation. This shifts the burden of verification: instead of on-site inspectors having to count every treaty-limited item to make sure that the limits are not exceeded, they simply need to ensure that each item they come across anywhere is tagged. Tags with in-built global positioning system (GPS)

receivers have been developed, permitting the exact location of tagged items to be monitored. Improvements are also being made to ensure that tags are not able to be reproduced or tampered with.

Tamper-proof seals can help ensure that certain equipment has not been used or moved or that rooms or buildings have not been entered. Seals are used by the IAEA, for instance, to ensure the containment of safeguarded nuclear materials. A number of different types of seals are available, including those using a fiber-optic random pattern that changes if tampered with or special adhesives that disintegrate if disturbed. Like tags, seals can make continuous monitoring unnecessary—periodic inspection to ensure that the seals are intact is sufficient. Technological advances permit both types of systems to be monitored at a distance to ensure their integrity and viability.

Information technology

Verification requires parties to provide detailed information relating to their compliance by means of data declarations, exchanges and notifications. In addition modern monitoring technologies produce vast amounts of information. The continuing revolution in information technology (IT), permitting the rapid collection, transmission and analysis of such large quantities of data makes verification potentially much more manageable. Some multilateral verification systems, notably the CTBTO, have advanced to the point of having dedicated communications systems for rapid bulk data transmission and data centres for continuous data collection and analysis.

Non-state stakeholders in verification

In addition to governments and international verification organizations, there are additional stakeholders in modern arms control and disarmament verification and monitoring whose actual and potential role must be taken into account.

Industry

Civilian industry may be involved in research, development and production of weapons, weapon systems and/or weapons components or it may be involved with dual-use technologies or materials. It may therefore have an important role in verification, in cooperation with governments and international verification organizations and will therefore be critically affected by the way in which verification is conducted. Industry will often have concerns about verification that need to be taken into account. Such concerns may include fears about the effects of adverse publicity as a result of inspections being conducted at their facilities, fears about loss of commercial proprietary information and concerns about both the real and opportunity costs of inspections (the time and expense involved in hosting on-site them, for instance). It is vital that industry be involved at an early stage of negotiations on verification in order that their concerns be addressed and, if possible, allayed.

A variety of steps can be taken to deal with industry concerns. Trial inspections can help allay fears about the potential intrusiveness, cost and disruption of OSIs. Managed access techniques may meet concerns about the loss of proprietary information. The chemical industry's experience of

verification of the CWC has, for example, been good and initial industry fears have not been realized. In some instances industry can benefit from the inspection process by publicizing the fact that they have been successfully inspected and have cooperated fully in the process. For example, chemical facilities can advertise the fact that they have been given a clean bill of health through the CWC process, thereby contributing to their respectability.

Non-governmental organizations

Increasingly NGOs play a role in monitoring compliance with international treaties, a development made possible by technical and political changes. On the technical side, the information revolution, including the use of the internet, has radically altered the ability of NGOs to gather, analyze and distribute verification-relevant data. At the same time, the sensor revolution is democratizing access to previously classified technologies such as high-resolution satellite imagery. Politically, globalization has strengthened the importance of transnational relations. The international arena now includes thousands of non-governmental and research organizations that are involved in all aspects of international life and that monitor state compliance with a wide variety of international obligations—whether states want them to or not. The most recent example of an NGO coalition becoming closely involved in encouraging and monitoring compliance with a WMD treaty is the Geneva-based Bio-Weapons Prevention Project (BWPP).

Compared to states or international verification organizations, NGOs are less constrained by questions of diplomacy or bureaucracy. They are able to publicize information immediately. On the other hand, since NGOs rely almost entirely on open sources their information may be inaccurate or incomplete. They can also be politically biased and crude in their analytical capabilities. A multiplicity of NGOs with different roles and sources of information is probably the best guarantee of ensuring that their contribution remains useful.

Conclusions

Multilateral WMD verification is currently better governed, organized, funded and supported by the requisite technical and technological means than ever before. Enormous advances have been made since 1972, when the NPT, the first major multilateral WMD treaty with a matching verification system, entered into force. Compliance mechanisms for multilateral WMD regimes, in contrast, are underdeveloped, untested and subject to doubt and confusion.

In addition to the scale of the international verification enterprise is the increasing extent of the commitments that such regimes, in combination, require of states, the growing degree of transparency they demand and the higher level of intrusiveness they seek. A state party to all of the relevant international instruments is obliged to provide information and accept safeguards on and inspections of their peaceful nuclear facilities and materials; make declarations on and submit their chemical industry to inspections; and become involved in the global nuclear test monitoring system, in all likelihood by hosting a CTBT monitoring station on its territory. Such a state is obliged to have a CWC national authority, a nuclear safeguards office, and sizeable numbers of staff to fulfil various membership requirements, including attending verification conferences, facilitating and accompanying on-site inspections, filling out declarations and complying with voluntary CBMs such

as those sought from BWC states parties. At any time the state may be subject to special inspections under IAEA safeguards, complementary access under the Additional Protocol, challenge inspections under the CWC and in the future challenge inspections under the CTBT.

Under some of the relevant treaties and now under Security Council resolution 1540 the state will be required to enact national implementation measures, progress in which will be monitored by one of the verification agencies and/or a Security Council committee. Even the richest of developed countries like the UK and the US, struggle to fulfil all of these requirements. If you are an Iraq, an Iran, a Libya or even a South Korea, you will be subject to even more intense scrutiny requiring an even greater investment of time and resources. The availability of resources is a significant factor to be considered when additional verification burdens are being contemplated.

The regimes

Multilateral WMD verification today is a substantial international enterprise. In addition to UNMOVIC, here are three global verification regimes monitoring and verifying the nonproliferation of nuclear weapons, the ban on nuclear weapons testing and the ban on chemical weapons. Recurrent annual expenditure on multilateral verification currently totals more than \$300 million. More than 3,000 people are employed by international verification bodies, not counting the hundreds more employed by national implementing authorities and regional organizations. The number of full-time arms control/disarmament inspectors employed by multilateral agencies exceeds 700, while a further 380 are on UNMOVIC's roster (in addition to a notional number on the roster of the UN Secretary-General for CBW use investigations).

Budgets (in US\$)

CTBTO (2005)	105 million
IAEA (2004)	102 million (verification only)
OPCW (2004)	76 million
UNMOVIC (2003)	80 million (includes permanent equipment purchase and aircraft hire)

Staff

CTBTO	274
IAEA	2200 (includes non-verification staff)
OPCW	556
UNMOVIC	51

Inspectors

CTBTO	0 (inspectors to be rostered only after entry into force)
IAEA	500
OPCW	200
UNMOVIC	380 (rostered).

The great lacuna here is BW: attempts to provide the BWC with a verification agency have failed utterly. Only UNMOVIC has anything approaching what would be needed for BW and it is mandated only to deal with Iraq, while the UN Secretary-General's mechanism is hyper-virtual.

Without strong US support and advocacy there is currently no prospect of this situation changing dramatically despite the earnest discussion among BWC states parties.

Governance and organization

Much has been learned by now about the organizational structures required for effective verification, especially when a comprehensive system is envisaged. There is now a standard model of a conference of states parties, an executive body and a technical secretariat, including where necessary a standing inspectorate. International verification organizations still, however, rarely adopt best management practices, as used in business or in the more effective national governments. They still tend to use allegedly tried and true UN practices, often simply because they are readily available. They still often assume that running a verification organization is a unique organizational challenge that has no parallels elsewhere. There would appear to be no a priori reason why the highest managerial standards—including those relating to finance and human resources—should not be expected of our verification systems. International security is too important to be waylaid by distracting organizational problems that have ready solutions. As seen in the IAEA's efforts to conceptualize and implement integrated safeguards, new approaches to making verification more effective and efficient, and in the long-run saving money, are possible in the most venerable of multilateral verification bodies.

Funding

The question of the funding of verification is perennially fraught. While no one expects verification systems to be given a blank cheque, verification cannot be expected to be done on the cheap lest it discredit the whole enterprise. All of the multilateral verification organizations are experiencing funding challenges as more effective and intrusive verification is demanded of them and technological possibilities grow. The OPCW has seemingly perennial funding challenges due to the unexpectedly large task of verifying CW destruction. While the IAEA was finally released from over a decade of punishing zero growth in 2003 additional funding would produce much enhanced verification and permit new activities like the Trilateral Initiative to proceed.

Particularly when compared to spending on defence, spending on verification is a security bargain. It should be considered in the same light as allegedly more hard-headed co-operative threat reduction and counter-proliferation programmes. Verification regimes themselves, where possible, should seek for new funding possibilities, including foundations and commercial spin-offs. For example, some of the data collected by the CTBTO's IMS has commercial value, for instance, for the airline industry.

Techniques and technologies

The extent to which the latest and most appropriate techniques and technologies can be used in multilateral verification systems is, perhaps surprisingly, often controversial. To begin with, there is always a trade-off between effectiveness and cost. States parties will naturally want to keep the costs of verification as low as possible, while still giving the verification system the requisite degree of credibility. Some states are fearful of technology that is too capable and will want to restrict it. In other cases the type of verification technology being applied needs to be restricted in order to prevent proliferation-relevant information being disseminated to the verifiers—hence the use of so-

called blinded instrumentation that will detect only specific, limited types of information. Sometimes bureaucratic inertia in multilateral organizations prevents greater use being made of technologies, as in the case of the mysterious inability of the OPCW to replace expensive permanent human monitors at chemical weapon destruction facilities with equally effective remote on-site monitoring equipment.

Another difficulty is that verification technology can be so specialised that it must be researched and developed by verification bodies themselves: no commercial company will invest in research for such a limited market and potentially low profit. This can be a heavy burden on verification organisations, although creative partnerships with universities and less commercially-driven organisations should be possible. There can also be a useful two-way exchange of technology and methodologies between international verification organizations and participating national research and monitoring agencies, to mutual benefit.

The good news where technology is concerned is that off-the-shelf equipment can be readily used for a variety of verification roles, and its price often drops rapidly once it begins to penetrate the commercial market. Both the hardware and the software of computers have demonstrated this trend dramatically.

National technical and technological incapacity for self-monitoring and for implementing treaty commitments is also a major issue in many regimes. Many developing countries, especially in Africa, and those that used to be part of the Soviet empire, struggle to report on their own compliance with international treaties and to adopt national implementation measures. They have even more difficulty in contributing technical personnel, including on-site inspectors, to international verification efforts. The obvious answer is to ensure that appropriate assistance and capacity-building are available to those states that need them.

As a multilateral verification technique, on-site inspections have come a long way since the voluntary CBM inspections pioneered by the Organization for Security and Co-operation in Europe (OSCE) in the 1970s and 1980s. There are now bodies of professional on-site inspectors, detailed protocols, procedures and technologies for on-site inspections, and a useful corpus of experience in making them effective. This includes 'managed access' techniques, the use of remote monitoring to supplement on-site inspections, environmental sampling, and procedures for handling commercially and militarily sensitive information. UNSCOM and UNMOVIC vastly increased our experience of the power and challenges of OSIs. The difficulties that the CTBTO is facing in reaching agreement on its OSI manual indicate, however, the sensitivities surrounding on-site inspections and the need for an educational process about them.

Use of information

One of the most pleasing verification developments in recent years has been the realization that multilateral verification organizations can and should use the vast array of open source material to their advantage. Commercial satellite imagery and the internet are just the most obvious of the new information tools available. The IAEA is leading the way in this respect and is to be highly commended. Clearly, however, open source information needs careful and discriminate handling lest

the multilateral organizations be overwhelmed by a tidal wave of information, as some national intelligence agencies appear to be.

Similarly, the use of information provided by states from their national technical means (NTM) is a significant development. The experience of UNMOVIC is, however, salutary. The intelligence information provided to UNMOVIC and the IAEA about Iraq was late and much of it was of dubious character. When almost all of the intelligence leads were verified by the international bodies as being without foundation, there was no public acknowledgement by the states that had provided the information that they had been wrong. Indeed, the impression was left that the UN's inspectors were not quite up to the verification job. While there are clearly enormous difficulties in states obtaining credible information from closed, autocratic regimes through NTM, and there is an undoubted need to protect sources, especially human sources of intelligence, those states that are able to provide NTM-derived information should be more honest and transparent in doing so. The UNMOVIC experience should be a warning for the standing verification bodies.

Compliance mechanisms

Compliance mechanisms are the least developed aspects of verification regimes. While a great deal of attention is paid to what information is to be sought and how it is to be collected, collated and analyzed, there is often a reluctance to be clear about how a determination of non-compliance is to be made and what subsequent steps are possible if such a finding is made. Even IAEA safeguards have not been free from this: confusion surrounding the possibility of 'special inspections' (essentially challenge inspections) has long dogged the NPT.

The most lively current case of alleged non-compliance with a multilateral arms control treaty, the Iran case, has wound its way through the IAEA compliance process as envisaged: following outside leads and its own investigations the IAEA has drawn the attention of its Executive Council to the possibility that Iran was not complying with its safeguards and NPT obligations. The Council has slowly increased the pressure on Iran to comply, issuing various requests, followed by demands, to the Iranian authorities, to which they have responded only partially satisfactorily. Technical means have been employed effectively by the Agency to strengthen its case, while at the same time keeping an open mind in investigating Iranian counter-claims. A like-minded group of members of the Board of Governors has attempted to engage Iran constructively, while another has issued veiled threats. This 'good cop, bad cop' routine is one way of seeking to deal with a non-compliance problem. If Iran fails to comply however, the question of how it can be induced to do so will soon confront the UN Security Council, since the IAEA itself will have exhausted the range of 'carrots and sticks' at its disposal. The cases of North Korea and Iraq followed different trajectories when their non-compliance was determined.

In the case of chemical weapons there have been only a few cases of alleged non-compliance in which investigations took place, but these related to the 1925 Geneva Protocol and they all ended unsatisfactorily. There has been no experience to date of deliberate non-compliance with the CWC, even though many consider a challenge inspection long overdue. Similarly there has been no alleged violation of the CTBT in its current state of non-entry into force. In the BWC case allegations ended in one unsatisfactory official compliance process and one inconclusive trilateral undertaking. Clearly

the BWC compliance process will always be at a disadvantage without an accompanying multilateral verification system with impartial monitoring and on-site inspection capabilities.

Overall there remains much work to be done to clarify how non-compliance cases should be dealt with and to broaden the range of incentives and disincentives that may be employed to bring a recalcitrant state back into compliance.

Building the international verification community

One of the critical lessons that can be drawn from the experience of multilateral verification and compliance regimes over recent years, including that of UNSCOM and UNMOVIC, has been the need to sustain political support and relevance. In this respect the multilateral organizations need to do better at promoting an appreciation of the contribution they make to international peace and security. Even governments themselves need to be reminded. Some governments, for example, when pressed to sign Additional Protocols to their nuclear safeguards agreements, have requested a quid pro quo in the form of technical and/or economic benefits—in essence a bribe from developed countries—when clearly the primary benefit derives from enhancement of their national security. These benefits need to be made clearer.

Political support can, naturally, wax and wane after a verification system has been put in place. While this might seem to be an unavoidable fact of international political life, there are steps that verification bodies can take to cushion themselves. They could start by cultivating stakeholders elsewhere, including in civil society and among NGOs, the general public, the media and the philanthropic foundation world, and even in business. Unless verification organisations can improve their record on this score they will forever be dependent on the kindness of governments and the limited attention span they often display, and their work will always be seen as arcane and marginal to what happens in the ‘real world’.

II – WEAPONS OF MASS DESTRUCTION VERIFICATION AND COMPLIANCE: CHALLENGES AND RESPONSES

I. General WMD Verification and Compliance

Increased attention to verification and compliance as a cross-cutting issue reflected growing concerns about non-compliance with WMD prohibitions and obligations. A majority of experts consulted saw the overall WMD verification and compliance situation as degenerating. Greater ongoing research and deliberative reform efforts focused upon both the technical and political aspects of WMD verification and compliance were seen to be required. On the technical side, the nuclear weapons verification and compliance regime was seen as the having the strongest capabilities, the chemical weapons regime next and the biological weapons regime as the weakest. All regimes, however, were seen as vulnerable in terms of a lack of political will to accept intrusive measures and thus broadly subject to non-technical challenges.

The issue of non-state actor use of WMD also emerged as a major source of debate, revealing divisions over the likelihood, nature and scale of such use. Non-state actors were seen as more likely to use chemical weapons than other kinds of WMD. Complicating the response was the understanding that although the probability of nuclear weapons use by non-state actors might be low, the effects of such an incident would be catastrophic. It was noted that the large scale use of chemical or biological weapons/materials by a non-state actor would likely require some assistance from a national programme, which would make detection easier. This suggested to experts that measures to strengthen and expand the scope of WMD verification and compliance both horizontally and vertically (to more states and greater normative depth within states) will be essential to reducing the risks associated with the proliferation of WMD to non-state actors.

Expert consultations generated the following assessments of general WMD verification and compliance challenges and recommended responses.

Expanding the Scope of WMD Verification and Compliance Mechanisms

Challenge - *Universalizing WMD Verification and Compliance* - Non-participation by states in widely accepted WMD regimes and establishment of new regimes without verification and compliance mechanisms were seen to set a bad example for other states and to raise the risks associated with double standards. There are many lessons to be learned from deliberative efforts that have already been undertaken to universalize various regimes.

Recommendation 1 - Well planned and fully resourced efforts should be undertaken to universalize existing WMD verification and compliance regimes of all types. Options for expanding the application of verification and compliance mechanisms to new WMD-related activities such as cooperative threat reduction initiatives should be explored.

Challenge - *Independent Multilateral WMD Verification Capabilities* - The maintenance and further development of independent multilateral WMD verification capabilities emerged as a significant concern. The preservation and exploitation of the lessons learned and capabilities of

UNMOVIC within the UN system was strongly advocated, despite the political sensitivities of the issue and disagreements over how this might best be done.

Recommendation 2 - United Nations verification and compliance capabilities should be reinforced by creating a new independent WMD investigative unit designed to complement existing WMD verification and compliance mechanisms. This unit should have a broad mandate (i.e., no geographic or weapons-type limitations), and could begin by specializing in certain areas (e.g. biological weapons and missiles). It should co-operate with rather than compete with existing verification and compliance institutions (e.g. IAEA and OPCW). It will need flexibility in its initiating mechanisms as well as adequate resources.

Challenge - UN Security Council Resolution 1540 - Interest was expressed in UN Security Council (UNSCR) 1540 as a potential response to the challenges associated with implementing WMD regimes at the national level, and the risks presented by the potential proliferation of WMD to non-state actors. Skepticism was, however, expressed about the ability and willingness of states to respond to 1540, as well as about the adequacy of the implementation mechanisms established under the Resolution. There was general agreement on the importance of the UNSC in WMD compliance matters, but also general concern about its ability to act.

Recommendation 3 - The UN Security Council should ensure effective implementation of UNSCR 1540, which mandates compliance with WMD obligations at the national level related to preventing the proliferation of WMD to non-state actors. The 1540 Committee should be provided with the necessary expert resources and funding for monitoring and analysis of compliance, perhaps along the lines of the Counter-Terrorism Committee (mandated by UNSCR 1374) Assistance in capacity-building for compliance should be offered to states where appropriate.

Compliance Management

Challenge - General WMD Compliance Management - WMD verification and compliance has long been viewed as a spectrum of activities and capabilities, within which the technical, operational and political dynamics of post-verification compliance management issues appear to be the least well developed. There was seen to be clear need for a more responsive and comprehensive range of compliance management options – linking compliance assessments to instruments for restoring compliance, including positive remedial approaches as well as punitive enforcement methods. Experts agreed that sanctions could be one useful tool in certain circumstances as a way to support verification and achieve compliance, as long as they were carefully crafted and targeted to facilitate verification by limiting the universe of verifiable items, to induce the acceptance of verification measures and to encourage compliance.

Recommendation 4 - There is a need to develop “rules of the road” for dealing with difficult compliance issues at both treaty regime and UN Security Council levels, including greater commitment to verification assessments by independent professional bodies.

Recommendation 5 - Greater focus should be placed upon WMD compliance management issues, including the development of more nuanced assessments of compliance situations,

efforts to explore a wider range of options to restore compliance, and greater utilization of existing compliance management mechanisms. This could include the development of a menu of remedial and probationary mechanisms and criteria for their application to states after a non-compliance finding. These could also include directed capacity-building and measures drawing on the concept of Ongoing Monitoring and Verification as well as consideration of targeted sanctions.

Investing in Smart WMD Verification and Compliance Mechanisms

Challenge - *More and Smarter WMD Verification and Compliance* - WMD verification and compliance mechanisms are clearly a bargain when compared to other similar forms of state security investments, but experts highlighted a number of governance challenges facing international WMD verification and compliance institutions which may be having a negative impact on their performance. A lack of capacity within states to implement WMD obligations was assessed to represent both a weakness in WMD verification and compliance systems and (in some cases) an excuse for perpetuating inaction. A lack of resources to support verification and compliance activities on the part of a range of actors within the system was also identified as a key challenge.

The role of non-governmental organizations (NGOs) in verification was also highlighted. NGO activism was seen to be especially useful as a means to reinforce WMD verification and compliance in areas, such as the chemical and biological research sectors, where compliance with voluntary codes of conduct was important. Experts noted that the NGO role has long been a specific theme in the verification literature (for example, "societal verification").

Recommendation 6 - Periodic independent expert reviews of the performance of WMD verification and compliance implementation agencies should be undertaken, and recommendations for reforms prepared for the consideration of states parties, including:

- a. reviewing the advantages and disadvantages of consensus in decision-making;
- b. encouraging greater use of more advanced mechanisms for verification and compliance (e.g., challenge and special inspections);
- c. revisiting the issue of patterns of verification (i.e. who gets inspected and how often); and,
- d. an examination of the question of voting rights for states under investigation or under a finding of non-compliance.

Recommendation 7 - In cooperation with treaty implementing institutions, greater resources should be devoted to financial and technical assistance for capacity-building within selected states to assist them in fulfilling their WMD verification and compliance commitments and obligations.

Recommendation 8 - States, private donors and foundations should be called upon to invest more resources (money, personnel and/or technology) in WMD verification and compliance capacities, including UN and treaty implementing organizations, (through budget and voluntary funds), national programmes and non-governmental organizations active on these issues.

Recommendation 9 - Non-governmental organizations should be actively encouraged, where appropriate, to assist in the development and implementation of WMD verification and compliance mechanisms, particularly through track II type contacts and initiatives.

Challenge - *Supporting Advanced WMD Verification and Compliance Research* - Experts concluded that there is currently insufficient applied advanced research being conducted on WMD verification and compliance issues. There is a need to draw more systematically and comprehensively on the specific technological, operational and political lessons learned from recent WMD verification and compliance experiences. There is also a need for forward looking research that identifies gaps in our capabilities as well as potential synergies of national, plurilateral, and multilateral approaches to WMD verification and compliance. Given the nascent state of work on missile issues, there is also clearly a need for some mechanism to encourage systematic analysis of emerging issues as well as to preserve expertise as it is developed.

Recommendation 10 - A world-class centre of excellence focused on the analysis of WMD verification and compliance issues should be established to encourage cross-fertilization of experience and expertise within and between existing and emerging WMD verification and compliance mechanisms.

II. Nuclear Weapons Verification and Compliance

It was generally agreed that the technical verification system is stronger within the nuclear weapons regime than elsewhere. This does not rule out making further improvements on the technical side, but the main area of concern was compliance, specifically its political aspects. Expert consultations generated the following assessments of nuclear weapons verification and compliance challenges and recommended responses.

Expanding the Scope of Verification and Compliance Mechanisms

Challenge - *The Comprehensive Test Ban Treaty* - The Comprehensive Test Ban Treaty remains a key element of the global nuclear verification and compliance effort and momentum needs to remain behind efforts to bring it into force, meanwhile completing the International Monitoring System and methodologies for on-site inspections.

Recommendation 11 - All states that have not yet signed and ratified the Comprehensive Test Ban Treaty, a key element in the global nuclear verification and compliance regime, should do so immediately. This applies especially to states listed in the treaty's Annex II. Meanwhile, work should continue with urgency to prepare all elements of the CTBT's verification system.

Challenge - *Nuclear Weapons States* - Verifying non-proliferation and peaceful uses of nuclear energy remains a challenge, especially with respect to enrichment and reprocessing. Nuclear weapons state (NWS) activity in this regard is important both in its own terms and as an example for

others. Compliance issues also arise from NWS obligations under Article VI of the NPT and may suggest an area for enhanced multilateral verification activity.

Recommendation 12 - Nuclear weapons states (NWS) should consider contributing to global nuclear verification and compliance efforts by submitting all of their civilian nuclear activities to IAEA safeguards and extending their Additional Protocols to all domestic civilian activities. They should also move forward on the removal of fissile material from weapons programmes under IAEA verification (e.g., implementation of the trilateral initiative) and ensure that nuclear disarmament agreements/arrangements, including existing bilateral agreements, are subject to effective verification mechanisms, including multilateral involvement.

Challenge - *Non-Parties to the NPT* - The challenge to the NPT posed by non-states parties with nuclear weapons was recognized and it was recommended that options be explored to draw non-parties to the NPT more fully into some form of multilateral verification and compliance mechanism. This would likely require the separation of civilian and military fuel cycles, which does not currently exist in these states, and would have to be carried out in ways that did not imply acceptance of these countries as *de facto* nuclear weapons states.

Recommendation 13 - Consideration should be given to encouraging states outside the NPT to accept more comprehensive multilateral commitments and safeguards relating to their civilian nuclear cycles, including negotiation of a full-scope safeguards agreement and an Additional Protocol with the IAEA. This effort could be undertaken by the international community, led by the P-5 and the UN Secretary General.

Challenge - *Nuclear Export Control Guidelines* - Nuclear export controls are a significant aspect of the broad nuclear non-proliferation regime. Problems, however, arise in that they are voluntary, open to interpretation and lacking a specific and transparent mechanism to verify compliance. There is a need to strengthen export control guidelines, in terms of the obligations they place upon supplier states.

Recommendation 14 - Options for expanding the application of verification and compliance mechanisms to existing nuclear export control guidelines should be explored with a view to transforming them into legally binding international conventions in order to support widespread transparency, verifiability and compliance.

Addressing Emerging Verification Challenges

Challenge - *Verification and the IAEA Additional Protocol* - Experts broadly supported the Additional Protocol as a welcome strengthening of the Agency's safeguards system, and argued that it should become the foundation requirement for nuclear safeguarding and supply activities under the NPT. This objective could be supported through the NPT review mechanism, UN General Assembly resolutions as well as through the co-operation of nuclear suppliers and supplier groups. IAEA resources would need to be increased to accommodate the additional burden this would

generate. The early implementation of integrated safeguards would, over time, be way to allow resources to be reallocated to this end.

Recommendation 15 - The IAEA Additional Protocol should become the new compulsory standard for nuclear safeguards: states should not receive nuclear technology or materials transfers unless they conclude such agreements.

Challenge – Nuclear Accounting and Control – The threat from non-state actors arises primarily from the theft or other acquisition of nuclear material or radioactive sources, or attacks on nuclear facilities. Strengthening existing nuclear security measures, making them both binding and verifiable, and helping states to implement adequately, would strengthen nuclear safeguards and assist states in coping with the non-state actor threat in the nuclear area. Improvements in and standardization of fissile materials accounting systems should be of use as both a broad safeguards measure as well in coping with the non-state actor threat.

Recommendation 16 - The adoption of higher standards for verifying nuclear accounting, safety, and physical protection should be given a high priority. Negotiations on strengthening the Convention on Physical Protection should be concluded as soon as possible. The Code of Conduct on the Safety and Security of Radioactive Sources, including sections relating to the import and export guidelines, should be made obligatory and legally binding. The IAEA should verify compliance with both the Physical Protection Convention and the Code of Conduct.

Recommendation 17 - The IAEA should commission an expert study to develop a standardized system of accounting for all fissile material for all states.

Challenge - Potential for Break-Out from the NPT - It has long been recognized that the spread of national capabilities in nuclear fuel cycle facilities can create both a “latent proliferation” threat and a potential “break-out capability” for a party choosing to withdraw from the NPT.

Recommendation 18 - To enhance the verifiability of peaceful nuclear programmes, consideration should be given to the internationalization of all uranium reprocessing and enrichment capabilities, beginning with any new facilities and progressively encompassing all reprocessing and enrichment facilities.

Challenge - Verification of a Fissile Material Cut-off Treaty (FMCT) - Preventing the further production of fissile material for weapons use is a key element in a broader nuclear non-proliferation strategy, binding all states within the NPT and thus addressing concerns regarding imbalances in the treaty. It could also provide an additional means to address the problems posed by weapons-capable states outside of the NPT. In order to serve these functions well, however, a FMCT must be effectively verifiable.

Recommendation 19 - The Conference on Disarmament (CD) should re-start negotiations towards a fully verified FMCT as soon as possible. In the meantime, the CD should establish a group of experts to review and develop mechanisms and procedures for effectively verifying compliance with such a treaty.

Compliance Management

Challenge – *After Non-Compliance, What?* – As part of their discussion on the International Atomic Energy Agency (IAEA), experts noted that a good technical verification system needs to be complemented by adequate follow-up with respect to compliance assessment and effective enforcement after verification of non-compliance. Some problems in compliance management may arise from a lack of more varied choices in articulating the findings of compliance cases, and particularly through a lack of a sufficiently broad array of instruments for compliance management. It was concluded that the proposed Experts Group to advise the IAEA Board of Governors on verification policy issues could also usefully serve as a vehicle to develop new compliance management mechanisms, including proactive positive and remedial measures, as well as punitive measures.

Recommendation 20 - Further to recommendations 4 and 5 (see Section I above) the IAEA should contribute to the improvement of compliance management through:

- a. development of better diagnostic tools for more nuanced assessments of compliance situations to clarify the nature of the non-compliance, the motivation for it and the appropriate responses to it;
- b. better use of existing compliance management mechanisms, such as special inspections, complementary access, and suspensions of IAEA privileges;
- c. establishment of a “Verification Expert Group” by the Board of Governors to advise it verification policy (the Standing Advisory Group on Safeguards Implementation would continue dealing with technical issues); the Group should be supplemented with outside/independent expertise to assist delegations and the Group as a whole; and
- d. closer cooperation by the IAEA with national systems of nuclear accounting and control, and the development of bilateral and regional safeguard mechanisms.

Challenge - *NPT Reporting* - Standardized reporting on compliance with NPT obligations by all states, covering all aspects of the Treaty’s obligations (on disarmament, non-proliferation and peaceful use) was seen by experts as useful in helping to addressing concerns regarding non-compliance. This was seen as particularly useful with respect to perceived non-compliance with Article VI of the NPT; although some experts downplayed the significance of this problem, it was seen as an issue that should be addressed, particularly since it could provide excuses for some non-nuclear weapon states to resist improvements in their own performance and/or to the effectiveness of the regime.

Recommendation 21 - The 2005 NPT Review Conference should mandate a standardized formal reporting, consultation and clarification mechanism for all states regarding their status of compliance with the NPT.

Investing in Smart WMD Verification and Compliance Mechanisms

Challenges - *National Capacities and Non-State Actor Concerns* - Experts expressed concerns about the threat from non-state actors, which was assessed to arise primarily from theft or other acquisitions of nuclear material or radioactive sources, or attacks on nuclear facilities. They stressed

the importance of building national regulatory and legislative capacity to deal with the non-state actor problem, and the development, monitoring and verification of state obligations in this area. More broadly, state capacity for effective implementation of WMD obligations was seen as needed to minimize risks. Improvements in and standardization of fissile materials accounting systems was flagged as a useful step forward, both as a broad safeguards measure and in coping with the non-state actor threat.

Recommendation 22 - In cooperation with treaty implementing institutions, greater resources should be devoted to technical assistance for capacity-building within selected states to assist them in fulfilling their nuclear weapons related verification and compliance commitments and obligations, and by extension to address non-state actor concerns.

III. Chemical Weapons Verification and Compliance

While the Chemical Weapons Convention (CWC) was assessed to be the most comprehensive WMD regime, many experts argued that there had been a weakening of the compliance aspects in recent years. In particular, experts cited the lack of full compliance with the CWC's national implementation requirements, the limited use of challenge inspection verification provisions, and the lack of political will to address non-compliance situations. Expert consultations generated the following assessments of chemical weapons verification and compliance challenges and recommended responses.

Expanding the Scope of Verification and Compliance Mechanisms

Challenge - Non-State Actors and Chemical Weapons - While there was a general concern about the risks of non-state actor use of toxic chemicals for hostile purposes, it was assessed that non-state actors' most probable access to toxic chemicals was through existing stocks and industrial facilities, which reinforced the need to ensure that existing state-based transfer control and physical security mechanisms were working properly and that potential gaps in the verification of measures in these areas were closed. Such an approach did not exclude the possibility of developing and using other mechanisms to counter non-state access to toxic chemicals, but it was held that priority should be given to ensuring that such controls were working adequately and that states were carrying out appropriate oversight and verification. Concerns were also expressed about the need to strengthen the implementation mechanisms established under UNSCR 1540.

Recommendation 23 - The application of verification and compliance mechanisms should be expanded to cover the security of chemical weapons facilities. CWC states parties should also accept an additional verification requirement relating to the security of facilities that produce, process or consume CWC-scheduled chemicals, for example by reporting to the OPCW on measures they have taken to secure such facilities in order to prevent their use for hostile purposes.

Recommendation 24 - To support UNSCR 1540 and strengthen the OPCW's verification capabilities, CWC states parties should be required to report to the OPCW on the measures they are taking to meet their 1540 obligations relating to chemical weapons. To the extent

possible, the Secretariat of the OPCW should, in cooperation with the 1540 Committee, monitor compliance with Sections 2 and 3 insofar as they relate to chemical weapons.

Addressing emerging verification challenges

Challenge - *New Types of Chemical and Biochemical Agents* - The verification provisions of the CWC in regard to production apply only to the chemicals listed in the treaty's schedules. Since entry into force in April 1997, no new chemicals have been added to the schedules, despite advances in science and technology, and notwithstanding concerns about the possible development of new types of chemical agents based on chemicals not included in the original schedules. Technological advance has also generated developments related to "non-lethal" biochemicals, and certain states have shown increased interest in the use of such agents in law enforcement and other types of operations falling under the "other than war" category. Some experts considered this new range of weapons to be particularly problematic for verification and compliance measures under the CWC.

Recommendation 25 - The CWC Scientific Advisory Board should study the impact of recent scientific and technological developments in order to make recommendations to the Conference of States Parties on new chemicals that should be added to the schedules of chemicals subject to verification and compliance. States parties should be encouraged to support the Scientific Advisory Board's work, including by providing technical information on chemicals relevant to the Convention.

Recommendation 26 - An independent expert study should examine the implications of the development of new biochemical agents, including "non-lethal" biochemicals, for the effectiveness of verification and compliance measures under the CWC, including aspects related to the "law enforcement" exemption.

Challenge - *Monitoring Schedule 2 and 3 Chemicals* - At present, most of the verification resources of the OPCW are directed at monitoring existing stockpiles and their destruction, with relatively few verification resources focused on monitoring facilities for Schedule 2 and 3 and discrete organic chemicals. This is the area where the risk of treaty breakout is highest.

Recommendation 27 - The OPCW should explore new techniques to monitor CW stockpile destruction, such as non-human monitoring arrangements, freeing resources for verification of production of CWC Schedule 2 and 3 chemical and discrete organic chemicals. The use of external sources of funding (in addition to further contributions from member states) should be considered in order to make up any funding shortfall that may be generated by a greater emphasis in this area of activity.

Investing in smart WMD verification and compliance mechanisms

Challenge - *CWC Destruction Deadlines* - Some states parties to the CWC have indicated that they will be unable to meet the April 2007 deadline for the destruction of their entire chemical weapons stockpiles and have sought the extension provided for under the treaty. There is a serious risk,

however, that even these extended deadlines will not be met. A failure to comply with treaty-mandated CW destruction deadlines could communicate a lack of commitment to CW disarmament.

Recommendation 28 - In cooperation with treaty implementing institutions, greater resources should be devoted to financial and technical assistance for capacity-building within selected states to assist them in fulfilling their CWC verification and compliance commitments and obligations in a timely fashion.

IV. Biological Weapons Verification and Compliance

Expert consultations generated the following assessments of biological weapons verification and compliance challenges and recommended responses.

Expanding the Scope of WMD Verification and Compliance Mechanisms

Challenges - *Absence of a BTWC Verification Regime* - The most significant challenge to the Biological and Toxin Weapons Convention (BTWC) was seen by experts to be the absence of an effective verification and compliance regime. While all involved in the questionnaire and workshop agreed that progress in this regard remained politically difficult, they stressed the importance of making every effort to work towards change in the current stasis and to be ready when change occurred. Pending the successful creation of an effective BTWC verification and compliance regime, experts explored various interim options, including expanding the schedule of inter-sessional meetings and more work on CBMs. Also discussed was the creation of a small secretariat within the BTWC process, under the UN Secretary-General, or as an independent group of experts funded by willing states. Its tasks could include collation, translation, and dissemination of CBM reports, follow-up with member states to ensure they submit them complete and on time, and, where necessary, provision of assistance to member states in completing their CBMs.

Recommendation 29 - Renewed efforts to develop an effective verification and compliance regime for biological weapons should be given high priority. In further support of verification of compliance, including the CBM process, states parties to the BTWC should continue to hold annual meetings between review conferences beyond the 2006 Review Conference to address 'compliance management' issues and important BW-related developments.

Recommendation 30 - States parties, not already doing so, should be encouraged to submit their BTWC CBM reports. Steps should be taken by other states parties to provide assistance to further this end. States should also release publicly their BTWC CBM declarations, as some state have, as transparency measure and to encourage independent expert analysis.

Recommendation 31 - The establishment of a small secretariat to monitor compliance with the BTWC confidence building measures should be considered.

This secretariat could also monitor reports submitted by states in accordance with Security Council Resolution 1540, as they relate to BW.

Challenge - *Security of Biological Research* - National programmes could be the source of material for biological weapons or may lead to the development of new agents that could be used as weapons.

Recommendation 32 - Options for expanding the application of verification and compliance mechanisms to the security of biological weapons relevant facilities and related research should be explored. This could include calling for international harmonization of national rules and procedures governing the security of dangerous pathogens, as well as oversight of research involving such materials.

Challenge - *Role of the UN Secretary-General in Investigating BW Issues* - In addition to the BTWC, the Geneva Protocol of 1925 remains in effect and prohibits the use of biological (and chemical) weapons as a means of warfare. Like the BTWC, the Protocol does not have any verification provisions. During the 1980s, however, the United Nations General Assembly and the Security Council both requested that the Secretary-General undertake investigations into alleged use of these weapons. At a July 2004 meeting of BTWC states parties, the British government proposed enhancing the capabilities of the UN Secretary General in this regard.

Recommendation 33 - Proposals to strengthen the UN Secretary-General's power to verify alleged use of biological and toxin weapons, as well as suspect biological facilities, should be supported.

Addressing Emerging Verification Challenges

Challenge - *Advances in the Biological Sciences* - Given the rapid advance in technological developments and the scope and nature of changes in the biological field in the past few years, there is a need to keep these changes under continual assessment and determine their implications for verification of the prohibitions outlined in the BTWC. It should also be recognized that developments in the field of biochemicals have the potential to undermine compliance with the BTWC. As such, it should be underscored that all biological agents and toxins, whatever their origin and method of production, are covered by the BTWC as affirmed by the second and third Review Conferences.

Recommendation 34 - An independent expert study should examine scientific and technological advances in the biological sciences and related fields and their implications for BTWC verification and compliance, including new verification technologies that might be used to help ensure compliance.

Investing in Smart WMD Verification and Compliance Mechanisms

Challenge - *Building Capacities for BTWC Implementation* - Article IV of the BTWC requires states parties to undertake measures in accordance with their “constitutional processes” to implement the Convention within their territory. The effective implementation and monitoring of national prohibitory measures is critical to BTWC compliance.

Recommendation 35 - In cooperation with treaty implementing institutions, greater resources should be devoted to financial and technical assistance for capacity-building to assist selected states in fulfilling their BTWC verification and compliance commitments and obligations. BTWC states parties which are in a position to do so should assist other states parties in preparing national measures to implement their obligations under Article IV.

V. Missile Verification and Compliance

Experts noted that missiles were unique among the categories of weapons addressed by this report in that they are a means of delivery rather than a weapon and, in addition they are not constrained by any multilateral legally binding control regime upon which verification and compliance mechanisms could be based. It was assessed that the early development of a more comprehensive and binding missile control regime would be difficult, given national sensitivities and a basic lack of essential groundwork. One of the difficulties was seen to be the fact that there are a significant range of missile types, including both ballistic and cruise missiles, with varying characteristics in each category, complicating verification efforts. While a verifiable multilateral agreement on missile controls was considered a valid long-term goal, less ambitious short term steps should be considered as “building blocks” toward the larger edifice. Experts noted that missiles were generally used for military action, influence and threat, and as such were primarily weapons of states. Given their expense, the difficulty of both operating and concealing them (especially those of medium and higher ranges) and the availability of easier delivery options, missiles were not seen as a major problem in terms of use by non-state actors. Expert consultations generated the following assessments of missile verification and compliance challenges and recommended responses.

Expanding the Scope of WMD Verification and Compliance Mechanisms

Challenge - *Moving Forward on Missile Verification and Compliance* - It was assessed that a good starting point for strengthening verification and compliance was to consider ways to strengthen existing approaches. In the area of missile non-proliferation, for example, it was noted that greater certainty on end-use compliance by receiving states would strengthen the utility of national export controls, while acting to build both norms and confidence. The missile field, with a reasonably circumscribed and tightly defined list of controlled items, could offer an initial self-contained pilot project for such an agreement, which could be expanded *mutatis mutandis* to other areas if successful. Given its export control mandate and established expertise, the Missile Technology Control Regime (MTCR) might form one useful pillar of such an approach, but in order to be accepted by the necessary range of countries, negotiations would need to include other suppliers and traditional recipient states as well.

Recommendation 36 - Options for expanding the application of verification and compliance mechanisms to WMD-related activities should be explored, such as the negotiation of a multilateral agreement on end-use verification, with missiles and related technology as a pilot case.

Challenge - *The Hague Code of Conduct* - The Hague Code of Conduct (HCOC), whose membership is both larger and more varied than that of the MTCR, could serve as the focus of action in the compliance and verification field. While focused on non-proliferation commitments, the HCOC contains the first multilaterally-agreed measures relating to missile disarmament, in terms of restraint and reduction in missile holdings. It also provides for certain basic transparency measures relating to ballistic missile and SLV activities, and mentions the possibility of voluntary development of additional transparency measures on a regional, bilateral or national basis (although such measures have yet to be carried out). Finally, it envisages the development of "appropriate mechanisms for the voluntary resolution of questions" relating to ballistic missile and SLV programmes.

While the Code's current focus is on reaching agreement on implementation of its CBM provisions and on increasing its membership (currently at 117), it also contains provisions for amendment, which could include monitoring, verification and compliance measures as part of a broader package that included increase in scope (e.g. to cover cruise as well as ballistic missiles), a strong statement on disarmament, more specific language on transfers and a commitment on technical cooperation. Experts also explored the concept of incentives (including positive or negative security assurances and economic or technological benefits) under the Code and noted that these could logically be linked to verification measures.

Recommendation 37 - Options for expanding the application of verification and compliance mechanisms to WMD-related activities should be explored, such as encouraging the Hague Code of Conduct process to consider verified compliance/monitoring on implementation of its commitments (perhaps linked to incentives) as part of its first round of amendments, and explore the possibility of implementing voluntary verification procedures in the meantime.

Challenge - *Establishing New Missile Norms* - There was general agreement that new work should be focused towards establishing verifiable norms and commitments (the logical first states of a compliance regime), with accompanying monitoring and transparency measures. In particular, it was considered that there was scope for regionally-based agreements, particularly since many of the "drivers" for acquisition of missiles by most states are based in regional tensions and insecurity. Some experts considered that this factor meant that regional missile agreements (ranging from basic voluntary confidence-building measures of the type being explored by India and Pakistan to more complex possibilities such as negotiated bilateral limitation or reduction arrangements and regional missile-free zones), including appropriate compliance and verification measures, could have a greater chance of achievement than binding global efforts under current conditions, while also contributing to broader norm-building.

Recommendation 38 - States should be urged to consider the negotiation of regional measures on missile-related non-proliferation, arms control and disarmament, focusing

initially on confidence-building measures including transparency and voluntary mutual monitoring of commitments.

Challenge – *The UN Role in Missile Verification and Compliance* - Some preliminary work on missiles has occurred at the UN through a UN panel of governmental experts on the issue of missiles in all its aspects. As the one body with universal membership, the United Nations by definition contains representatives of all factions in the consideration of missile questions, including compliance and verification aspects, and is the only place at present where they can meet on terms of equality. Although this has so far meant that the UN has been largely unable to reach a consensus on far-reaching practical measures in the field (aside, notably, from the missile aspects of UN Security Council resolution 1540), the UN remains an indispensable locus for seeking convergence on the key issues.

Recommendation 39 - The UN should be encouraged to continue its efforts in the missile field, with special attention to norm-building and confidence building measures, as a first step towards fully developed verification and compliance mechanisms.

ANNEX A: STUDY METHODOLOGY AND PARTICIPATION

This report draws upon the views of a range of Canadian and international experts (see below) provided through an integrated consultation process which included five distinct elements.

Study Methodology

I. Study Design (May 2004) - A Working Group on WMD Verification and Compliance was convened to develop and implement the study described in this report.

II. Baseline Study (Aug - Oct 2004) - A baseline study was completed by VERTIC reviewing the current status of WMD verification and compliance mechanisms and issues.

III. Expert Questionnaire (Sept 2004) - An on-line expert questionnaire, *Verification of and compliance with Weapons of Mass Destruction Regimes in the New Security Environment: Challenges and Responses* was completed by a group of 35 independent experts. The purpose of the questionnaire was to seek expert views on a number of proposals currently animating the international debate on WMD verification and compliance issues, within five thematic areas:

1. General WMD-related Verification and Compliance Issues;
2. Nuclear and Radiological Weapons Verification and Compliance: Challenges and Responses;
3. Chemical Weapons Verification and Compliance: Challenges and Responses;
4. Biological Weapons Verification and Compliance: Challenges and Responses;
5. Missile Verification and Compliance: Challenges and Responses.

IV. Expert Conference Calls (Oct 2004) - Those who completed the questionnaire were contacted for a 1-2 hour follow-up conference call moderated by one of the core working group members, to discuss in greater detail the issues/proposals worthy of further analysis. Five separate conference calls were held to address each of the five clusters of WMD verification and compliance.

V. Expert Workshop (Oct 14-15, 2004) - An Expert Workshop on WMD Verification and Compliance was held in Ottawa, including approximately 20 non-government and government participants acting in their expert capacity. The objective of the workshop was to complete a substantive review of WMD-related verification and compliance challenges and responses identified through the questionnaire and conference call consultations of the virtual expert group. A discussion of missile verification and compliance issues was not included in the workshop as these issues were addressed separately through a separate conference call on October 20, 2004.

Study Participants

Working Group on WMD Verification and Compliance

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4. **Dr. Robert Lawson**, Senior Policy Advisor, Non-Proliferation, Arms Control and Disarmament Division, Foreign Affairs Canada
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Expert Questionnaire Participants

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3. **Dr. Michael Brzoska**, Head of Research Department, Bonn International Centre for Conversion
4. **Colonel (Ret.) Heinrich Buch**, Federal Armed Forces University, Munich
5. **Dr. Marie Isabelle Chevrier**, Associate Professor of Political Economy, University of Texas at Dallas
6. **Dr. Jonathan Dean**, Advisor on Global Security Issues, Union of Concerned Scientists
7. **Dr. Walter Dorn**, Associate Professor, Department of Politics and Economics, Royal Military College of Canada
8. **Dr. Gerald Epstein**, Senior Fellow, Science and Security, Center for Strategic and International Studies
9. **Mr. Daniel Feakes**, Research Fellow, Harvard Sussex Program
10. **Dr. Charles Ferguson**, Fellow, Science and Technology, Council on Foreign Relations
11. **Dr. Asha George**, Managing Director, ANSER Institute for Homeland Security
12. **Dr. Jozef Goldblat**, Geneva International Peace Research Institute
13. **Dr. Roger Hagengruber**, Director, University of New Mexico Office for Policy, Security and Technology
14. **Dr. Helmut Hoenig**, Professor, Graz University of Technology, Institute of Organic Chemistry; former UNSCOM Commissioner
15. **Dr. Iris Hunger**, Study Group on Biological Arms Control of the Research Center for Biotechnology, Society and the Environment, University of Hamburg; former biological weapons expert, German Foreign Ministry
16. **Dr. Edward Ifft**, Foreign Policy Officer, US Department of State and Adjunct Professor, Edmund A. Walsh School of Foreign Service, Georgetown University
17. **Mr. Ian Kenyon**, Visiting Senior Research Fellow, Mountbatten Centre for International Studies

18. **Dr. Igor Khripunov**, Associate Director of the Center for International Trade and Security, and Adjunct Professor of Political Science, University of Georgia,
19. **Mr. Milton Leitenberg**, Senior Research Scholar, University of Maryland School of Public Policy
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26. **Mr. John Pike**, Director, GlobalSecurity.org
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28. **Dr. Brad Roberts**, Institute for Defence Analysis
29. **Dr. Clifford Singer**, Professor of Nuclear Engineering, Director of the Program in Arms Control, Disarmament and International Security, University of Illinois at Urbana-Champaign
30. **Mr. James Sutterlin**, Distinguished Fellow in United Nations Studies, Yale University
31. **Mr. James Taylor**, UNMOVIC Weapons Inspector and Consultant
32. **Dr. Jonathan Tucker**, Senior Researcher, Center for NonProliferation Studies, Monterey Institute for International Studies
33. **Dr. Mark Wheelis**, Senior Lecturer in Microbiology, Section of Microbiology, University of California
34. **Ms. Angela Woodward**, Arms Control and Disarmament Researcher, Verification Research, Training and Information Centre
35. **Dr. Jean Pascal Zanders**, Director, Biological Weapons Prevention Project

Expert Conference Call participants

General WMD Verification and Compliance

1. Chair: Dr. James Keeley
2. Colonel Heinrich Buch
3. Dr. Jozef Goldblat
4. Ms. Rita Grossman-Vermaas
5. Mr. Maciek Hawyrlak
6. Dr. George MacLean
7. Mr. James Sutterlin

Nuclear Weapons Verification and Compliance

1. Chair: Dr. James Keeley
2. Dr. Charles Ferguson
3. Ms. Rita Grossman-Vermaas
4. Dr. Roger Hagengruber
5. Ms. Jennifer Mackby

Chemical Weapons Verification and Compliance

1. Chair: Dr. Jane Boulden
2. Mr. Maciek Hawrylak
3. Ms. Rita Grossman-Vermaas
4. Dr. Igor Khripunov
5. Dr. Mark Wheelis

Biological Weapons Verification and Compliance

1. Chair: Ms. Rita Grossman-Vermaas
2. Mr. Maciek Hawrylak
3. Dr. Iris Hunger
4. Mr. Milton Leitenberg
5. Dr. Jez Littlewood
6. Professor Graham Pearson
7. Dr. Jonathan Tucker
8. Ms. Angela Woodward
9. Dr. Jean Pascal Zanders

Missile Verification and Compliance

1. Chair: Dr. Jane Boulden
2. Ms. Rita Grossman-Vermaas
3. Dr. Freleigh Osborne
4. Mr. James Taylor

Experts Workshop Participants

1. **Dr. Jane Boulden**, Canada Research Chair in International Relations and Security Studies, Royal Military College of Canada
2. **Dr. Frank Ronald Cleminson**, Rundle Virtual Research Group
3. **Mr. Simon Collard-Wexler**, Senior Research Officer, International Security Research and Outreach Programme, Non-Proliferation, Arms Control and Disarmament Division, Foreign Affairs Canada
4. **Dr. Trevor Findlay**, Executive Director, Verification Research, Training and Information Centre (London)
5. **Dr. Nancy Gallagher**, Associate Director for Research, Center for International and Security Studies at Maryland
6. **Major Donald A. Neill**, Analyst, Weapons of Mass Destruction Section Directorate of Arms and Proliferation Control Policy, Policy Planning Division, Policy Group National Defence Headquarters
7. **Ms. Rita Grossman-Vermaas**, Research Associate, Non-Proliferation, Arms Control and Disarmament Division, Foreign Affairs Canada
8. **Ms. Elisa Harris**, Senior Research Scholar, Center for International and Security Studies at Maryland

9. **Mr. Maciek Hawyrlak**, Norman Patterson School of International Affairs (NPSIA), Carleton University
10. **Mr. John Hay**, Senior Fellow, Norman Patterson School of International Affairs (NPSIA), Carleton University
11. **Dr. James Keeley**, Associate Professor of Political Science, Centre for Military and Strategic Studies, University of Calgary
12. **Dr. Robert Lawson**, Senior Policy Advisor, Non-Proliferation, Arms Control and Disarmament Division, Foreign Affairs Canada
13. **Ms. Peggy Mason**, Chair of the Group of 78
14. **Mr. Robert McDougall**, Director, Non-Proliferation, Arms Control and Disarmament Division, Foreign Affairs Canada
15. **Ms. Kim Rebenchuck**, Policy Officer, Directorate Arms Proliferation Control Policy, Department of National Defence, Canada
16. **Dr. Barbara Hatch Rosenberg**, Natural Science Division, State University of New York
17. **Mr. Douglas Scott**, President, The Markland Group
18. **Mr. Ron Stansfield**, Advisor, Nuclear Non-Proliferation, Non-Proliferation, Arms Control and Disarmament Division, Foreign Affairs Canada
19. **Mr. David Steuerman**, BTWC Treaty Implementation Officer, Non-Proliferation, Arms Control and Disarmament Division, Foreign Affairs Canada
20. **Major C. Victor Sattler**, Operations Officer, Treaty Operations, J3 Arms Control, Department of National Defence, Canada

Missile Experts Conference Call Participants (October 20, 2004)

1. **Dr. Jane Boulden**, Canada Research Chair in International Relations and Security Studies,, Royal Military College of Canada
2. **Mr. Dennis Gormley**, Senior Fellow, Center for NonProliferation Studies, Monterey Institute for International Affairs and Visiting Professor and Research Associate, Graduate School of Public and International Affairs, University of Pittsburgh
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4. **Mr. Robert McDougall**, Director, Non-Proliferation Arms Control and Disarmament Division, Foreign Affairs Canada
5. **Dr. Mark Smith**, Research Fellow, Mountbatten Centre for International Studies
6. **Dr. Jing-dong Yuan**, Senior Research Associate, Monterey Institute for International Studies

ANNEX B: SUMMARY OF EXPERT QUESTIONNAIRE RESULTS

Section One

General WMD-Related Verification and Compliance Issues

WMD and the International Security Environment

The following question assessed experts' views on the threats presented by weapons of mass destruction within the current international security environment.

1.1 *Please rank your assessment of the likelihood of the following events within the next 5 to 10 years.*

(Numbers assigned 1 through 8 from most to least likely. 1=most likely)

The use of nuclear weapons by a state actor

(34 respondents)

Rank 1: 3 responses (9%)

Rank 2: 1 response (3%)

Rank 3: 1 response (3%)

Rank 4: 1 response (3%)

Rank 5: 4 responses (12%)

Rank 6: 5 responses (15%)

Rank 7: 13 responses (38%)

Rank 8: 6 responses (18%)

The use of nuclear weapons by a non-state actor.

(33 respondents)

Rank 1 : 0 responses (0%)

Rank 2 : 0 responses (0%)

Rank 3 : 3 responses (9%)

Rank 4 : 4 responses (12%)

Rank 5 : 2 responses (6%)

Rank 6 : 8 responses (24%)

Rank 7 : 1 response (3%)

Rank 8 : 15 responses (45%)

The use of radiological weapons by a state actor.

(31 respondents)

Rank 1: 0 responses (0%)

Rank 2: 0 responses (0%)

Rank 3: 1 response (3%)

Rank 4: 2 responses (6%)

Rank 5: 4 responses (13%)

Rank 6: 9 responses (29%)

Rank 7: 8 responses (26%)

Rank 8: 7 responses (23%)

The use of radiological weapons by a non-state actor.

(33 respondents)

Rank 1 : 4 responses (12%)

Rank 2 : 10 responses (30%)

Rank 3 : 11 responses (33%)

Rank 4 : 4 responses (12%)

Rank 5 : 3 responses (9%)

Rank 6 : 1 response (3%)

Rank 7 : 0 responses (0%)

Rank 8 : 0 responses (0%).

The use of chemical weapons by a state actor.

(34 respondents)

Rank 1 : 4 responses (12%)

Rank 2 : 2 responses (6%)

Rank 3 : 6 responses (18%)

Rank 4 : 8 responses (24%)

Rank 5 : 6 responses (18%)

Rank 6 : 4 responses (12%)

Rank 7 : 2 responses (6%)

Rank 8 : 2 responses (6%).

The use of chemical weapons by a non-state actor.

(33 respondents)

Rank 1 : 20 responses (61%)

Rank 2 : 6 responses (18%)

Rank 3 : 6 responses (18%)

Rank 4 : 0 responses (0%)

Rank 5 : 0 responses (0%)

Rank 6 : 0 responses (0%)

Rank 7 : 1 response (3%)

Rank 8 : 0 responses (0%).

The use of biological weapons by a state actor.

(32 respondents)

Rank 1 : 0 responses (0%)

Rank 2 : 3 responses (9%)

Rank 3 : 1 response (3%)

Rank 4 : 8 responses (25%)

Rank 5 : 11 responses (34%)

Rank 6 : 3 responses (9%)

Rank 7 : 6 responses (19%)

Rank 8 : 0 responses (0%).

The use of biological weapons by a non-state actor.

(33 respondents)

Rank 1 : 3 responses (9%)

Rank 2 : 12 responses (36%)

Rank 3 : 5 responses (15%)

Rank 4 : 7 responses (21%)

Rank 5 : 2 responses (6%)

Rank 6 : 2 responses (6%)

Rank 7 : 0 responses (0%)

Rank 8 : 2 responses (6%).

Basic appreciation of the situation

The following two questions assessed experts' views on the general nature of current WMD-related verification and compliance issues

1.2 Broadly assessed, how would you categorize the current situation with respect to the verification of compliance with international WMD-related non-proliferation, arms control and verification regimes (more than one answer may be indicated):

(35 respondents)

- **Broadly adequate:**
10 responses (29%)
- **Adequate in some areas (e.g. types of weapons), inadequate in others:**
2 responses (6%)
- **Better in some types of agreements (e.g. bilateral/multilateral) than in others**
20 responses (57%)
- **Deteriorating overall**
21 responses (60%)
- **Improving overall**
16 responses (45%)
- **Stagnant overall**
1 response (3%)

1.3 To the extent that you see problems in the current situation, to which factors do you primarily ascribe them (more than one answer may be indicated):

(35 respondents)

- **Existing verification technology is inadequate to detect non-compliance:**
16 responses (46%)
- **Restrictions on inspections and limits on technology applied to verification:**
10 responses (29%)
- **Inadequate verification provisions in existing agreements:**
15 responses (43%)
- **Refusal of states to allow full verification of existing commitments:**

- 20 responses (57%)
- **Deliberate circumvention of verification measures and deception of verification agencies:**
17 responses (49%)
- **Increased non-state activity (eg transfers) outside verification regimes:**
20 responses (57%)
- **Inadequate resources (financial/personnel/equipment) devoted to verification (including agencies):**
18 responses (51%)
- **Unwillingness of states to accede to agreements requiring strict(er) verification:**
11 responses (31%)
- **Unwillingness of states to negotiate new agreements with strict verification provisions:**
20 responses (57%)
- **Under-development of international verification and compliance mechanisms for situations outside existing treaty regimes and commitments**
22 responses (63%)
- **Other (specified in comments section):**
20 responses (57%)

WMD-related verification and compliance and the United Nations

1.4 *The possibility of a greater role of the UN Security Council in addressing WMD-related verification and compliance challenges should be the subject of a significant analysis.*

Strongly agree:	14 responses (40%)
Agree:	18 responses (51%)
Disagree:	2 responses (6%)
Strongly disagree:	1 response (3%)
Don't know:	0 responses (0%).

Respondents: 35 **Mean response:** 1.71 **Variance:** 0.50

1.5 *Which of the following should have primary responsibility for undertaking an analysis of the role of the UN Security Council in verification and compliance issues?*

(33 respondents)

- **The UN Security Council:** 6 responses (18%)
 - **The UN General Assembly:** 5 responses (15%)
 - **UN member governments:** 6 responses (18%)
 - **Non-government research institutes:** 16 responses (48%).
-

1.6 *In an effort to address the danger of the proliferation of WMD-related capabilities to non-state actors, UN Security Council Resolution 1540 (28 April 2004) requires states to adopt national legislation that would secure WMD-related materials within their borders, criminalize*

illicit exchanges of WMD-related materials, and strengthen WMD-related export controls. Please outline your views on how the UN Security Council should best monitor compliance with Resolution 1540.

Note: Answers for this question were in comment-form and were incorporated into conference call and workshop discussions, and ultimately into “Part II: Weapons of Mass Destruction Verification and Compliance: Challenges and Responses.”

1.7 A basic monitoring mechanism for Resolution 1540, mandated for an initial two years, has been established by the Council to monitor compliance. The effectiveness of this initiative should be the subject of significant analysis.

Strongly agree: 17 responses (52%)
Agree: 12 responses (36%)
Disagree: 1 response (3%)
Strongly disagree: 1 response (3%)
Don't know: 2 responses (6%).

Respondents: 33 **Mean response:** 1.76 **Variance:** 1.19

1.8 UNMOVIC's capabilities should be retained and institutionalized within the United Nations system in some form.

Strongly agree: 13 responses (38%)
Agree: 15 responses (44%)
Disagree: 0 responses (0%)
Strongly disagree: 1 response (3%)
Don't know: 5 responses (15%).

Respondents: 34 **Mean response:** 2.12 **Variance:** 1.86

1.9 Please answer this question if you selected “Strongly Agree” or “Agree” in the above question. A variety of models for institutionalizing UNMOVIC's capabilities within the United Nations have been proposed. Some have suggested placing such capabilities within the UN Department of Disarmament Affairs under the aegis of the UN Secretary-General, while others have suggested retaining them as an independent commission under the direct control of the UN Security Council. What are your views on these and other possible models designed to address the future of UNMOVIC's capabilities?

Note: Answers for this question were in comment-form and were incorporated into conference call and workshop discussions, and ultimately into “Part II: Weapons of Mass Destruction Verification and Compliance: Challenges and Responses.”

WMD-Related Verification and compliance and national, plurilateral (i.e. coalitions of the willing) and multilateral WMD regimes.

1.10 The potential complementarities of national (unilateral), plurilateral, and multilateral approaches to addressing WMD threats should be the subject of a significant study.

Strongly agree: 17 responses (49%)
Agree: 16 responses (46%)
Disagree: 0 responses (0%)
Strongly disagree: 0 responses (0%)
Don't know: 2 responses (6%).

Respondents: 35 **Mean response:** 1.69 **Variance:** 0.93

1.11 There should be a study of the comparative strengths, weaknesses and possible interactions of different organizational forms and levels of non-proliferation institutions (global, regional, interested party, national/unilateral, binding/voluntary, formal/informal) with regard to their implications for compliance and verification issues.

Strongly agree: 16 responses (46%)
Agree: 12 responses (34%)
Disagree: 5 responses (14%)
Strongly disagree: 0 responses (0%)
Don't know: 2 responses (6%).

Respondents: 35 **Mean response:** 1.86 **Variance:** 1.13

1.12 Are there other potential responses to the general challenges facing WMD verification and compliance that merit analysis?

Note: Answers for this question were in comment-form and were incorporated into conference call and workshop discussions, and ultimately into "Part II: Weapons of Mass Destruction Verification and Compliance: Challenges and Responses."

Section Two

Nuclear and Radiological Weapons Verification and Compliance: Challenges and Responses

Challenges

The following questions assessed experts' views on the relative severity of 'internal' and 'external' challenges facing the verification and compliance arrangements for the nuclear non-

proliferation regime – defined for this purpose as the Nuclear Non-Proliferation Treaty and the International Atomic Energy Agency (IAEA) and its nuclear safeguards system. Here ‘internal’ challenges refer to issues directly related to the nuclear verification and compliance mechanisms themselves. ‘External’ challenges refer to issues external to the nuclear verification and compliance mechanisms that have the potential to influence the effectiveness of the nuclear non-proliferation regime.

2.1 Please rank the following internal challenges that face the IAEA and its nuclear safeguards system. (Please assign numbers 1 through 9 to the following statements. 1= most significant challenge.)

Lack of universal adherence to and the implementation of the strengthened nuclear safeguards system, including the Additional Protocol.

(17 respondents)

Rank 1: 8 responses (47%)

Rank 2 : 5 responses (29%)

Rank 3 : 2 responses (12%)

Rank 4 : 1 response (6%)

Rank 5 : 1 response (6%)

Rank 6: 0 responses (0%)

Rank 7 : 0 responses (0%)

Rank 8 : 0 responses (0%)

Rank 9 : 0 responses (0%).

Tensions between the IAEA’s mandate as both promoter of the peaceful uses of nuclear energy and verifier of nonproliferation commitments.

(16 respondents)

Rank 1 : 0 responses (0%)

Rank 2 : 1 response (6%)

Rank 3 : 4 responses (25%)

Rank 4 : 4 responses (25%)

Rank 5 : 2 responses (13%)

Rank 6 : 2 responses (13%)

Rank 7 : 0 responses (0%)

Rank 8, 1 response (6%)

Rank 9 : 2 responses (13%).

Managerial and administrative effectiveness of the IAEA.

(15 respondents)

Rank 1 : 1 response (7%)

Rank 2 : 0 responses (0%)

Rank 3 : 1 response (7%)

Rank 4 : 0 responses (0%)

Rank 5 : 1 response (7%)

Rank 6 : 2 responses (13%)

Rank 7 : 3 responses (20%)

Rank 8 : 2 responses (13%)
Rank 9 : 5 responses (33%).

Limitations on the IAEA's ability to allocate verification resources based on an assessment of proliferation risks.

(14 respondents)

Rank 1 : 1 response (7%)
Rank 2 : 1 response (7%)
Rank 3 : 3 responses (21%)
Rank 4 : 4 responses (29%)
Rank 5 : 0 responses (0%)
Rank 6 : 2 responses (14%)
Rank 7 : 0 responses (0%)
Rank 8 : 1 response (7%)
Rank 9 : 2 responses (14%).

Limitations on the IAEA's ability to de-link allocation of verification resources from allocation of resources to technical assistance to developing countries.

(14 respondents)

Rank 1 : 0 responses (0%)
Rank 2 : 1 response (7%)
Rank 3 : 2 responses (14%)
Rank 4 : 0 responses (0%)
Rank 5 : 5 responses (36%)
Rank 6 : 2 responses (14%)
Rank 7 : 2 responses (14%)
Rank 8 : 2 responses (14%)
Rank 9 : 0 responses (0%).

Inadequate financial resources to fully support mandated verification and compliance activities.

(16 respondents)

Rank 1 : 0 responses (0%)
Rank 2 : 4 responses (25%)
Rank 3 : 4 responses (25%)
Rank 4 : 1 response (6%)
Rank 5 : 1 response (6%)
Rank 6 : 4 responses (25%)
Rank 7 : 1 response (6%)
Rank 8 : 0 responses (0%)
Rank 9 : 1 responses (6%).

Inadequate/insufficient uptake of new verification technology.

(14 respondents)

Rank 1 : 0 responses (0%)
Rank 2 : 1 response (7%)

Rank 3 : 0 responses (0%)
Rank 4 : 0 responses (0%)
Rank 5 : 1 response (7%)
Rank 6 : 1 response (7%)
Rank 7 : 4 responses (29%)
Rank 8 : 6 responses (43%)
Rank 9 : 1 response (7%).

Inappropriate balance between use of inspectors and on-site technology such as remote cameras.

(14 respondents)

Rank 1 : 0 responses (0%)
Rank 2 : 0 responses (0%)
Rank 3 : 0 responses (0%)
Rank 4 : 2 responses (14%)
Rank 5 : 2 responses (14%)
Rank 6 : 1 response (7%)
Rank 7 : 3 responses (21%)
Rank 8 : 2 responses (14%)
Rank 9 : 4 responses (29%).

Lack of consensus amongst IAEA Member States on strengthened safeguards measures.

(16 respondents)

Rank 1 : 7 responses (44%)
Rank 2 : 4 responses (25%)
Rank 3 : 0 responses (0%)
Rank 4 : 3 responses (19%)
Rank 5 : 1 response (6%)
Rank 6 : 0 responses (0%)
Rank 7 : 1 response (6%)
Rank 8 : 0 responses (0%)
Rank 9 : 0 responses (0%).

2.2 Please rank the following internal challenges that face the enforcement of states' nuclear non-proliferation commitments. (Please assign numbers 1 through 5 following statements. 1= most significant challenge.)

Inadequate legal/political authority on the part of the IAEA to take effective steps to clarify suspicions of non-compliance.

(17 respondents)

Rank 1: 1 response (6%)
Rank 2: 3 responses (18%)
Rank 3: 5 responses (29%)
Rank 4: 6 responses (35%)
Rank 5: 2 responses (12%)

Lack of political will in the IAEA Board of Governors to fully address potential/actual non-compliance.

(17 respondents)

Rank 1: 3 responses (18%)

Rank 2: 4 responses (24%)

Rank 3: 4 responses (24%)

Rank 4: 2 responses (12%)

Rank 5: 4 responses (24%).

Lack of willingness by the UN Security Council to deal with cases of noncompliance.

(15 respondents)

Rank 1: 7 responses (47%)

Rank 2: 2 responses (13%)

Rank 3: 3 responses (20%)

Rank 4: 2 responses (13%)

Rank 5: 1 response (7%).

Lack of a robust compliance enforcement mechanism within the NPT review process.

(17 respondents)

Rank 1: 2 responses (12%)

Rank 2: 4 responses (24%)

Rank 3: 3 responses (18%)

Rank 4: 2 responses (12%)

Rank 5: 6 responses (35%).

Unwillingness by some states to sign comprehensive safeguards and/or additional protocols.

(16 respondents)

Rank 1: 5 responses (31%)

Rank 2: 3 responses (19%)

Rank 3: 1 response (6%)

Rank 4: 4 responses (25%)

Rank 5: 3 responses (19%).

2.3 Please rank the following external challenges that face the nuclear non-proliferation regime to the extent that they affect verification and compliance. (Please assign numbers 1 through 8 to the following statements. 1= most significant challenge.)

The existence of states outside the NPT regime.

(19 respondents)

Rank 1 : 7 responses (37%)

Rank 2 : 4 responses (21%)

Rank 3 : 2 responses (11%)

Rank 4 : 1 response (5%)

Rank 5 : 0 responses (0%)

Rank 6 : 1 response (5%)
Rank 7: 3 responses (16%)
Rank 8: 1 response (5%).

The existence of inadequately strict and specific safeguards, verification and compliance obligations in the Non-Proliferation Treaty (NPT).

(17 respondents)

Rank 1 : 1 response (6%)
Rank 2 : 1 response (6%)
Rank 3 : 4 responses (24%)
Rank 4 : 3 responses (18%)
Rank 5 : 2 responses (12%)
Rank 6 : 2 responses (12%)
Rank 7 : 2 responses (12%)
Rank 8 : 2 responses (12%).

The inherently discriminatory nature of the NPT which permits nuclear weapon states (NWS) to retain nuclear weapons.

(19 respondents)

Rank 1 : 6 responses (32%)
Rank 2 : 1 response (5%)
Rank 3 : 2 responses (11%)
Rank 4: 3 responses (16%)
Rank 5: 1 response (5%)
Rank 6: 2 responses (11%)
Rank 7: 1 response (5%)
Rank 8, 3 responses (16%).

Perceptions by non-nuclear weapon states (NNWS) parties to the NPT that there are no multilateral means for verifying NWS compliance with disarmament obligations under Article VI.

(16 respondents)

Rank 1 : 0 responses (0%)
Rank 2 : 1 response (6%)
Rank 3 : 4 responses (25%)
Rank 4 : 2 responses (13%)
Rank 5 : 2 responses (13%)
Rank 6 : 2 responses (13%)
Rank 7 : 2 responses (13%)
Rank 8 : 3 responses (19%).

NWS non-compliance with their disarmament obligations under Article VI of the NPT.

(19 respondents)

Rank 1 : 1 response (5%)
Rank 2 : 3 responses (16%)
Rank 3 : 3 responses (16%)

Rank 4 : 2 responses (11%)
Rank 5 : 4 responses (21%)
Rank 6 : 2 responses (11%)
Rank 7 : 2 responses (11%)
Rank 8 : 2 responses (11%).

Perceptions by the NWS that the NNWS are not complying sufficiently with their NPT obligations.

(18 respondents)

Rank 1 : 0 responses (0%)
Rank 2 : 3 responses (17%)
Rank 3 : 1 response (6%)
Rank 4 : 4 responses (22%)
Rank 5 : 2 responses (11%)
Rank 6 : 4 responses (22%)
Rank 7 : 3 responses (17%)
Rank 8 : 1 response (6%).

Difficulties of existing nuclear supply regimes in stopping covert nuclear supply networks for nuclear technology and materials.

(18 respondents)

Rank 1 : 3 responses (17%)
Rank 2 : 3 responses (17%)
Rank 3 : 2 responses (11%)
Rank 4 : 2 responses (11%)
Rank 5 : 4 responses (22%)
Rank 6 : 2 responses (11%)
Rank 7 : 0 responses (0%)
Rank 8 : 2 responses (11%).

Increased capacities of non-state actors to engage in activities of nuclear proliferation concern.

(17 respondents)

Rank 1 : 3 responses (18%)
Rank 2 : 4 responses (24%)
Rank 3 : 1 response (6%)
Rank 4 : 1 response (6%)
Rank 5 : 1 response (6%)
Rank 6 : 1 response (6%)
Rank 7 : 3 responses (18%)
Rank 8 : 3 responses (18%).

Responses: Improving the Regime

2.4 Strengthened nuclear safeguards, including measures that the IAEA is able to take under its existing legal authority and the implementation of the Additional Protocol, are sufficient to ensure that a state subject to these measures will be unable to escape detection should it undertake undeclared illicit activities.

Strongly agree: 0 responses (0%)
Agree: 4 responses (19%)
Disagree: 11 responses (52%)
Strongly disagree: 2 responses (10%)
Don't know: 4 responses (19%)

Respondents: 21 Mean response: 3.29 Variance: 1.01

2.5 The Additional Protocol should be made mandatory for all NPT states parties in terms of fulfilling the safeguards commitments under Article III.1 of the NPT.

Strongly agree: 9 responses (45%)
Agree: 6 responses (30%)
Disagree: 1 response (5%)
Strongly disagree: 0 responses (0%)
Don't know: 4 responses (20%)

Respondents: 20 Mean response: 2.20 Variance: 2.38

2.6 The Additional Protocol should be made mandatory for all NPT states parties in terms of commitments to a condition of supply under Article III.2 of the NPT.

Strongly agree: 9 responses (41%)
Agree: 6 responses (27%)
Disagree: 1 response (5%)
Strongly disagree: 0 responses (0%)
Don't know: 6 responses (27%)

Respondents: 22 Mean response: 2.45 Variance: 2.83

2.7 Verified compliance with comprehensive safeguards agreements and the Additional Protocol should be mandatory 'as a condition of supply' (meaning the IAEA is able to declare the non-diversion of declared nuclear material and the absence of undeclared nuclear activities in a state) for civilian nuclear materials and equipment.

Strongly agree: 14 responses (64%)
Agree: 2 responses (9%)
Disagree: 1 response (5%)
Strongly disagree: 0 responses (0%)
Don't know: 5 responses (23%).

Respondents: 22 Mean response: 2.09 Variance: 2.85

2.8 If a state is under investigation by the IAEA for non-technical violations of the state's safeguards obligations, all nuclear cooperation with that state by NPT states parties and the IAEA itself should be suspended.

Strongly agree: 3 responses (14%)
Agree: 10 responses (45%)
Disagree: 3 responses (14%)
Strongly disagree: 0 responses (0%)
Don't know: 6 responses (27%).

Respondents: 22 Mean response: 2.82 Variance: 2

2.9 Non-governmental organizations can play a significant role with respect to the verification of NPT implementation.

Strongly agree: 4 responses (18%)
Agree: 12 responses (55%)
Disagree: 5 responses (23%)
Strongly disagree: 0 responses (0%)
Don't know: 1 response (5%).

Respondents: 22 Mean response: 2.18 Variance: 0.82

2.10 States in full compliance with their obligations under their comprehensive safeguards agreement and the Additional Protocol, and which forgo enrichment and reprocessing capabilities, should be guaranteed a supply, at reasonable market rates, of nuclear fuel for civilian applications.

Strongly agree: 10 responses (45%)
Agree: 7 responses (32%)
Disagree: 2 responses (9%)
Strongly disagree: 1 response (5%)
Don't know: 2 responses (9%)

Respondents: 22 Mean response: 2.00 Variance: 1.62

2.11 Nuclear enrichment and reprocessing capabilities should be limited by international agreement to those states that currently possess them, provided that supply of nuclear materials for peaceful purposes, under safeguards, is guaranteed by the possessor states.

Strongly agree: 4 responses (20%)
Agree: 6 responses (30%)
Disagree: 6 responses (30%)
Strongly disagree: 2 responses (10%)
Don't know: 2 responses (10%).

Respondents: 20 Mean response: 2.60 Variance: 1.52

2.12 States which withdraw from the NPT should be required to cease the use of any nuclear materials and equipment acquired from other NPT states parties prior to withdrawal and to return these materials to the supplier under international verification.

Strongly agree: 7 responses (35%)
Agree: 10 responses (50%)
Disagree: 1 response (5%)
Strongly disagree: 0 responses (0%)
Don't know: 2 responses (10%).

Respondents: 20 Mean response: 2.00 Variance: 1.37

2.13 Nuclear export control mechanisms such as the Zangger Committee and the Nuclear Suppliers Group are useful to nuclear verification and compliance objectives.

Strongly agree: 7 responses (32%)
Agree: 10 responses (45%)
Disagree: 1 response (5%)
Strongly disagree: 1 response (5%)
Don't know: 3 responses (14%).

Respondents: 22 Mean response: 2.23 Variance: 1.80

2.14 The IAEA should pursue integrated safeguards as a means of increasing the effectiveness and efficiency of safeguards.

Strongly agree: 6 responses (29%)
Agree: 9 responses (43%)
Disagree: 0 responses (0%)

Strongly disagree: 0 responses (0%)
Don't know: 6 responses (29%).

Respondents: 21 Mean response: 2.57 Variance: 2.66

2.15 It has been suggested that the IAEA's Board of Governors needs a verification committee to continuously monitor the effectiveness of nuclear safeguards and suggest improvements. Is this a worthwhile idea?

Strongly agree: 2 responses (9%)
Agree: 14 responses (64%)
Disagree: 0 responses (0%)
Strongly disagree: 0 responses (0%)
Don't know: 6 responses (27%).

Respondents: 22 Mean response: 2.73 Variance: 2.11

2.16 It has been suggested that IAEA Member States under investigation should not be allowed to serve on the Board of Governors. Is this a worthwhile idea?

Strongly agree: 1 response (5%)
Agree: 9 responses (43%)
Disagree: 5 responses (24%)
Strongly disagree: 0 responses (0%)
Don't know: 6 responses (29%).

Respondents: 21 Mean response: 3.05 Variance: 1.85

2.17 The IAEA voluntary Code of Conduct on the Safety and Security of Radioactive Sources represents an effective response to the threat of radiological weapons.

Strongly agree: 1 response (5%)
Agree: 2 responses (10%)
Disagree: 8 responses (38%)
Strongly disagree, 1 response (5%)
Don't know: 9 responses (43%)

Respondents: 21 Mean response: 3.71 Variance: 1.61

2.18 Negotiations on a Fissile Material Cut-off Treaty will need to include effective verification provisions to ensure compliance with any agreement that is reached.

Strongly agree: 9 responses (41%)
Agree: 11 responses (50%)
Disagree: 0 responses (0%)
Strongly disagree: 0 responses (0%)
Don't know: 2 responses (9%).

Respondents: 22 **Mean response:** 1.86 **Variance:** 1.27

2.19 Despite the fact that the CTBT has not yet entered into force, possibilities and approaches for using the CTBT's verification and compliance mechanisms in informal modes should be studied.

Strongly agree: 9 responses (41%)
Agree: 11 responses (50%)
Disagree: 0 responses (0%)
Strongly disagree: 0 responses (0%)
Don't know: 2 responses (9%).

Respondents: 22 **Mean response:** 1.86 **Variance:** 1.27

2.20 Are there other potential responses to the challenges facing the nuclear nonproliferation regime that merit detailed analysis?

Note: Answers for this question were in comment-form and were incorporated into conference call and workshop discussions, and ultimately into "Part II: Weapons of Mass Destruction Verification and Compliance: Challenges and Responses."

Section Three

Chemical Weapons Verification and Compliance: Challenges and Responses

Challenges

The following questions assessed expert views on the relative severity of 'internal' and 'external' challenges facing the chemical weapons regime – defined for this purpose as the Chemical Weapons Convention (CWC) and the Organization for the Prohibition of Chemical Weapons (OPCW). Here 'internal' challenges refer to issues directly related to the CWC verification and compliance mechanisms themselves. 'External' challenges refer to issues external to the chemical weapons regime that have the potential to influence the effectiveness of the chemical weapons regime.

3.1 Please rank the following internal challenges that face the chemical weapons regime. (Please assign numbers 1 through 7 to the following statements. 1 = most significant challenge.)

Organization, management and administration of the OPCW.

(14 respondents)

- Rank 1 : 1 response (7%)**
- Rank 2 : 0 responses (0%)**
- Rank 3 : 2 responses (14%)**
- Rank 4 : 3 responses (21%)**
- Rank 5 : 1 response (7%)**
- Rank 6 : 5 responses (36%)**
- Rank 7 : 2 responses (14%)**

Reforming the OPCW budget process and the underlying financial rules.

(14 respondents)

- Rank 1 : 0 responses (0%)**
- Rank 2 : 0 responses (0%)**
- Rank 3 : 1 response (7%)**
- Rank 4 : 2 responses (13%)**
- Rank 5 : 5 responses (36%)**
- Rank 6 : 3 responses (21%)**
- Rank 7 : 3 responses (21%).**

Inadequate/insufficient uptake of new verification technology.

(14 respondents)

- Rank 1 : 0 responses (0%)**
- Rank 2 : 0 responses (0%)**
- Rank 3 : 2 responses (14%)**
- Rank 4 : 2 responses (14%)**
- Rank 5 : 2 responses (14%)**
- Rank 6 : 4 responses (29%)**
- Rank 7 : 4 responses (29%)**

The need to develop an OPCW response to the threat of chemical terrorism.

(14 respondents)

- Rank 1: 2 responses (14%)**
- Rank 2: 1 response (7%)**
- Rank 3: 1 response (7%)**
- Rank 4: 2 responses (14%)**
- Rank 5: 2 responses (14%)**
- Rank 6: 1 response (7%)**
- Rank 7: 5 responses (36%).**

Lack of full adherence by all CWC states parties to CWC national legislative requirements.

(17 respondents)

- Rank 1 : 4 responses (24%)**

Rank 2 : 6 responses (35%)
Rank 3 : 4 responses (24%)
Rank 4 : 1 response (6%)
Rank 5 : 2 responses (12%)
Rank 6 : 0 responses (0%)
Rank 7 : 0 responses (0%)

Lack of political will to address alleged non-compliance by states parties.
(18 respondents)

Rank 1 : 9 responses (50%)
Rank 2 : 2 responses (11%)
Rank 3 : 4 responses (22%)
Rank 4 : 2 responses (11%)
Rank 5 : 0 responses (0%)
Rank 6 : 1 response (6%)
Rank 7 : 0 responses (0%).

Lack of invigorated Challenge Inspection provisions which would make them a normal part of the verification regime.
(18 respondents)

Rank 1 : 3 responses (17%)
Rank 2 : 9 responses (50%)
Rank 3 : 2 responses (11%)
Rank 4 : 2 responses (11%)
Rank 5 : 2 responses (11%)
Rank 6 : 0 responses (0%)
Rank 7 : 0 responses (0%).

3.2 Please rank the following external challenges that face the chemical weapons regime. (Please assign numbers 1 through 6 to the following statements. 1= most significant challenge.)

Development of new chemicals, not listed in the CWC's existing schedules, which can act as chemical weapons or precursors.

(18 respondents)
Rank 1 : 3 responses (17%)
Rank 2 : 7 responses (39%)
Rank 3 : 4 responses (22%)
Rank 4 : 2 responses (11%)
Rank 5 : 2 responses (11%)
Rank 6 : 0 responses (0%).

The development and use of non-lethal weapons (including riot control agents) and toxic chemicals used for law enforcement that may contravene the CWC's prohibitions.

(19 respondents)
Rank 1 : 5 responses (26%)

Rank 2 : 6 responses (32%)
Rank 3 : 2 responses (11%)
Rank 4 : 1 response (5%)
Rank 5 : 0 responses (0%)
Rank 6 : 5 responses (26%).

Increased accessibility of dual-use CW knowledge, technology, and materials.
(18 respondents)

Rank 1: 6 responses (33%)
Rank 2: 1 response (6%)
Rank 3: 3 responses (17%)
Rank 4: 1 response (6%)
Rank 5: 3 responses (17%)
Rank 6: 4 responses (22%).

The development of covert supply networks.
(17 respondents)

Rank 1 : 0 responses (0%)
Rank 2 : 0 responses (0%)
Rank 3 : 2 responses (12%)
Rank 4 : 8 responses (47%)
Rank 5 : 4 responses (24%)
Rank 6 : 3 responses (18%)

Lack of universal adherence to the CWC.
(20 respondents)

Rank 1 : 3 responses (15%)
Rank 2 : 2 responses (10%)
Rank 3 : 5 responses (25%)
Rank 4 : 5 responses (25%)
Rank 5 : 3 responses (15%)
Rank 6 : 2 responses (10%).

Increased capacities of non-state actors to acquire chemical weapons and/or related material.

(18 respondents)
Rank 1 : 3 responses (17%)
Rank 2 : 3 responses (17%)
Rank 3 : 3 responses (17%)
Rank 4 : 1 response (6%)
Rank 5 : 5 responses (28%)
Rank 6 : 3 responses (17%)

Responses: Improving the Regime

3.3 Significant efforts should be undertaken by the OPCW to address the challenges associated with the new and emerging chemical weapons relevant materials, inter alia by updating the CWC's existing schedules of controlled chemical weapons and precursors.

Strongly agree: 6 responses (27%)
Agree: 12 responses (55%)
Disagree: 2 responses (9%)
Strongly disagree: 0 responses (0%)
Don't know: 2 responses (9%).

Respondents: 22 Mean response: 2.09 Variance: 1.23

3.4 CWC states parties should address the challenges associated with the use of nonlethal weapons (including riot control agents) and toxic chemicals used for law enforcement.

Strongly agree: 12 responses (55%)
Agree: 3 responses (14%)
Disagree: 3 responses (14%)
Strongly disagree: 1 response (5%)
Don't know: 3 responses (14%)

Respondents: 22 Mean response: 2.09 Variance: 2.09

3.5 Greater use of new technology, such as remote monitoring techniques and other means, should be explored in order to reduce the human resource requirements for the verification of CW destruction.

Strongly agree: 9 responses (43%)
Agree: 11 responses (52%)
Disagree: 0 responses (0%)
Strongly disagree: 0 responses (0%)
Don't know: 1 response (5%).

Respondents: 21 Mean response: 1.71 Variance: 0.81

3.6 CWC challenge inspections should be mounted, if only on a trial basis, to ensure the credibility of this verification tool.

Strongly agree: 14 responses (64%)
Agree: 7 responses (32%)
Disagree: 1 response (5%)

Strongly disagree: 0 responses (0%)
Don't know: 0 responses (0%)

Respondents: 22 **Mean response:** 1.41 **Variance:** 0.35

3.7 Non-governmental organizations can play a significant role with respect to the verification of CWC implementation.

Strongly agree: 6 responses (27%)
Agree: 9 responses (41%)
Disagree: 3 responses (14%)
Strongly disagree: 1 response (5%)
Don't know: 3 responses (14%)

Respondents: 22 **Mean response:** 2.36 **Variance:** 1.77

3.8 Universal adherence to the CWC provisions (including national implementation legislation) would establish sufficient barriers to the non-state actor acquisition of chemical weapons.

Strongly agree: 4 responses (18%)
Agree: 6 responses (27%)
Disagree: 7 responses (32%)
Strongly disagree: 5 responses (23%)
Don't know: 0 responses (0%)

Respondents: 22 **Mean response:** 2.59 **Variance:** 1.11

3.9 The OPCW should place a greater emphasis upon international responses to the threat of chemical terrorism.

Strongly agree: 2 responses (10%)
Agree: 12 responses (57%)
Disagree: 4 responses (19%)
Strongly disagree: 1 response (5%)
Don't know: 2 responses (10%)

Respondents: 21 **Mean response:** 2.48 **Variance:** 1.16

3.10 Are there other potential responses to the challenges facing the chemical weapons verification and compliance regime that merit detailed analysis?

Note: Answers for this question were in comment-form and were incorporated into conference call and workshop discussions, and ultimately into "Part II: Weapons of Mass Destruction Verification and Compliance: Challenges and Responses."

Section Four

Biological Weapons Verification and Compliance: Challenges and Responses

Challenges

The following questions assessed experts' views on the relative severity of 'internal' and 'external' challenges facing the biological weapons verification and compliance regime – defined for this purpose as the compliance provisions of the Biological and Toxin Weapons Convention (BTWC) and limited authorities within the United Nations to investigate instances of suspected non-compliance with the BTWC. Here 'internal' challenges refer to issues directly related to BTWC verification and compliance mechanisms themselves. 'External' challenges refer to issues external to the biological weapons regime that have the potential to influence the effectiveness of the regime.

4.1 Please rank the following internal challenges that face verification and compliance respect of the biological weapons regime. (Please assign numbers 1 through 5 to following statements. 1= most significant challenge.)

Absence of a BTWC verification mechanism

(26 respondents)

Rank 1: 13 responses (50%)

Rank 2: 9 responses (35%)

Rank 3: 3 responses (12%)

Rank 4: 0 responses (0%)

Rank 5: 1 response (4%)

Lack of universal adherence to the BTWC

(25 respondents)

Rank 1: 4 responses (16%)

Rank 2: 4 responses (16%)

Rank 3: 4 responses (16%)

Rank 4: 5 responses (20%)

Rank 5: 8 responses (32%)

Lack of political will to fully address allegations of non-compliance with the BTWC

(26 respondents)

Rank 1: 9 responses (35%)

Rank 2: 8 responses (31%)

Rank 3: 8 responses (31%)

Rank 4: 0 responses (0%)

Rank 5: 1 responses (4%)

**Lack of compliance with voluntary confidence-building measures
(24 respondents)**

Rank 1 : 0 responses (0%)

Rank 2 : 2 responses (8%)

Rank 3 : 5 responses (21%)

Rank 4 : 8 responses (33%)

Rank 5 : 9 responses (38%)

Lack of compliance by all BTWC states parties with the obligation to adopt national implementation measures.

(25 respondents)

Rank 1: 1 response (4%)

Rank 2: 3 responses (12%)

Rank 3: 5 responses (20%)

Rank 4: 11 responses (44%)

Rank 5: 5 responses (20%)

4.2 Please rank the following external challenges that face the verification and compliance aspects of the biological weapons regime. (Please assign numbers 1 through 4 to the following statements. 1= most significant challenge.)

Emerging BW threats, including those from non-state actors.

(25 respondents)

Rank 1: 7 responses (28%)

Rank 2: 6 responses (24%)

Rank 3: 7 responses (28%)

Rank 4: 5 responses (20%)

The potential for the abuse of legitimate biological research

(26 respondents)

Rank 1: 9 responses (35%)

Rank 2: 5 responses (19%)

Rank 3: 9 responses (35%)

Rank 4: 3 responses (12%)

The lack of internationally recognized codes of conduct for biological research

(24 respondents)

Rank 1: 1 response (4%)

Rank 2: 3 responses (13%)

Rank 3: 4 responses (17%)

Rank 4: 16 responses (67%)

Increased accessibility of dual-use BW knowledge, technologies, and materials (26 respondents)

Rank 1: 9 responses (35%)

Rank 2: 12 responses (46%)

Rank 3: 5 responses (19%)

Rank 4: 0 responses (0%)

Responses: Improving the Regime

4.3 The current new process of Expert Group meetings and follow-up meetings of states parties is likely to result in improvements in verification and compliance.

Strongly agree: 0 responses (0%)

Agree: 9 responses (32%)

Disagree: 16 responses (57%)

Strongly disagree: 2 responses (7%)

Don't know: 1 response (4%)

Respondents: 28 Mean response: 2.82 Variance: 0.52

4.4 Efforts should continue to seek the establishment of a multilateral verification and compliance regime for the BTWC.

Strongly agree: 16 responses (57%)

Agree: 8 responses (29%)

Disagree: 1 response (4%)

Strongly disagree: 1 response (4%)

Don't know: 2 responses (7%)

Respondents: 28 Mean response: 1.74 Variance: 1.38

4.5 Efforts to establish a BW verification mechanism along the lines envisaged in the draft BTWC Protocol should be abandoned in favor of some other alternative.

Strongly agree: 3 responses (11%)

Agree: 6 responses (22%)

Disagree: 10 responses (37%)

Strongly disagree: 5 responses (19%)

Don't know: 3 responses (11%)

Respondents: 27 Mean response: 2.96 Variance: 1.34

4.6 Universal compliance with BTWC obligations (including national implementation legislation) would establish sufficient barriers to the non-state actor acquisition of BW knowledge, technologies and materials.

Strongly agree: 2 responses (7%)
Agree: 5 responses (18%)
Disagree: 14 responses (50%)
Strongly disagree: 7 responses (25%)
Don't know: 0 responses (0%)

Respondents: 28 Mean response: 2.93 Variance: 0.74

4.7 In order to increase transparency about BTWC-related activities, the BTWC confidence building measures (CBM's) should be made legally binding.

Strongly agree: 7 responses (25%)
Agree: 15 responses (54%)
Disagree: 1 response (4%)
Strongly disagree: 2 responses (7%)
Don't know: 3 responses (11%)

Respondents: 28 Mean response: 2.25 Variance: 1.53

4.8 What other kinds of measures should be undertaken to strengthen voluntary CBM's and promote more substantive follow-up on requests for clarification of states' activities?

Note: Answers for this question were in comment-form and were incorporated into conference call and workshop discussions, and ultimately into "Part II: Weapons of Mass Destruction Verification and Compliance: Challenges and Responses."

4.9 States should be encouraged to fulfill their obligation to adopt national measures to implement the BWC.

Strongly agree: 17 responses (%)
Agree: 10 responses (%)
Disagree: 0 responses (0%)
Strongly disagree: 0 responses (0%)
Don't know: 0 responses (0%)

Respondents: 27 Mean response: 1.37 Variance: 0.24

4.10 *States should be encouraged to establish national implementing authorities to encourage full compliance with their BTWC obligations.*

Strongly agree: 14 responses (52%)
Agree: 12 responses (44%)
Disagree: 1 response (4%)
Strongly disagree: 0 responses (0%)
Don't know: 0 responses (0%)

Respondents: 27 Mean response: 1.52 Variance: 0.34

4.11 *Non-governmental organizations can play a significant role with respect to the verification of BWC implementation.*

Strongly agree: 8 responses (30%)
Agree: 9 responses (33%)
Disagree: 5 responses (19%)
Strongly disagree: 1 response (4%)
Don't know: 4 responses (15%)

Respondents: 27 Mean response: 2.41 Variance: 1.87

4.12 *A permanent Group of Experts should be established to assess scientific and technological developments with the potential to affect the scope and effectiveness of the BWC.*

Strongly agree: 15 responses (54%)
Agree: 10 responses (36%)
Disagree: 2 responses (7%)
Strongly disagree: 0 responses (0%)
Don't know: 1 response (4%)

Respondents: 28 Mean response: 1.64 Variance: 0.83

4.13 *More effort is needed to highlight the verification and compliance challenges associated with emerging BW threats and the potential for the abuse of legitimate biological research.*

Strongly agree: 13 responses (46%)
Agree: 13 responses (46%)
Disagree: 0 responses (0%)
Strongly disagree: 0 responses (0%)
Don't know: 2 responses (7%)

Respondents: 28 Mean response: 1.75 Variance: 1.08

4.14 *Cooperative threat reduction initiatives, such as those detailed within the Global Partnership Against Weapons and Materials of Mass Destruction designed to increase biosafety and security at laboratories in Russia and the states of the Former Soviet Union should be expanded to include other states.*

Strongly agree: 11 responses (39%)
Agree: 14 responses (50%)
Disagree: 0 responses (0%)
Strongly disagree: 0 responses (0%)
Don't know: 3 responses (11%)

Respondents: 28 **Mean response: 1.93** **Variance: 1.40**

4.15 *Means by which the UN Security Council (UNSC) could investigate alleged BW use, based on a request made under BTWC Article VI, should be strengthened by explicitly requiring states to accept investigations on their territory when requested by the UN Secretary-General, by updating the list of experts mandated by UNDDA, by providing training to a roster of inspectors, and by the acquisition of the necessary verification equipment.*

Strongly agree: 16 responses (57%)
Agree: 9 responses (32%)
Disagree: 2 responses (7%)
Strongly disagree: 0 responses (0%)
Don't know: 1 response (4%)

Respondents: 28 **Mean response: 1.61** **Variance: 0.84**

4.16 *Consideration should be given by the BTWC states parties as to the nature of consequences in cases where the UNSC finds non-compliance in response to a request made under BTWC Article VI.*

Strongly agree: 9 responses (33%)
Agree: 16 responses (59%)
Disagree: 0 responses (0%)
Strongly disagree: 1 response (4%)
Don't know: 1 response (4%)

Respondents: 27 **Mean response: 1.85** **Variance: 0.82**

4.17 *The capabilities of UNMOVIC in regard to biological weapons verification should be preserved and enhanced in some form or other.*

Strongly agree: 11 responses (41%)

Agree: 10 responses (37%)

Disagree: 1 response (4%)

Strongly disagree: 1 response (4%)

Don't know: 4 responses (15%)

Respondents: 27

Mean response: 2.15

Variance: 1.98

4.18 *Are there other potential responses to the challenges facing the biological weapons verification and compliance regime that merit analysis?*

Note: Answers for this question were in comment-form and were incorporated into conference call and workshop discussions, and ultimately into "Part II: Weapons of Mass Destruction Verification and Compliance: Challenges and Responses."

Section Five

Missile Verification and Compliance Issues

Although there are a number of bilateral (eg USA-USSR/Russia) agreements that deal with missile arms control and disarmament, including some with highly elaborated and intrusive verification provisions, there are no multilateral legal obligations prohibiting the acquisition, development or use of missiles or missile technology against which the compliance of states with such obligations can be measured, and no established multilateral mechanisms by which any such compliance could be verified. The Hague Code of Conduct (HCOC) on ballistic missiles and the Missile Technology Control Regime (MTCR) do provide elements of an emerging regime aimed at restraining the proliferation of various missile and related systems which can be used to deliver WMD.

Challenges

With this in mind, the following section sought experts' views on the challenges posed by missile-related verification and compliance *lacunae*, on proposals aimed at reinforcing the utility of existing verification and compliance measures and on means to ensure that effective verification and compliance concepts and capabilities are being considered as part of further development of non-proliferation, arms control and disarmament measures in this field.

5.1 *Please rank the challenges that face the current or potential missile verification and compliance regime. (Please assign numbers 1 through 12 to the following statements. 1= most significant challenge)*

**Absence of a legally binding regime with universal obligations
(12 respondents)**

Rank 1 : 5 responses (42%)
Rank 2 : 0 responses (0%)
Rank 3 : 2 responses (17%)
Rank 4 : 1 response (8%)
Rank 5 : 0 responses (0%)
Rank 6 : 2 responses (17%)
Rank 7 : 0 responses (0%)
Rank 8 : 0 responses (0%)
Rank 9 : 1 response (8%)
Rank 10 : 0 responses (0%)
Rank 11 : 0 responses (0%)
Rank 12 : 1 response (8%)

**Absence of agreed verification and compliance mechanisms
(11 respondents)**

Rank 1 : 0 responses (0%)
Rank 2 : 1 response (9%)
Rank 3 : 1 response (9%)
Rank 4 : 3 responses (27%)
Rank 5 : 2 responses (18%)
Rank 6 : 0 responses (0%)
Rank 7 : 1 response (9%)
Rank 8 : 1 response (9%)
Rank 9 : 0 responses (0%)
Rank 10 : 0 responses (0%)
Rank 11 : 2 responses (18%)
Rank 12 : 0 responses (0%)

**Insufficient registry of verified/verifiable information on states' activities
(10 respondents)**

Rank 1 : 0 responses (0%)
Rank 2 : 0 responses (0%)
Rank 3 : 0 responses (0%)
Rank 4 : 0 responses (0%)
Rank 5 : 3 responses (30%)
Rank 6 : 0 responses (0%)
Rank 7 : 2 responses (20%)
Rank 8 : 1 response (10%)
Rank 9 : 1 response (10%)
Rank 10 : 2 responses (20%)
Rank 11 : 0 responses (0%)
Rank 12 : 1 response (10%)

Unwillingness of some major missile-using states to accept (verified) constraints on further development, accumulation, transfer and other missile-related activities

(11 respondents)

Rank 1 : 4 responses (36%)
Rank 2 : 3 responses (27%)
Rank 3 : 1 response (9%)
Rank 4 : 0 responses (0%)
Rank 5 : 0 responses (0%)
Rank 6 : 0 responses (0%)
Rank 7 : 1 response (9%)
Rank 8 : 1 response (9%)
Rank 9, 0 responses (0%)
Rank 10 : 0 responses (0%)
Rank 11 : 1 response (9%)
Rank 12 : 0 responses (0%)

Desire on the part of some states to acquire missile capabilities and their unwillingness to accept (verified) restraints on such acquisition

(11 respondents)

Rank 1 : 2 responses (18%)
Rank 2 : 4 responses (36%)
Rank 3 : 0 responses (0%)
Rank 4 : 1 response (9%)
Rank 5 : 0 responses (0%)
Rank 6 : 2 responses (18%)
Rank 7 : 1 response (9%)
Rank 8 : 0 responses (0%)
Rank 9 : 0 responses (0%)
Rank 10 : 0 responses (0%)
Rank 11 : 1 response (9%)
Rank 12 : 0 responses (0%)

A perception by some that the major powers are focusing on controlling proliferation of ballistic missiles to other states, while paying insufficient attention to reducing their own existing missile holdings or to the issues raised by cruise missiles

(11 respondents)

Rank 1 : 0 responses (0%)
Rank 2 : 1 response (9%)
Rank 3 : 3 responses (27%)
Rank 4 : 0 responses (0%)
Rank 5 : 1 response (9%)
Rank 6 : 2 responses (18%)
Rank 7 : 0 responses (0%)
Rank 8 : 1 response (9%)
Rank 9 : 1 response (9%)

Rank 10 : 2 responses (18%)
Rank 11 : 0 responses (0%)
Rank 12 : 0 responses (0%)

**Qualitative and quantitative improvement in missile arsenals
(11 respondents)**

Rank 1 : 0 responses (0%)
Rank 2 : 0 responses (0%)
Rank 3 : 1 response (9%)
Rank 4 : 0 responses (0%)
Rank 5 : 1 response (9%)
Rank 6 : 0 responses (0%)
Rank 7 : 2 responses (18%)
Rank 8 : 1 response (9%)
Rank 9 : 2 responses (18%)
Rank 10 : 0 responses (0%)
Rank 11: 2 responses (18%)
Rank 12: 2 responses (18%)

**An increasing number of missile-holding, -producing and -exporting states
(11 respondents)**

Rank 1 : 1 response (9%)
Rank 2 : 1 response (9%)
Rank 3 : 1 response (9%)
Rank 4 : 1 response (9%)
Rank 5 : 0 responses (0%)
Rank 6 : 1 response (9%)
Rank 7 : 2 responses (18%)
Rank 8 : 1 response (9%)
Rank 9 : 1 response (9%)
Rank 10 : 0 responses (0%)
Rank 11 : 1 response (9%)
Rank 12 : 1 response (9%)

**The development of covert supply networks
(10 respondents)**

Rank 1 : 0 responses (0%)
Rank 2 : 1 response (10%);
Rank 3 : 2 responses (20%)
Rank 4 : 1 response (10%)
Rank 5 : 1 response (10%)
Rank 6 : 0 responses (0%)
Rank 7 : 0 responses (0%)
Rank 8 : 1 response (10%)
Rank 9 : 0 responses (0%)
Rank 10 : 4 responses (40%)

Rank 11 : 0 responses (0%)

Rank 12 : 0 responses (0%)

**Increased capacities of non-state actors to acquire missile technology and materials
(11 respondents)**

Rank 1 : 0 responses (0%)

Rank 2 : 1 response (9%)

Rank 3 : 1 response (9%)

Rank 4 : 0 responses (0%)

Rank 5 : 0 responses (0%)

Rank 6 : 1 response (9%)

Rank 7 : 0 responses (0%)

Rank 8 : 0 responses (0%)

Rank 9 : 1 response (9%)

Rank 10 : 1 response (9%)

Rank 11 : 2 responses (18%)

Rank 12 : 4 responses (36%)

**Increased accessibility of dual-use missile technology and materials, inter alia those useful
for peaceful space launch purposes**

(10 respondents)

Rank 1 : 0 responses (0%)

Rank 2 : 0 responses (0%)

Rank 3 : 0 responses (0%)

Rank 4 : 2 responses (20%)

Rank 5 : 1 response (10%)

Rank 6 : 1 response (10%)

Rank 7 : 1 response (10%)

Rank 8 : 3 responses (30%)

Rank 9 : 1 response (10%)

Rank 10 : 0 responses (0%)

Rank 11 : 1 response (10%)

Rank 12 : 0 responses (0%)

**The role of private industry and the importance of commercial exports in technology
development**

(10 respondents)

Rank 1 : 1 response (10%)

Rank 2 : 0 responses (0%)

Rank 3 : 0 responses (0%)

Rank 4 : 1 response (10%)

Rank 5 : 1 response (10%)

Rank 6 : 1 response (10%)

Rank 7 : 0 responses (0%)

Rank 8 : 0 responses (0%)

Rank 9 : 2 responses (20%)

Rank 10 : 1 response (10%)

Rank 11 : 1 response (10%)

Rank 12 : 2 responses (20%)

Responses: Improving Missile Verification and Compliance

5.2 Research should be undertaken to explore, and advocacy considered to promote verification and compliance concepts and capabilities applicable to missile nonproliferation, arms control and disarmament.

Strongly agree: 5 responses (29%)

Agree: 10 responses (59%)

Disagree: 1 response (6%)

Strongly disagree: 0 responses (0%)

Don't know: 1 response (6%)

Respondents: 17 Mean response: 1.94 Variance: 0.93

5.3 Research should be undertaken to explore, and advocacy considered to promote verification and compliance concepts and capabilities applicable to a possible comprehensive and binding multilateral ballistic missile control treaty regime.

Strongly agree: 5 responses (29%)

Agree: 10 responses (59%)

Disagree: 1 response (6%)

Strongly disagree: 0 responses (0%)

Don't know: 1 response (6%)

Respondents: 17 Mean response: 1.94 Variance: 0.93

5.4 Research should be undertaken to explore, and advocacy considered to promote verification and compliance concepts applicable to the existing missile control regime (eg MTCR and HCOC) and covering a wide range of unmanned delivery systems (eg ballistic and cruise missiles, UAVs) and functions (eg end-use monitoring on transfers, confirmation of testing-related and other CBMs).

Strongly agree: 7 responses (44%)

Agree: 8 responses (50%)

Disagree: 0 responses (0%)

Strongly disagree: 0 responses (0%)

Don't know: 1 response (6%)

Respondents: 16 Mean response: 1.75 Variance: 1.00

5.5 MTCR member states should be encouraged to play a more active role in the development of a multilateral regime on missile non-proliferation, arms control and disarmament, with verification and compliance provisions.

Strongly agree: 2 responses (12%)
Agree: 12 responses (71%)
Disagree: 1 response (6%)
Strongly disagree: 0 responses (0%)
Don't know: 2 responses (12%)

Respondents: 17 Mean response: 2.29 Variance: 1.22

5.6 The HCOC should be encouraged to play a more active role in the development of a multilateral regime on missile non-proliferation, arms control and disarmament, with verification and compliance provisions.

Strongly agree: 2 responses (13%)
Agree: 8 responses (50%)
Disagree: 1 response (6%)
Strongly disagree: 0 responses (0%)
Don't know: 5 responses (31%)

Respondents: 16 Mean response: 2.88 Variance: 2.38

5.7 The UN and/or Conference on Disarmament should be encouraged to play a more active role in the development of a multilateral regime on missile non-proliferation, arms control and disarmament, with verification and compliance provisions.

Strongly agree: 5 responses (29%)
Agree: 6 responses (35%)
Disagree: 2 responses (12%)
Strongly disagree: 0 responses (0%)
Don't know: 4 responses (24%)

Respondents: 17 Mean response: 2.53 Variance: 2.39

5.8 An effective response to non-compliance with the existing missile control regimes would be to impose UN sanctions.

Strongly agree: 2 responses (13%)
Agree: 3 responses (19%)
Disagree: 3 responses (19%)
Strongly disagree: 2 responses (13%)

Don't know: 6 responses (38%)

Respondents: 16 **Mean response: 3.44** **Variance: 2.26**

5.9 The capabilities of UNMOVIC in regard to missile verification should be preserved and enhanced in some form or other.

Strongly agree: 6 responses (35%)

Agree: 8 responses (47%)

Disagree: 0 responses (0%)

Strongly disagree: 0 responses (0%)

Don't know: 3 responses (18%)

Respondents: 17 **Mean response: 2.18** **Variance: 2.03**

5.10 Non-governmental organizations can play a significant role with respect to developing a broader missile-related regime, including verification and compliance aspects.

Strongly agree: 6 responses (38%)

Agree: 10 responses (63%)

Disagree: 0 responses (0%)

Strongly disagree: 0 responses (0%)

Don't know: 0 responses (0%)

Respondents: 16 **Mean response: 1.62** **Variation: 0.25**

5.11 Before any concrete steps can be taken to negotiate a broader legally-binding missile-related treaty regime, it will be necessary to develop a consensus (not yet present) among major missile-using states that such a regime is desirable and necessary in terms of national and international security.

Strongly agree: 8 responses (47%)

Agree: 6 responses (35%)

Disagree: 2 responses (12%)

Strongly disagree: 0 responses (0%)

Don't know: 1 response (6%)

Respondents: 17 **Mean response: 1.82** **Variance: 1.15**

5.12 *Are there other potential responses to the challenges facing the missile regime that merit detailed analysis?*

Note: Answers for this question were in comment-form and were incorporated into conference call and workshop discussions, and ultimately into “Part II: Weapons of Mass Destruction Verification and Compliance: Challenges and Responses.”

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