Verification Yearbook 2002

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The Verification Research, Training and Information Centre is an independent, non-profit making, non-governmental organisation. Its mission is to promote effective and efficient verification as a means of ensuring confidence in the implementation of international agreements and intra-national agreements with international involvement. VERTIC aims to achieve its mission through research, training, dissemination of information, and interaction with relevant political, diplomatic, technical, scientific and non-governmental communities.

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Acronyms

AAU	Assigned Amount Units
ABM	Anti-Ballistic Missile
AFB	Air Force Base
AHG	Ad Hoc Group
AOSIS	Alliance of Small Island States
ANC	African National Congress
AND	Aggregate National Data
ARD	Afforestation, Reforestation and Deforestation
BICC	Bonn International Center for Conversion
BRSS	Biological Research Security System
BW	Biological Weapons
BWC	Biological Weapons Convention
BWPP	BioWeapons Prevention Project
CAPEL	Centro de Asistencia y Promoción Electoral
CBM	Confidence-Building Measure
CDM	Clean Development Mechanism
CEOS	Committee on Earth Observation Satellites
CER	Certified Emission Reduction
CFE	Conventional Armed Forces in Europe
CITES	Convention on International Trade in Endangered Species
COG	Commonwealth Observer Group
COP	Conference of the Parties (UNFCCC)
CPR	Commitment Period Reserve
CSCE	Conference on Security and Co-operation in Europe
CTBT	Comprehensive Nuclear Test Ban Treaty
CSP	Conference of States Parties (CWC)
CTBTO	Comprehensive Nuclear Test Ban Treaty Organisation
CW	Chemical Weapons

CWC	Chemical Weapons Convention
CWDFS	Chemical Weapon Destruction Facilities
DG	Director-General
DNA	Deoxyribonucleic acid
DOC	Discrete Organic Chemical
DPRK	Democratic People's Republic of Korea
EC	Executive Council (OPCW)
ECOSOC	(UN) Economic and Social Council
EDR	Extremely Dangerous Research
ERS	European Remote Sensing Satellite
ERT	Expert Review Team
ERU	Emission Reduction Unit
ESA	European Space Agency
ET	Emissions Trading
EU	European Union
FY	Fiscal Year
GCI	Global Communications Infrastructure
GHG	Greenhouse Gas
IA	International Alert
IAEA	International Atomic Energy Agency
ICBM	Inter-Continental Ballistic Missile
IDC	International Data Centre
IDEA	International Institute for Democracy and Electoral Assistance
IFES	International Foundation for Election Systems
IMS	International Monitoring System
INF	Intermediate-range Nuclear Forces
IPCC	International Panel on Climate Change
IR	Infrared
ISTC	International Science and Technology Center
ITL	International Transaction Log
JI	Joint Implementation
LTBT	Limited Test Ban Treaty

LULUCF	Land Use, Land-Use Change and Forest
MEA	Multilateral Environmental Agreement
MIRV	Multiple Independently Targetable Re-entry Vehicle
MOP	Meeting of the Parties (to the Kyoto Protocol)
NAM	Non-Aligned Movement
NATO	North Atlantic Treaty Organization
NGO	Non-Governmental Organisation
NIS	National Institutes of Health (NIS)
NPT	Nuclear Non-Proliferation Treaty
NTM	National Technical Means
OAS	Organization of American States
OAU	Organization of African Unity
OCPF	Other Chemical Production Facility
ODIHR	Office for Democratic Institutions and Human Rights (OSCE)
OECD	Organization for Economic Cooperation and Development
OM	Operational Manual
OPCW	Organisation for the Prohibition of Chemical Weapons
OSCC	Open Skies Consultative Commission
OSCE	Organization for Security and Co-operation in Europe
OSI	On-Site Inspection
PDR	Potentially Dangerous Research
PrepCom	Preparatory Commission
PrepCom	Preparatory Committee (for the NPT review conferences)
PTBT	Partial Test Ban Treaty
PTS	Provisional Technical Secretariat
R&D	Research and Development
rDNA	Recombinant DNA
Revcon	Review Conference (CWC)

RMU	Removal Unit
RV	Re-entry Vehicle
SADC	Southern African Development Community
SAR	Synthetic Aperture Radar
SIPRI	Stockholm International Peace Research Institute
SLBM	Submarine-Launched Ballistic Missile
SORT	Strategic Offensive Reductions Treaty
START	Strategic Arms Reduction Treaty
TNW	Tactical Nuclear Weapons
TS	Technical Secretariat (of the OPCW)
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNMOVIC	United Nations Monitoring, Verification and Inspection Commission
UNSCOM	United Nations Special Commission on Iraq
US	United States
USDA	United States Department of Agriculture
WGB	Working Group B (CTBT)
WSSD	World Summit on Sustainable Development

Preface

Joke Waller-Hunter

Since the 1972 Stockholm Conference on the Human Environment, which produced the UN Environment Programme, the number of multilateral environmental agreements (MEAs) has risen sharply. Most of the newer agreements contain some kind of verification mechanism (even though the term is rarely used in MEAs) to monitor and assess parties' compliance. For these, negotiators incorporated provisions for the reporting, assessment and review of treaty implementation right from the start of their negotiation, as in the case of the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer. However, such mechanisms have even evolved for older agreements which originally lacked verification provisions. The trend towards stronger monitoring provisions for assessing compliance with MEAs continues, indicating that effective verification is increasingly considered a prerequisite for their successful implementation. The Kyoto Protocol, which includes extensive and rigorous provisions for reporting and review, is an excellent example of this new generation of MEAs.

In response to growing scientific evidence, parties to the 1992 United Nations Framework Convention on Climate Change (UNFCCC) now acknowledge the need for quicker and tougher measures to reduce the burning of fossil fuels—the biggest contributory cause of global warming. The adoption of the Kyoto Protocol to the convention in 1997 was an important first step towards tackling the problem by establishing—for the first time—legally binding emissions reduction targets for greenhouse gases. Agreement on the Marrakech Accords in October 2001 paves the way for the Kyoto Protocol to enter into force in 2003 once the necessary ratifications have been deposited.

The verification system, which is based on self-reporting and expert review, will be fundamental to the successful implementation of the Kyoto Protocol. The main objective of the system will be to judge each country's compliance with its emissions reduction targets. The verification provisions will also encourage the open and transparent exchange of information, which is important for several reasons.

First, transparency is key to reassuring parties that the burdens of implementation are being shared fairly. This is vital, because many parties anticipate that the costs of implementing emission reductions will affect commercial competitiveness and trade. To create a level playing field, each ton of carbon claimed by parties against their targets must be verified as authentic and equivalent according to established standards.

Second, many of the provisions of the protocol are innovative and untested. The open exchange of information will help countries learn from each other's successes and mistakes as national policies are developed.

Third, and most important, transparency is key to protecting the integrity of the protocol. The reporting and review mechanisms agreed at Marrakech will provide a framework for parties to show that they are taking their obligations to protect the environment seriously. Any suggestion that the system is being cheated could jeopardise the treaty by undermining public confidence in it.

The Kyoto Protocol's verification regime is unique among MEAs. Its complex and stringent provisions are designed to provide strong incentives to parties as they implement their obligations. This has been achieved by integrating verification into all operational elements of the protocol. Under the protocol, parties can choose to meet their emission reduction targets using a combination of domestic measures, land-based sinks, emissions trading and the project mechanisms. The resulting complex web of measures is more difficult to monitor and verify than a system based on only one measure. However, this has also made it possible to be innovative, using penalties and economic incentives to strengthen the role of verification. One example of this 'stick and carrot' approach is that parties are rewarded for submitting high-quality inventories on time by becoming eligible to participate in the emissions trading mechanism. Failure to meet reporting obligations, on the other hand, results in withdrawal of such entitlements.

Reporting requirements under the Kyoto Protocol are more stringent than under other MEAs because reporting is strongly linked to the assessment of compliance. This was felt necessary given the legally binding nature of the emissions reduction targets. Building on requirements under the UNFCCC, developed countries will submit an annual inventory listing emissions of greenhouse gases from their energy, transport, waste, industrial and agricultural sectors, and the absorption of greenhouse

gases by land-based sinks. Guidelines have been developed which provide default methodologies for calculating inventory estimates and which set standards to ensure that parties implement quality control and uncertainty assessment systems. This standardisation is designed to maximise comparability and facilitate independent compliance assessment by expert review teams.

During the first commitment period (2008–2012), the national inventories themselves will not show whether individual parties will meet their emissions reduction target at the end of 2012. This can only be judged by projecting the effect on existing emission trends of policies that are still being implemented. Parties will therefore also be obliged to report on a range of qualitative measures, including actions taken domestically to reduce greenhouse gas emissions. While non-compliance with these aspects of implementation may be harder to judge, this does not make such information less valuable. On the contrary, a true overall assessment of compliance can only be made by combining the quantitative and qualitative information submitted by parties.

The climate regime is now moving into uncharted territory. The innovations of the Kyoto Protocol are designed to reduce emissions cost-effectively and efficiently, but there will be much 'learning by doing' as each element of the agreement becomes operational. To facilitate this process, parties should seize opportunities to exchange information and share experience. One such opportunity is the 'demonstrable progress' report that parties are urged to submit by 1 January 2006. The report is designed as an early-warning mechanism, putting under the spotlight those parties which are not taking tough enough measures to meet their commitments by 2012. The sooner parties begin implementing their national policies and systems in the pre-commitment period, the longer they will have to resolve problems prior to their becoming formal questions of implementation under the remit of the compliance mechanisms.

One likely difficulty for the implementation of the verification regime is the scarcity of suitably qualified and experienced personnel to undertake the expert review of parties' national reports. There will be a need for continuing capacity-building, particularly in developing countries and countries undergoing economic transition. Assistance is also required to facilitate the development of national systems and promote scientific research in order to further develop inventory methodologies,

taking national circumstances into account. The overall aim should be to harmonise methodologies and, where possible, simplify the inventory process. This would be helped by the development of global databases of emission factors and activity data. The wider use of earth observation data should also be explored as a way of reducing countries' reporting burdens.

A problem in all MEAs is the need to keep pace with scientific advances. Fortunately there are provisions in the Kyoto Protocol permitting the updating of the reporting and review guidelines to incorporate new research, methodologies and experience. As climate science matures and new issues emerge, linkages with other international agreements will also become apparent. Parties to the Kyoto Protocol and the Montreal Protocol already share an interest in reducing ozone-depleting gases, and finding and using alternatives that do not contribute to global warming. Linkages have also already become apparent between the Kyoto Protocol and the 1992 Convention on Biological Diversity, the 1994 Convention to Combat Desertification and the United Nations Forum on Forests as a result of the inclusion of sinks activities in the climate change regime. Identifying these linkages, filling the gaps between agreements and exploiting synergies in order to maximise resources will become increasingly important, as countries strive to implement the broad objectives of the World Summit on Sustainable Development, which took place in Johannesburg, South Africa, in September 2002.

Non-governmental organisations (NGOs)—such as VERTIC—are playing an important role in the evolving climate regime. They exert political pressure and contribute expertise, helping to establish the strong rules and systems that form the basis for effective implementation. While parties negotiate primarily with their own national interests in mind, NGOs can act on the side of the environment, championing the integrity of the Kyoto Protocol's objectives. Furthermore, as parties begin implementing their commitments under the protocol, NGOs can engage with and educate the public about the complex issues arising from climate change and attempts to deal with it. Governments, NGOs and other stakeholders must work together to raise the profile of environmental protection and encourage tough, effective action.

NGOs can also monitor countries' actions under the protocol. Open access to national information via the UNFCCC website will leave countries' policies and actions exposed to public scrutiny. This external monitoring will function parallel

to and independently of official expert review and compliance procedures under the protocol. NGOs will also undoubtedly undertake independent reviews of projects undertaken under the clean development mechanism (CDM). Public participation in the CDM is formalised in the operational rules, allowing interested groups to submit their views about proposed projects, including their objections.

Continuous monitoring by a range of stakeholders will be necessary to ensure that projects are managed with integrity and contribute to real and verifiable emission reductions over their lifetime. It is important that the role of third parties in the implementation of the Kyoto Protocol is not weakened. VERTIC's *Verification Yearbook* plays a unique role in sustaining interest in and attention to verification and monitoring, not only in respect of environmental agreements but with regard to other co-operative multilateral endeavours on which the future of our planet depends.

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I

Introduction: verification in the news for all the wrong and right reasons

Trevor Findlay

If some good has come from the crisis over Iraq, which has dominated headlines in 2002, it is renewed worldwide interest in verification. There will be few who have not heard of the United Nations (UN) Security Council's efforts to obtain Iraqi agreement to a campaign of new inspections by the United Nations Monitoring, Verification and Inspection Commission (UNMOVIC). Archival footage of white-suited inspectors of its benighted predecessor, the United Nations Special Commission (UNSCOM) on Iraq, has been constantly shown on television around the world. Few will have failed to notice the protracted negotiations in the Security Council on a tougher resolution mandating a significantly more intrusive verification regime for Iraq. There will perhaps be fewer still who missed attempts by senior US officials, notably Secretary of Defense Donald Rumsfeld, to belittle the capabilities of UNMOVIC even before it had set foot in the country, or the quiet reassurances of UNMOVIC Executive Secretary Hans Blix and Mohamed ElBaradei, Director-General of the International Atomic Energy Agency (IAEA), that they can successfully verify Iraqi non-compliance with its obligation not to acquire weapons of mass destruction. All of this has raised the general public's awareness of monitoring and verification to unprecedented levels.

Other issues have also thrust verification into unusual prominence. The April 2002 leadership crisis at the Organisation for the Prohibition of Chemical Weapons (OPCW), which in effect saw the US blackmail its fellow members into sacking Brazilian Director-General José Bustani by withholding its financial support, appeared on the surface to be more about personality than policy. However, there was not only sufficient evidence of mismanagement and poor financial planning to warrant an urgent leadership change (albeit not quite in the manner that the US

achieved it), but also signs of a serious imbalance in the verification effort that needed attention. Essentially, as VERTIC's October 2002 report *Getting Verification Right* documented, verification of the destruction of existing, declared chemical weapons (CW) had gradually taken undue precedence over efforts to verify that new CW stockpiles were not being amassed.

Unlike the UNMOVIC controversy, which as of late November 2002 had yet to be played out, that involving the OPCW has met with a positive outcome, at least to date. A new Director-General, Rogelio Pfirter of Argentina, has been appointed and the US has paid its dues in full. The October 2002 meeting of states parties made some progress on verification issues; but the best opportunity for a thorough assessment of the whole CW verification regime is still to come—the first Review Conference for the Chemical Weapons Convention (CWC) will be held in 2003.

Another verification issue that attracted press attention and simmered throughout 2002 was the wrangle over a future verification mechanism for the currently verification-less 1972 Biological Weapons Convention (BWC), as described by Jenni Rissanen in her contribution to this *Yearbook*. Again, it was the US that was responsible, having not only sabotaged negotiations on a verification protocol at the eleventh hour in late 2001, but also campaigned during 2002 against any moves to initiate meaningful multilateral BW verification. Even its own list of initiatives, which President George W. Bush had paraded as a substitute for a protocol, quietly disappeared—evidence that they had been mere window-dressing designed to lessen the blow of outright US opposition to BW verification. This took on a surreal quality in light of repeated American insistence that BW represent one of the greatest threats to humankind; that they may well be terrorists' future weapons of choice; and that Washington was convinced that at least Iran, Libya, North Korea and Syria already had BW and that it intended to 'name and shame' more suspected possessors.

Ultimately, at the resumed BWC Review Conference in November 2002, total disaster was averted and agreement at least reached on a series of annual meetings of states parties on various verification and compliance issues. Topics will comprise: national implementation legislation; national oversight mechanisms for controlling pathogens and toxins; enhanced international capacities for responding to alleged BW use or suspicious disease outbreaks; strengthening of methods to detect and deal with infectious disease outbreaks; and a code of conduct for scientists.

North Korea threw another verification issue open to public gaze in October 2002 when it admitted to US officials that it was attempting to acquire a uranium enrichment capability in order to have alternative fissionable material for nuclear weapons. Its previous efforts to secure plutonium-based weapons had ended (it is presumed) in 1994 with the signing of the Agreed Framework. This committed it to a verifiable freeze of its nuclear programme in return for fuel oil supplies and relatively less proliferation-prone light-water nuclear power reactors. The revelation that North Korea had illicitly pursued an alternative path initially led uninformed observers to berate the IAEA for being 'asleep at the wheel'. However, the agency quite rightly pointed out that, since 1994, it had not had been permitted to conduct 'special' inspections in North Korea to verify undeclared illegal activities—a capability that it has now acquired in respect of countries that have signed an Additional Protocol to their traditional nuclear safeguards agreements.

Since the proximity and vulnerability of South Korea prevents the US from coercing North Korea in the same way it has coerced Iraq—by threatening the use of force—peaceful means, including verification, will have to be the solution. As in the Iraqi case, verification in North Korea will need to be intrusive and cover all types of weapons of mass destruction, as well as missile capabilities (as discussed by Leon Sigal in this volume), if the US is to feel comfortable enough to afford Pyongyang the recognition and an end to US enmity that, apparently, it so eagerly seeks.

As usual, verification and monitoring developments in the environmental field were decidedly less prominent than those in the arms control and disarmament realm. This was despite the fact that a significant breakthrough occurred in late 2001 in regard to verifying compliance with the 1997 Kyoto Protocol on climate change. As Molly Anderson describes in her chapter, at a conference of the signatories in Marrakech, Morocco, in October–November 2001, agreement was finally reached on the most important details of the compliance system, emphasising reporting and review of implementation.

At the World Summit on Sustainable Development in Johannesburg, South Africa, in August–September 2002, the whole raft of international agreements and arrangements that had been agreed at the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil, in June 1992 was reviewed. Unfortunately, this did not yield the optimal outcome that many non-governmental

organisations had hoped for—new and binding quantitative and qualitative obligations in all areas that would be subject to monitoring and verification. Although some new commitments were made, notably with regard to water resources, fish stocks and protection of the marine environment, even these are unlikely to be subject to rigorous monitoring soon. The Commission on Sustainable Development itself lacks the mandate and the capacity to do so. One bright spot was agreement to set up by 2004 a regular UN process for assessing the state of the marine environment.

Also quietly operationalised in 2002 was the 1992 Open Skies Treaty, which entered into force on 1 January after ratification by Belarus and Russia. As the chapter by Ernst Britting and Hartwig Spitzer indicates, this unexpected event, after so long a hiatus, establishes an aerial monitoring regime that may grow into a significant tool for increasing transparency and building confidence, not just in relation to arms control and disarmament agreements and peace accords, but also for environmental and human rights monitoring.

International election monitoring, covered for the first time in a *Verification Yearbook* chapter, by Gray and Laanela, did hit the news this year, thanks to the controversial Zimbabwe elections.

In one sense increased attention to, and the often rancorous debate over, verification is to be applauded. One of the criticisms of traditional verification posited by the Bush administration is that it tends to have a lulling effect: governments of goodwill become convinced that all others have benign intentions, while inspectors and analysts who never discern evidence of non-compliance become complacent and inattentive. The recent debate over verification, not least thanks to the US, has increased official and public scrutiny of existing and planned verification regimes in a way that is the complete opposite of a lulling effect.

Since no verification system can claim to be perfect, constant attention to implementation is, indeed, essential. Improvements in governance and management are almost always possible. David Kelly, in his chapter, identifies numerous lessons that may be drawn on in future to improve management of future BW inspections.

In addition, it is imperative that the swift advance of technology does not leave verification trailing behind, especially when those who seek to flout it will be looking to employ the most modern technologies and methods for doing so. The way in

which the verification organisation for the Comprehensive Nuclear Test Ban Treaty (CTBT) is incorporating the latest technologies, even those that are not yet completely proven—as with infrasound technology, which is assessed in this volume by Hein Haak and Läslo Evers—is to be applauded. In the environmental realm, Josef Aschbacher examines the increasing value of remote satellite monitoring for verifying compliance with multilateral agreements.

In another sense, though, the more sensationalist and speculative news coverage of verification damages its cause. For verification is inherently vulnerable to accusations that it is failing or is incapable of ever succeeding, especially since 100 percent verifiability is virtually never possible. The US has highlighted such vulnerabilities in attempting to discredit UNMOVIC. It is using the fact that UNSCOM failed to uncover all of Iraq's previous weaponry and weapons-related facilities, most notably in the BW and missile fields, to cast doubt on UNMOVIC's ability to complete its predecessor's work, as well as to expose new Iraqi capabilities. Yet UNMOVIC, like most verification systems, cannot prove a negative: it can never convince complete sceptics that it has uncovered all there is to unearth. Moreover, its work is likely to be painstakingly slow—far too sluggish for military planners keen on launching an attack while favourable political, military and climatic conditions prevail. Slow, methodical detective work that cannot be rushed and long-term monitoring are verification's hallmarks. UNMOVIC will be torn between wanting to do a professional job and being expected to provide early evidence of a 'smoking gun'. In revealing this, it will in addition walk a tightrope between giving the US a casus belli and providing reassurance that, ultimately, it can both detect and destroy by peaceful means the most threatening Iraqi capabilities.

The US has also underlined the inherent paradoxes of verification to hold at bay the more ambitious multilateral proposals for BW verification. It was unable to countenance a strong BW verification system for fear that its bio-defence programmes, which skirt close to the defensive/offensive dividing line, might be considered a violation of the convention and that the commercial secrets of its biotechnology industries might be revealed. Yet, it would not agree to a weaker verification system, on the spurious grounds that it would be of no use at all and that it would allegedly give the international community a false sense of security. (Although the latter is hardly credible given the way that the US, with its unsurpassed national technical

means of verification, is always alert to potential treaty violators, regardless of the existence of multilateral regimes). In her chapter Nancy Gallagher examines some of the more valid criticisms of verification in the new strategic environment and explains efforts to devise a new concept that will supplement and enhance verification, known as 'advanced cooperative security'.

None of the above means that the US is the only verification sceptic abroad today; it is simply the most bombastic and insistent. Indeed, many others hide behind its position. Depending on the particular issue and for various reasons, these states include China, India, Iran, Iraq, Israel, North Korea, Pakistan, Russia, Saudi Arabia and Syria. It remains for the generally pro-verification nations—such as Australia, Canada, European Union members, Japan, Norway, New Zealand and South Africa (although occasionally even their support wavers, according to the issue)—along with non-governmental organisations and civil society generally, to take up the cudgels on behalf of effective and efficient verification. The Americans may join them in this endeavour on occasion, but, for the time being, only when it suits their narrow national purposes and sometimes not even then.

One brave new non-governmental verification initiative—launched in 2002—is the BioWeapons Prevention Project (BWPP), which, in the absence of multilateral verification institutions, will attempt to monitor compliance with the BW ban.

Another modest means of keeping the verification flame alight is VERTIC's *Verification Yearbook*. This edition has been, as in past years, a collaborative effort, involving VERTIC staff and external contributors. VERTIC is indebted to all of them, particularly to the co-editor, Oliver Meier, who has now left VERTIC after contributing substantially to the organisation's success over the past three years, to Eve Johansson, the sub-editor, and to Richard Jones, who handled design and production. VERTIC also acknowledges the financial support of the Joseph Rowntree Charitable Trust, the Ford Foundation and the John D. and Catherine T. MacArthur Foundation, which has made continuing publication of the *Verification Yearbook* possible.

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arms control and disarmament





2

Recent developments in nuclear weapons verification

Nikolai Sokov

The year 2001–2002 again saw little or no progress on nuclear weapons verification; on some issues there was actually a retreat or indications that retreat might happen in the near future. Specifically, the Conference on Disarmament in Geneva failed, once again, to initiate negotiations on a fissile material cut-off treaty (FMCT). The review process for the 1968 Nuclear Non-Proliferation Treaty (NPT) saw attempts to weaken ideas for improving compliance reporting with respect to Article VI of that treaty. Finally, after several attempts to conclude a new treaty that would reduce strategic offensive arms beyond the only treaty currently in force (the 1991 Treaty on the Reduction and Limitation of Strategic Offensive Arms, START I), the United States and Russia concluded, on 24 May 2002, a treaty without any verification provisions whatsoever—the Strategic Offensive Reductions Treaty (SORT), also known as the Moscow Treaty. In the meantime, American withdrawal from the 1972 Anti-Ballistic Missile (ABM) Treaty triggered Russia's announcement on 14 June 2002 that the 1992 START II Treaty (the second Strategic Arms Reduction Treaty, which had been ratified by both sides but had never entered into force) was null and void.

This chapter will concentrate only on the issues where there have been some developments in the past year. In considering these it is vital to keep in mind that verification is not only a means to confirm that the parties to an international regime abide by their obligations. It is also—and probably primarily—a means to ensure the transparency of intentions and capabilities, which, in turn, enhances the predictability of the international system. The reduction of nuclear arsenals does not itself increase confidence and trust among the nuclear weapon states or demonstrate to the non-nuclear weapon states that Article VI of the NPT, which

calls for efforts in good faith to achieve nuclear disarmament, is being taken seriously. Reductions often have the purpose of cost-effective optimisation of nuclear arsenals rather than nuclear disarmament, and might in some cases actually reduce the nuclear threshold.

Implementation of START I

START I was signed on 31 July 1991 and entered into force on 5 December 1994.[1] Verification began in January 1995. In 2001–2002 implementation continued without major problems, having become largely routine. On 5 December 2001 the US and Russia reported that they had completed reductions mandated by the treaty.

START I provides for the most comprehensive verification mechanism among the bilateral treaties on nuclear weapons. It includes 12 types of on-site inspections (five of them short-notice inspections with procedures that provide for an element of surprise), perimeter and portal continuous monitoring (PPCM) at production facilities for mobile inter-continental ballistic missiles (ICBMs), a comprehensive reporting system that covers hundreds of categories of data, extensive exchange of telemetry data, and a system of notifications that covers all changes in strategic nuclear arsenals on an almost daily basis.[2] The verification regime will remain in force until the treaty expires on 1 December 2009, unless it is extended.

Since entry into force of the treaty and up until mid-2002, the US had conducted 335 inspections, while Russia, Belarus, Kazakhstan and Ukraine[3] had conducted only 243 (the bulk of them conducted by Russia).[4] In 2001 35 inspections were carried out by the US and 28 by the four former Soviet states, but in the first half of 2002 the numbers of inspections were almost equal—25 and 24, respectively.

The difference in the numbers is partly explained by the difference in the numbers of inspectable facilities: there were 27 in the US at the end of 2001, as opposed to 41 in Russia and 13 in Belarus, Kazakhstan and Ukraine.[5] Another, probably more important, reason is cost. Russia and to an even greater extent the other newly independent states are not prepared or able, given their other pressing priorities, to spend too much on inspection activity. In fact, the majority of Russian inspections have reportedly been sequential, that is, conducted by the same group moving from one facility to another.[6] This option allows Russia at least to save money on air transport, but it also reduces the element of surprise.

Russia deemed the cost of inspections to be so high that it informally raised with the US the possibility of reducing the number of short-notice inspections.[7] It argued that each facility had been inspected so many times that short-notice inspections were no longer useful. Other elements of the verification regime, including notifications, data exchange and telemetry data exchange, in Russia's view, could have remained intact, but the number of short-notice inspections would be reduced or some replaced by 'visits' to clarify concerns. Russian soundings followed a similar (and also unsuccessful) attempt in 1997 to terminate inspections under the 1987 INF Treaty (the Treaty on the Elimination of Intermediate-Range and Shorter-Range Missiles) more than three years earlier than provided for by the treaty (on 31 May 2001).[8] The US declined the Russian proposal, citing the need for a complicated and lengthy process of ratification of amendments and probably also fearing setting a precedent for other changes.

START I implementation has not been free of disagreements, discussed confidentially in the Joint Compliance and Implementation Commission (JCIC). In most cases these have been successfully resolved, although some issues have remained unresolved for years. Russian concerns are somewhat better known than those of the US, since Russia is more outspoken, but the US has its share as well. Reportedly, the Russian side has repeatedly raised the following four issues.[9]

The inability to confirm the number of warheads on American SLBMs. During re-entry vehicle (RV) inspections (designed to confirm that the number of warheads deployed on a particular ballistic missile does not exceed the number attributed to it under the treaty) the inspected party is allowed to cover warheads to keep secret these elements that are not relevant for verification purposes. In most cases both sides use soft covers separately for each warhead; the US Navy, however, uses a single hard cover for the entire front section. The Russian side claims that this prevents inspectors from ascertaining that the missile front section does not contain undeclared warheads. Two possible problems have reportedly been mentioned: undeclared warheads could be concealed inside the cover; and a second platform with warheads could be hidden beneath the one inspectors see. Reportedly, Russian inspection teams have not certified a single RV inspection of Trident II submarine-launched ballistic missiles (SLBMs). The US claims that the treaty does not prohibit single hard covers and that hiding warheads would be impossible.

The number of warheads on Trident II SLBMs displayed during test launches. Some test launches of these SLBMs include front-section manoeuvres whose telemetry 'signature' is indistinguishable from that involved in a release of RVs. Since the number of warheads demonstrated during a flight test is the sum of the number of warheads actually released plus the number of release procedures, telemetry data could be interpreted as indicating that Trident II SLBMs are being tested for up to 12 warheads, four above the legal limit. According to the US, these additional manoeuvres are not associated with release of warheads and Russia might run into the same problem if it deploys a manoeuvring warhead on its Topol-M ICBM, as many expect.

Flight tests of British Trident II SLBMs from American test ranges. According to the Russians, these tests are indistinguishable from tests of American SLBMs, but Russia does not receive telemetry information from them. Reportedly, some elements of these tests would have violated START I had they been conducted by the US and the possibility of sharing data allows the US to effectively circumvent the treaty. The American side responds that the co-operative programme with the United Kingdom is sanctioned by START I and that the Russian side was supplied with the dates of test flights conducted for the UK so that they could be distinguished from those conducted by the US.[10]

Elimination of MX ICBMs. The US is eliminating only the first stages of its MX ICBMs, but the Russian side claims that, since that missile is legally considered a mobile one (even though none have been actually deployed in that mode), all three stages should be eliminated, as well as the front section. Furthermore, it says that, since the first stage of the Castor-120 space launch vehicle (SLV) is similar to the first stage of the MX ICBM (SLVs are not limited by START I), the US is de facto acquiring the capability to assemble new, MX-like missiles using the first stages of the Castor-120 SLV and the second and third stages of the MX. Alternatively, the second and third stages could conceivably be used as an intermediate-range ballistic missile (IRBM).

The US contends that, since its ICBMs are accounted for by first stages only, elimination of the first stage should be sufficient for the whole missile to be considered eliminated and, further, SLV stages cannot be used with the second and third stages of the MX without additional modernisation and testing.

These are serious problems which could under different circumstances justify the abrogation of the treaty. The US has not publicly raised equally serious problems. There have been other significant concerns on both sides that have apparently been resolved, since they are no longer publicly mentioned, as well as dozens of smaller ones. Notwithstanding multiple complaints, both sides clearly judge START I a success and have given no indication of being ready to withdraw.

Furthermore, it appears that the Russian decision to go public with these complaints about implementation is usually triggered by events not related to START I, including the expectation that the US would withdraw from the ABM Treaty. For example, in January 1999 Leonid Ivashov, then the chief of the International Cooperation Main Department of the Russian Ministry of Defence, gave an interview in which he detailed Russian complaints following an unsuccessful attempt by the Russian Duma to ratify START II (the vote was cancelled in protest against US and British bombing of Iraq). An official statement by the Russian Foreign Ministry in January 2001 questioning American implementation of START I appeared immediately after allegations in the US media about the suspected deployment of land-based tactical nuclear weapons (TNW) in Kaliningrad Oblast.[11] On 5 December 2001 a statement by the Foreign Ministry in connection with the completion of reductions mandated by START I noted that Russia had 'questions with regard to the implementation of certain provisions of that Treaty',[12] but this intimation was probably intended to set the stage for withdrawal from START I if deemed necessary as a response to impending American withdrawal from the ABM Treaty. When that withdrawal took place, the Russian government reacted very mildly, and statements concerning START I implementation did not reappear.

US support for verification weakens

With hindsight it is clear that the inauguration of the US administration of President George W. Bush in January 2001 heralded the end of an era in nuclear arms control. In place of the traditional approach, which emphasised legally binding, verifiable agreements, the new administration has promoted as much freedom from legal and other constraints as possible. Surprisingly to many, Russia did not offer much resistance but embraced flexibility as an opportunity to reduce the costs of optimising its nuclear arsenal.[13]

Symbolic of the new US approach was its formal abrogation of the ABM Treaty on 13 June 2002 (the announcement of its intention to do so had been made on 13 December 2001). The next day Russia announced that it no longer considered itself bound by START II, thus ending the long story of attempts to bring that treaty into force.[14]

The demise of START II meant, among other things, that several types of verification measures created specifically for that treaty would not go into effect. These include, in particular, inspections to confirm the conversion of silos for MIRVed ICBMs (those equipped with multiple independently targetable re-entry vehicles) to house single-warhead ICBMs, as well as additional RV inspections, which could have been instrumental for verifying the 2002 Moscow Treaty (see below).

The new American administration also failed to resume consultations on a START III treaty, which had been conducted on and off since late 1997. These consultations nevertheless left an important legacy of proposals tabled by both sides—the American draft text of January and February 2000, and the Russian draft of June 2000.

START III was expected to change some provisions of START I to give both sides greater flexibility and opportunities for cost savings. For example, the US planned to convert four Ohio Class nuclear-powered, ballistic-missile submarines (SSBNs) from SLBM carriers into carriers of conventionally armed sea-launched cruise missiles (SLCMs) without following START I procedures, which made such conversion very expensive. Russia reportedly considered MIRVing its new ICBM, the Topol-M, although no proposals to that effect were included in the Russian START III draft. As noted above, Russia also proposed cutting the number of short-notice inspections, which were considered excessively expensive and not as essential in the post-Cold War world.

The American draft contained additional verification measures with regard to mobile ICBMs, which only Russia has, and a Memorandum of Understanding that contained the most exhaustive list so far of categories of data officially proposed for exchange. These included the location of warhead storage facilities and the number of warheads at each location; the location and number of all containers with fissile materials removed from nuclear warheads; the number of newly assembled and disassembled warheads at each facility; the location of components of nuclear

warheads (trigger mechanism); and information about fissile materials disposed of in accordance with international agreements. The proposal did not, however, include a mechanism to verify the data.

The two sides failed to reach agreement in the short time left until the 2000 US presidential elections. Nevertheless, the draft texts registered certain similarities, in particular with regard to the simplification of the START I rules and procedures to give both sides greater flexibility in planning their nuclear postures and reducing the costs of reduction. The American draft of the Memorandum of Understanding was the first formalised attempt to address verification of nuclear warheads and could still be used when the US and Russia are once again prepared to tackle that issue.

Under the new American administration, on 24 May 2002, the two countries concluded SORT. Whereas START III drafts had provided for limited simplification of the START I rules, SORT went to the other extreme, being one of the shortest arms control treaties in history. Its only substantive provision obliges the parties to 'reduce and limit strategic nuclear warheads . . . so that by December 31, 2012 the aggregate number of such warheads does not exceed 1700–2200 for each Party'.[15] That number refers to so-called 'operationally deployed' warheads. Reductions will be primarily implemented by 'downloading'—reducing the number of warheads on delivery vehicles. The treaty does not limit or account for the warheads that are put in reserve or prevent them being uploaded again. The number of warheads in 'ready reserve' has not been announced, but is expected to be in the thousands (the officially announced figure for the US is 2400;[16] Russian sources have not disclosed any figures, but the number is widely expected to be negligible).

A particular feature of the new treaty is the complete absence of data exchange and verification mechanisms.[17] As things stand now, transparency will depend on the voluntary provision of information by the two sides. Much of this information will not be verifiable. The START I verification regime, which will remain in force at least until the end of 2009, will not be able to fill the SORT verification gap. START I RV inspections can confirm downloading, but only 10 of those can be conducted annually and, as mentioned above, downloading of Trident II SLBMs cannot be verified because of the hard covers. Nor does the treaty provide for any means of verifying the number of stored warheads or any uploading activities.

Following the signing of SORT, both sides tentatively declared their intention to address the issues of verification and transparency in various fora, including the Bilateral Implementation Commission which SORT establishes. High-level Russian officials noted that they saw SORT as only 'the first step' in a series of agreements and announced their intention to discuss measures that would guarantee against clandestine uploading of warheads, presumably meaning verification measures. American officials emphasised transparency, that is, primarily an exchange of information.[18] Still, there seems to be enough common ground to allow some hope for progress in that area in the years ahead.

Tactical nuclear weapons

TNW are subject to an informal regime created by parallel unilateral declarations made by presidents George Bush and Mikhail Gorbachev in September and October 1991. Gorbachev's was subsequently confirmed and expanded on by President Boris Yeltsin in January 1992 (these statements are known as the Presidential Nuclear Initiatives).

The regime provides for the removal to central storage facilities or the elimination of all TNW except for a limited number of short-range air-based weapons which remain deployed—that is, usable on short notice. The subsequent reductions, including moving them to central storage and elimination, numbered in the thousands and probably represented the largest single reduction of nuclear warheads ever. It was clear that the warheads were removed from deployment quickly, but the status of their elimination remains uncertain as a result of the lack of data exchange and verification. The status of Russia's TNW is, in particular, often questioned.

In September 1996 Russia announced that the elimination of warheads pursuant to its undertakings would be completed by 2000.[19] However, its National Report on the Implementation of the NPT at the 2000 NPT Review Conference mentioned the reduction of artillery shells and nuclear mines as only 'nearing completion'.[20] Two years later, the Russian report to the 2002 NPT Preparatory Committee (PrepCom) meeting stated that Russia planned to 'complete implementation of the initiatives . . . by 2004' but only 'on condition of adequate financing'. The list of uncompleted eliminations included land-based short-range missile warheads.[21]

Even as Russian progress was widely doubted, it was generally assumed that the US had completed the implementation of its 1991 statement relatively quickly, especially since it did not have similar funding problems. In 1998, however, a US representative to the Conference on Disarmament, Ambassador Norman A. Wulf, said that, while dismantlement in some categories had been completed, artillery shells, warheads for short-range missiles and nuclear depth bombs would be eliminated by 1999.[22] Neither his statement at the 2002 NPT PrepCom nor the US Information Paper on Article VI included specific details, although they gave an impression that elimination had been completed.[23] According to a recent report, however, artillery shells are still awaiting dismantlement because dismantlement capacity is insufficient, although completion of that work was originally scheduled for August 2000.[24] If this is correct, then the US is in roughly the same position with regard to implementation of its unilateral statement as Russia. It appears that the completion of work has now been scheduled for the end of 2003.

International pressure for the formalisation of the 1991 statements and further reduction of TNW suffered a temporary setback at the First Committee of the UN General Assembly in late 2001. At that time Mexico was unable to gain support from several key states, including its partners in the New Agenda Coalition (NAC),[25] for a significant draft resolution on 'Reduction of Non-Strategic Nuclear Weapons' and Mexico limited itself to a statement,[26] with individual support from a number of countries. The 2002 PrepCom meeting registered the renewal of the non-nuclear weapon states' interest in further reductions of TNW. A large number of delegations called for progress beyond unilateral initiatives, including Spain on behalf of the European Union. The NAC and Finland (on behalf of itself and Sweden) also made strong statements, and Germany introduced an important working paper.[27]

NPT reporting requirements

The 2002 PrepCom meeting witnessed conflict over the reporting requirements provided for in the Programme of Action (Next Steps) on Nuclear Disarmament, which was adopted at the 2000 NPT Review Conference. Paragraph 12 of that document provided for 'regular reports, within the framework of the NPT strengthened review process, by all States parties on the implementation of Article VI and paragraph 4 (c) of the 1995 Decision on "Principles and Objectives for Nuclear

Non-Proliferation and Disarmament", and recalling the Advisory Opinion of the International Court of Justice of 8 July 1996'.[28] The US and France threatened to block the programme of work if it explicitly included discussion of reports. Other nuclear weapon states remained on the sidelines but supported the substance of the American and French objections, namely, that reports should not be linked to the issue of implementation of Article VI of the NPT and that they should not be 'excessively formal'. Effectively, the issue was left unresolved, and the conflict might resume at future meetings.

The Trilateral Initiative

Another area that has not seen progress is the Trilateral Initiative—the agreement between the International Atomic Energy Agency (IAEA), the US and Russia to develop methods of putting fissile materials excess to defence requirements under IAEA control. The initiative was launched in 1996 following unilateral statements by the two countries about their intention to dispose of considerable amounts of surplus plutonium extracted from weapons; in 2000 the US and Russia concluded an agreement pledging to dispose of 34 tonnes of plutonium each. At the 2000 NPT Review Conference the Trilateral Initiative was included in the Programme of Action (Next Steps) on Nuclear Disarmament.

The special feature of the Trilateral Initiative and the reason for the protracted negotiations is the intention to allow IAEA inspectors access to plutonium, which still has classified properties, freshly removed from weapons. Procedures should enable inspectors to certify that the material is not being diverted to defence programmes and at the same time preserve sensitive information. All three sides have for years reported smooth progress, saying that only 'technical details' remained, but there is no saying when talks will end.

Conclusion

Thus, the distinguishing feature of the status of multilateral verification efforts regarding nuclear weapons in 2001–2002 was the slow decline of various initiatives, which seem to fade away without serious dissent, at least among the nuclear weapon states. All sides, in particular the US and Russia, but also France, the UK and China, espouse positive attitudes and report modest progress; but actual

progress is at best minimal, and retreats from past achievements and the dismantlement of promising endeavours are more frequent. The nuclear weapon states slide comfortably into convenient unilateralism, which provides flexibility in nuclear posture planning and cost reductions but no progress in verification.

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Endnotes

[1] The full title is the Treaty between the United States of America and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms.

[2] For details see Annette Schaper, 'Verifying nuclear arms control and disarmament', in Trevor Findlay (ed.), *Verification Yearbook 2000*, The Verification Research, Training and Information Centre (VERTIC), London, December 2000, p. 60.

[3] These three states became parties to START I because strategic nuclear weapons were located on their territories at the time of the dissolution of the Soviet Union in December 1991. Their status as parties to START I was recognized in the May 1992 Lisbon Protocol, but all three also undertook to join the NPT as non-nuclear weapon states.

[4] See also Defense Threat Reduction Agency, 'Strategic Arms Reduction Treaty (START)', DTRA Factsheet available at www.dtra.mil/news/fact/nw_start.html, current as of January 2002.

[5] At the entry of START I into force, there were 43 inspectable facilities in the US and 69 in the newly independent states. See Defense Threat Reduction Agency, 'Strategic Arms Reduction Treaty (START) inspectable sites in the former Soviet Union', available at www.dtra.mil/news/fact/nw_stfsu.html; and 'Strategic Arms Reductions Treaty (START) inspectable sites in the United States', available at www.dtra.mil/news/fact/nw_stus.html, both documents current as of January 2002.

[6] Sequential inspections were introduced for the first time in START I precisely for cost-saving reasons; the INF Treaty did not provide for them. After an agreement at the START I talks on this option, sequential inspections were also adopted for the Conventional Armed Forces in Europe (CFE) Treaty.

[7] Although the cost for Russia of inspecting American facilities is considerable, the cost of receiving American inspection teams on Russian territory is even greater since the inspected party covers all in-country expenses. According to the treaty, however, Russia does not have control over the number of these inspections within the quotas established by the treaty. The number of American inspections could be reduced only by a special agreement.

[8] ITAR-TASS, 1 December 1997.

[9] See Gennadiy Obolenskiy, 'O serykh zonakh budushchikh peregovorov po dogovoru SNV-3' [On the 'grey areas' of future negotiations on a START III treaty], *Yadernaya bezopasnost',* November 1997, pp. 4–5; a statement of an unnamed representative of the Russian Ministry of Defence, Interfax, 16 June 1998; a statement by Vladimir Lukin and Roman Popkovich, chairmen of the International Affairs and Defence committees of the Duma, respectively, in *Nezavisimaya gazeta,* 28 August 1998, p. 1; Ivan Sidorov, 'Naskol'ko otvetstvenno storony vypolnyayut dogovor SNV-1?' [How responsibly are the parties implementing the START I Treaty?], *Yadernoye rasprostranenie*, August/October 1999, pp. 64–69; 'SShA narushayut dogovor SNV-1' [The US is violating the START I Treaty], *Krasnaya zvezda,* 23 January 1999, pp. 1–2; and 'O narusheniyakh SShA dogovora SNV-1' [On the US's breaches of the START I Treaty], Statement no. 6-04-01-2001 of the Ministry of Foreign Affairs of the Russian Federation, 4 January 2001.

[10] The Russian concern is caused by the fact that such tests could produce useful information for the US and thus present an opportunity to circumvent the treaty.

[11] Nikolai Sokov, 'The tactical nuclear weapons controversy', *Jane's Defence Weekly,* 31 January 2001.

[12] Statement of the official representative of the Russian Foreign Ministry Alexander Yakovenko, document no. 2273-05-12-2001, 5 December 2001.

[13] From the point of view of maintaining its remaining missiles it may be cheaper for Russia not to have any treaty at all. The technical details of START I and possible other treaties often require expensive changes in standard operating procedures. START I rules would entail extra costs if three warheads were to be deployed on the Topol-M. Implementation of some provisions in the American draft of START III could also be expensive. These concerns are very similar to those that drive the American approach.

[14] Since START II never entered into force, Russia was not obligated to implement it, but according to the 1969 Vienna Convention on the Law of Treaties it was bound to 'refrain from acts which would defeat the object and purpose' of START II. The 14 June 2002 announcement formally relieved Russia from that obligation.
[15] For the text of the treaty see, e.g., the website of the US State Department, www.state.gov/t/ac/trty/10527.htm.
[16] Statement of Secretary of State Colin Powell before the US Senate Foreign Relations Committee, 9 July 2002, transcript by Federal News Service on 10 July 2002; and Bill Nichols, 'US to keep 2,400 nukes in reserve despite treaty', *USA Today,* 10 July 2002, p. 10.
[17] Nikolai Sokov, 'No SORT of verification', *Trust & Verify* (VERTIC), issue 103, July/August 2002, pp. 1–3.
[18] See, e.g., a statement by the Russian Minister of Foreign Affairs, Igor Ivanov, at a joint session of the International Relations Committees of the State Duma and the Federation Council on 21 May 2002, Ministry of Foreign Affairs document no. 1069-24-05-2002; 'Neobkhodima posledovatel'nost' v reshenii problem yadernogo razoruzheniya, zayavil Yuriy Baluevskiy' [Follow-up is essential in resolving issues of nuclear disarmament, says Yuriy Baluevskiy], available at www.Strana.ru, 18 May 2002; Statement of the State Duma on the new strategic stability agreements between the Russian Federation and the United States of America, 21 June 2002, available at www.armscontrol.ru/start/rus/docs/duma061402.htm; and Statement of Secretary of State Colin Powell before the United States Senate Foreign Relations Committee, 9 July 2002.
[19] Interfax, 26 September 1996.
[20] 'National report on the implementation of the nuclear nonproliferation treaty by the Russian Federation, 25 April 2000', document of the Permanent Mission of the Russian Federation to the United Nations no. 37.
[21] Statement of the delegation of the Russian Federation at the first session of the Preparatory Committee for the 2005 NPT Review Conference under Article VI of the treaty, New York, 11 April 2002 (document distributed by the Russian delegation at the PrepCom).
[22] Statement by US Ambassador Norman A. Wulf on 27 April 1998 at the second Preparatory Committee (PrepCom) meeting for the 2000 Review Conference of the Non-Proliferation Treaty NPT, available at www.acronym.org.uk/textonly/dd/dd26/26doc.htm.
[23] Statement of Ambassador Norman A. Wulf on 8 April 2002 at the first session of the Preparatory Committee for the 2005 NPT Review Conference under Article VI of the Treaty, New York, 11 April 2002, available at www.acronym.org.uk/npt/2002us.htm; and 'US Information Paper on Article VI', 11 April 2002, at www.acronym.org.uk/npt/2002us2.htm.
[24] Walter Pincus, 'Powerhouse H-bomb heads for graveyards', *Washington Post,* 8 August 2002, p. 10.
[25] Besides Mexico, the NAC includes Brazil, Egypt, Ireland, New Zealand, South Africa and Sweden.
[26] 'Statement by the Representative of Mexico, H.E. Mr Gustavo Albin, on reductions of non-strategic nuclear weapons', New York, 24 October 2001 (document distributed at the meeting). See also 'Statement by H.E. Mr Markku Reimaa, Permanent Representative of Finland to the Conference on Disarmament', New York, 23 October 2001 (document distributed at the meeting).
[27] 'Statement by H.E. Mr Markku Reimaa'. For a description of the German proposal see Rebecca Johnson, 'The 2002 PrepCom: papering over the cracks?', *Disarmament Diplomacy,* May–June 2002, available at www.acronym.org.uk/dd/dd64/64npt.htm.
[28] See 'Nuclear Disarmament Plan of Action, final document', *Disarmament Diplomacy,* no. 46, May 2000, pp. 20–21.

3

CTBT verification: technical progress versus political stasis

Oliver Meier

In 2001–2002 the Comprehensive Nuclear Test Ban Treaty (CTBT) continued to be faced with contradictory developments. The number of states that had signed and ratified the treaty continued to rise. As of 15 October 2002, 166 states had signed, while 96 had ratified it. Many of the new signatories and ratifiers were African or Latin American.[1] At the same time, good progress was made in setting up the CTBT Organisation (CTBTO) and the treaty's verification system. The Preparatory Commission (PrepCom) continued to meet in Vienna and work towards full implementation of the regime. The Provisional Technical Secretariat (PTS) for the future CTBTO continued to grow and the International Monitoring System (IMS) came closer to completion. All the states that had tested nuclear weapons in the past continued to observe test moratoria and there was no evidence that any other state was contemplating nuclear testing in the near future.

Paradoxically, despite these positive developments, the prospects for entry into force of the CTBT did not improve. Instead, the clouds over the test ban treaty darkened further. The only truly significant new member states were Kazakhstan, a former nuclear weapon state and host to a former Soviet nuclear test site, and Libya, which has been suspected of having nuclear ambitions in the past. Worse still, since 23 February 2000, when Ukraine ratified, not one of the remaining 13 countries of the 44 required to ratify before the treaty can enter into force has signed or ratified.[2] The US, which in August 2001 had announced its partial withdrawal from the PrepCom, distanced itself further from the treaty. Indeed, there remains a danger that the US will repudiate its 1996 signature, sever all connections to the PrepCom and stop all support for the PTS. Such a decision could be made either to signal complete disapproval of the treaty or in the context of a move to

increase American readiness to resume nuclear tests or in the event of an actual resumption.

How the widening gap between practical progress and political support can be bridged remains the unsolved puzzle for diplomats in Vienna, PTS staff and treaty supporters around the world. The second Conference on Facilitating the Entry into Force of the CTBT (foreseen by Article XIV of the treaty in case of slow entry into force), which took place in New York on 11–13 November 2001, provided an opportunity to discuss possible ways forward.[3] In his opening statement, UN Secretary-General Kofi Annan urged those who believe that the CTBT had been 'marginalized by the events of 11 September and their aftermath' to 'think again'.[4]

If this was directed at the administration of George W. Bush, it fell on deaf ears. The US was the only signatory state not represented at the meeting. Its boycott of the conference, in which 118 states (including 74 ratifiers, 35 signatories and 9 non-signatories) took part, was only one of a number of actions designed by the Bush administration to distance itself from the treaty.

- On 21 August 2001, during the 15th session of the PrepCom, the US announced that it would continue to participate in and fund only those PrepCom activities 'directed to establishing and supporting the International Monitoring System'. Specifically, the US announced its complete withdrawal from discussions on the development of arrangements for on-site inspections (OSIs) to be conducted once the treaty enters into force.[5]
- Accordingly, in its budgetary request to Congress the Bush administration sought a reduction of US$1.8 million in the American contribution to the funding of PrepCom activities in fiscal year (FY) 2003.[6] This is equivalent to the proportion of the American contribution that the PrepCom would have spent on OSI-related activity.
- The Bush administration also requested US$15 million as part of the FY 2003 budget to increase readiness at its Nevada nuclear test site. The Defense Department's Nuclear Posture Review calls for enhancing test site readiness to be able to resume testing within 18 months, compared with 24–36 months previously.[7]
- The US Nuclear Posture Review, released in January 2002, endorsed research into new nuclear weapon capabilities. It particularly recommended increased efforts to assess concepts for low-yield nuclear weapons ('mini-nukes') to destroy

underground targets.[8] Such research might eventually be deemed to require nuclear tests.

- At a closed briefing for members of the US Congress in May, Bush administration officials accused Russia of preparing to conduct a nuclear test. Officials reportedly alleged that the pattern of work at the former Soviet test site on Novaya Zemlya (presumably observed by American satellites) is similar to that observed in preparation for past nuclear tests.[9]

The implications of the American move away from the CTBT overshadowed events marking the fifth anniversary of the PTS on 17 March 2002, which were meant to highlight the progress made towards completion of the verification system. Speakers at these events emphasised the need to keep the US involved in the CTBT PrepCom, while also convincing other states to ratify the treaty.[10]

Progress in setting up the CTBT verification system

The International Monitoring System

The IMS, which is intended to monitor compliance with the CTBT, will consist of 321 monitoring stations and 16 radionuclide laboratories located in some 90 countries. Before an IMS station is set up, the PrepCom and the host state must agree on a legal framework for co-operation. By June 2001, 21 states had concluded formal facility agreements. However, some kind of legal arrangement was in place for more than 300 facilities in 72 countries.[11]

As of 31 July 2002, 30 IMS stations and one radionuclide laboratory were certified. One hundred and thirty-five stations were completed, 66 were under construction

Table 1 Progress in primary station certification[1]

	2000	2001	2002[2]	Total
Primary seismic	5	6	2	13
Infrasound	-	5	-	5
Hydroacoustic	1	1	1	3
Radionuclide	5	-	4	9
Total	11	12	7	30

NOTES 1 As of 31 July 2002 2 Covers the period 1 January–31 July 2002
SOURCE Private communication

and for 32 stations there was a contract pending. For 88 stations, construction had not yet started. Site surveys had been completed for 87 percent of all stations. Progress in certification of stations depends on a number of factors that are difficult to predict, but the PTS hopes to certify an additional 23 by the end of 2002 and approximately 40 more in 2003.

Now that an increasing number of stations are being completed, the PrepCom is putting additional efforts into establishing legal and financial rules for their operation and maintenance. As a first step, Working Group B (WGB), responsible for verification, has made recommendations for provisional operation and maintenance. This includes the development of rules for staff and operators.[12] Following a workshop on the subject, the PTS has established a working group in the IMS Division to discuss issues related to IMS station operation and maintenance.[13]

The International Data Centre and Global Communications Infrastructure

The PTS is also establishing a Global Communications Infrastructure (GCI) to securely transmit all IMS data to the International Data Centre (IDC) in Vienna. The IDC receives, processes and distributes the information to authorised users, such as national authorities in member states. All CTBT member states can receive raw data and/or screened information from IMS stations, as they wish.

IMS stations are being equipped with Very Small Aperture Terminals (VSATs) which relay data to communications satellites. The satellites transmit information to one of three hubs on the ground, from where data are sent to the IDC by terrestrial link. During 2001, 42 additional VSATs were installed and at the end of May 2002 the 100th VSAT started operating in Namibia.[14] As of February 2002, 150 GCI sites had been surveyed.[15] By August 2002, 114 VSATs out of a planned total of 234 had been installed.[16]

Four states have concluded agreements on the establishment of independent in-country sub-networks for data transmission to the IDC.[17] Such networks are an alternative to the PTS establishing the communications links itself. Independent sub-networks give states greater control over data released to the IDC because information is first sent to their national data centres and transmitted from there to Vienna. However, such networks are more expensive for the host state and more problematic than transmitting data directly from stations to the IDC. The problems associated with independent sub-networks have been illustrated by the case of

China, which has not yet completed its own network. This has led to allegations that China has 'stopped' data transmission to the IDC.[18]

During 2001, approximately 80 IMS seismic, hydroacoustic and infrasound stations transmitted to the IDC near-real-time data, which were used to compile so-called reviewed event bulletins (REBs). (Data were delivered from 16 of the 19 certified waveform stations as well as from a number of other stations that are substantially complete.) REBs are a compilation of events which are screened using automatic filters and human analysts to exclude events that are clearly not nuclear tests. During 2001, on average 61 events per day were listed in REBs.

In contrast to waveform data, information from radionuclide stations has to be analysed before it is transmitted to the IDC. At the end of 2001, nine radionuclide stations had provided 270 sample spectra to the IDC. As of July 2002, 397 users in 55 CTBT member states received IDC data via a secure account.[19]

Since the American decision to support only IMS-related elements of the CTBT verification system, the PTS has completely taken over the development of IDC software. In February 2001, a Software Integration Unit was set up to handle ownership, maintenance and development of IDC software. In June 2001, Release 3 of the IDC's application software was validated. This was the first time the provisional IDC in Arlington, Virginia, US (which had provided all previous versions of the IDC software free) was not involved. The PTS will develop Release 4 independently.[20]

On-site inspections

Working Group B has continued to elaborate procedures for OSIs. After Ambassador Arend Meerburg of the Netherlands was appointed Task Leader for the OSI Operational Manual (OM),[21] discussions continued on the Initial Draft Rolling Text (IDRT) but made little progress. The IDRT has 13 chapters and 7 annexes, and was distributed to PrepCom delegates on CD-ROM in June 2001. It contains hundreds of brackets indicating areas of disagreement. The complexity of the text has grown with the introduction of different kinds of brackets, indicating at what stage participants disagreed on which sections of the text. Agreement has not even been reached on the 'hierarchy' of the different documents governing the future OSI regime.[22]

These discussions are now taking place without the US. Talks on the OM were extremely slow even with the US fully participating and it is not clear what effect the absence of the US has had. However, the current format is unlikely to lead to a

successful conclusion. At the time of writing, the chairman was expected to begin tabling compromise proposals ('Chairman's text') for certain sections of the manual, but expectations were low that this approach will lead to a breakthrough.

The American withdrawal has not only removed an important proponent of a strong and effective on-site regime from the OM discussions, but has also cast doubt on the value of the endeavour. The stringency of OSI provisions has always been an important criterion for US support for verification. It remains unclear whether the US Senate would give advice and consent to an inspection regime that had been developed without US input.

Some states have argued that, given the remote likelihood of early entry into force, the lack of progress may not be such a bad thing because it will allow for a thorough discussion of the issues at stake. Others maintain that at the current speed of discussions a manual will not even be in place by the current IMS completion target date of 2007.

Meanwhile, practical progress is being made on a number of related issues. A second large OSI field experiment took place in Slovakia in September and October 2001. (The first field experiment was in 1999 in Kazakhstan.) The exercise was used to test the Seismic Aftershock Monitoring System (SAMS), which can detect seismic activities indicative of previous underground tests. For its third large OSI field experiment, planned for the second half of 2002, the PTS had intended to keep the location secret so as to simulate the conditions of an actual short-notice inspection, but it later announced that Kazakhstan would again be the location.[23] Several workshops were also held in 2001–2002 to discuss OSI issues. One was held in Beijing, China, from 15–19 October 2001. Another was held from 24–28 June 2002, in Vienna, Austria, in which 35 experts from 17 signatory states (but not the US) participated. By the end of 2001, 180 potential future CTBT inspectors had taken part in introductory courses.

Procurement of OSI equipment is being hampered by the lack of progress in the talks on the OM. As long as the procedures for OSIS are not agreed, it is difficult (sometimes impossible) to define specifications for equipment. Thus, it is mainly equipment for the less intrusive aspects of OSIS (such as visual observation and orientation) that has been procured, while other items, such as drilling and active seismic survey equipment, has not been approved or even considered.[24] The PTS

continued to try to procure a 'blinded' high-resolution gamma spectrometer tool for field and laboratory use.[25]

Other issues facing the Preparatory Commission

Discussions in the PrepCom on most issues proceeded smoothly. The lack of controversy was reflected in the fact that several PrepCom sessions ended early. This led to proposals to reduce the number of PrepComs from three to two annually. Such a move would bring the CTBTO closer to the practice of other international treaty regimes which have only one meeting of states parties each year. Some developing countries were keen to cut the number of meetings to save costs. Others, including some European countries, wanted at least to maintain three WGB meetings, arguing that much work remained to be done on verification.

Funding

PrepCom budgets continued to rise (see table 2). The 2002 budget of US$85.1 million was 1.9 percent higher than that of the previous year. For 2003, the PTS proposed a budget of US$86.4 million, a 1.5 percent increase.[26] The PTS argued that at least for the next two or three years budgets need to continue to grow, ideally by 10–15 percent annually, to pay for the operation of installed stations and the installation costs of the remaining facilities. Thereafter budgets could be scaled back to approximately US$84 million annually.[27] Meanwhile, the collection rate for assessed state contributions is still good, but not as good as it used to be. By August 2002, 90.9 percent of contributions for financial year 2001

Table 2 Regular budget of the PrepCom, 2002

International Monitoring System	US$44 million
International Data Centre	US$13.7 million
Communications	US$9.6 million
On-site inspections	US$2.5 million
Evaluation	US$0.9 million
Policymaking organs	US$2.8 million
Administration	US$11.4 million
Total	US$85.1 million

SOURCE CTBT/PC-16/1/Annex VII, Vienna, 4 December 2001, p. 7

and 81.3 percent of those for 2002 had been paid. This compares to collection rates in 2001 of 97.5 percent for 2000 and 84.1 percent for 2001.[28]

Prolonged discussions in the PrepCom on the application of the new United Nations scale of assessments formally ended when it was adopted for the 2002 financial year.[29] Some developing countries, however, protested. China expressed its 'strong reservations' by disassociating itself from the consensus. China made clear that it intends to continue to support the CTBT by paying its full assessment on time but opposes simply applying the revised UN scale to the CTBTO. Its representative expressed his hope that Chinese 'kindness would be returned on certain occasions and concerning other issues'.[30]

The PTS has benefited from several voluntary contributions by member states, both in cash and in kind. On 22 November 2001, the Netherlands contributed €15,882 to support participation of experts from developing countries in PTS information programmes to promote the treaty.[31] Finland organised a training course for experts from developing countries on the operation of national data centres, while France sponsored a training programme for IMS station operators from an African country.[32] Austria, Japan and Norway also made extra-budgetary contributions to the work of the PrepCom by supporting training and outreach.[33]

Station operation

With a substantial number of IMS stations certified, the PTS and states parties for the first time face the challenge of operating the IMS. Like so many PrepCom issues, this is uncharted territory. No international organisation has ever operated such an elaborate network of monitoring stations. Discussions so far have focused on costs and availability of data. These issues, however, point to the larger question of the status of the IMS before the CTBT has entered into force.

For stations which are part of the primary network, the PTS will pay for operational and maintenance costs.[34] Thus, states parties collectively have to foot the bill. As the expenses for operating stations rise, discussions about the purpose of operating a monitoring network to verify a treaty that has not yet entered into force, and may not do so for some years, grow more acute. China reportedly took the lead on this issue in the February session of WGB, with the support of Iran.[35] China argued that: 'We should have a realistic view on the prospects of the Treaty's entry into force rather than seeking speed for the sake of speed, so as to avoid imposing

unnecessary financial burdens on member states of the PrepCom or giving rise to unnecessary political or legal problems'.[36] This line has been echoed by other developing countries, notably some from Latin America. At the Article XIV conference, Australia, reflecting the views of many Western states, urged treaty supporters 'to ensure that adequate resources are provided to establish the monitoring and verification system, so that we can start reaping its benefits even before the Treaty enters into force'. Australia argued that the IMS can detect (and thus presumably deter) nuclear testing regardless of the legal status of the CTBT.[37]

Ominously, while China and Iran were raising questions about the operation of IMS stations, neither was transmitting live data to Vienna from stations on its territory. China was reportedly not doing so because it has not completed its domestic data infrastructure. Data from its stations, none of which is certified, were apparently being sent by diskette to Vienna. Iran stopped transmission of IMS data to the IDC on 27 January 2002, citing difficulties with its national implementation legislation. A spokesperson was quoted as saying that 'the Iranian constitution does not allow the government to undertake any commitment for the implementation of treaties prior to the ratification by the parliament', including the obligation to transmit IMS data continuously to the PTS.[38]

A long-standing and related issue is whether the PTS will be responsible for the operational and maintenance costs for the 120 auxiliary seismic stations. These are operated for scientific purposes unrelated to the CTBT and will only transmit data to the IDC when there is a need to clarify a suspicious event. However, auxiliary stations need to be certified to the same standards as stations in the primary network. Papua New Guinea is the first state to request the PTS to shoulder the operational costs of such a station.[39] Other developing countries are expected to make similar requests, but the PrepCom intends to deal with them case by case.

Growth and transparency

The PTS continues to evolve into a fully-fledged international organisation. In July 2002, it had 271 staff from 69 member states.[40]

Three external and independent evaluations of different aspects of PTS operations have taken place over the past two years. In October and November 2000, six experts, led by the former head of the Preparatory Commission for the Organisation for the Prohibition of Chemical Weapons (OPCW), Ian Kenyon, evaluated the

operations of the IDC. In 2001, IMS operations were evaluated by a team led by Dr Michael J. Berry: the report was issued in December 2001.[41] However, it was an external report on 'human resources' by the German consultancy firm Cedar which received most public attention. According to press reports, it sharply criticised the PTS,[42] claiming that there was a 'high degree of fear and mistrust in the decision-making processes' in the PTS and that the organisation suffered from a 'lack of transparency' and 'inflexibility of rules'.[43]

The PrepCom debated these reports and the PTS began to implement their recommendations. Reacting to the suggestions in the IDC report, the PTS developed a Medium Term Plan for the IDC. In addition, the IDC and IMS directorates instituted monthly co-ordination meetings, reflecting the recommendation that the IMS and IDC should improve co-ordination.

Creating an open organisation

No solution has been found for the problem of using IMS data for purposes other than test ban monitoring. Some states, including China, argue that the confidentiality provisions of the treaty prohibit the distribution of IMS data to non-states parties. Some Western states and others favour a more open policy, arguing that IMS data have little national security relevance. The US argues for the immediate and complete release of all IMS data.

The treaty itself only obliges the Technical Secretariat to 'make available all data, both raw and processed, and any reporting products, to all States Parties'.[44] It is unclear whether this excludes the possibility of making information available to others. Unlike other verification regimes, data available to the IMS have not been provided by governments in confidence. Rather, they are scientific data that have been collected and analysed by the organisation itself.

IMS data could be used in various ways. Scientific and humanitarian relief organisations, for example, have expressed an interest in receiving it. Data from the seismic network are of interest to seismologists in improving their ability to predict earthquakes and other natural phenomena. Hydroacoustic stations could give early warning of tsunamis, while infrasound stations could warn of volcanic eruptions.[45]

In order to evaluate the data confidentiality rules, the PTS has been planning a phased release of certain types of data to a limited number of non-state recipients. Thus, humanitarian organisations could promptly receive IMS data for disaster

relief operations, while others would only have delayed access. Another option would be to make IMS data available to everyone, possibly with a built-in delay for certain types of data. The proposed test of a delayed release of certain types of IMS data has not happened because of the continued resistance of at least one state party. However, during its 17th session, the PrepCom approved a request by a British non-governmental organisation (NGO), the International Seismological Centre (ISC), to receive old IMS seismological data. The data are for 2000 and 2001 and will be used in the ISC's catalogue and bulletin. The PrepCom decided that future discussions will 'focus on guidelines for a draft model agreement between the PTS and scientific organizations, before addressing any further requests'.[46]

Options for civil and scientific applications of CTBT verification technologies were discussed by international experts at a two-day workshop in London in May 2002, sponsored jointly by the PTS and the UK Foreign and Commonwealth Office. Experts identified a wide range of potential civil and scientific applications and agreed that the potential usefulness of IMS data merits further study.[47] A follow-up seminar sponsored by Australia, Japan, the Netherlands and the United Kingdom took place at the PTS in October 2002.[48]

As part of becoming a fully fledged international organisation, the CTBTO PrepCom is establishing itself as part of the network of such bodies. It acceded to the 1986 Vienna Convention on the Law of Treaties and established a formal relationship with the UN by concluding an Agreement to Regulate the Relationship between the United Nations and the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization, which entered into force on 15 June 2000. Finally, it concluded agreements with the United Nations Development Programme (UNDP). In addition to signing such formal agreements, the PTS has also begun real co-operation with the World Meteorological Organization (WMO) which involves sharing data and weather models with it. The CTBTO uses this information to model the dispersal of radionuclides which could be indicative of nuclear tests.[49]

The way forward

Over the past 12 months, the work of the PrepCom has been characterised by conflicting signals. On many issues, the PTS and PrepCom have been conducting

'business as usual'. Political support for the CTBTO has remained generally high. On some controversial issues, bureaucratic and political inertia has prevailed. At the same time, there have been worrying signs that the regime could 'unravel from within', as one diplomat has been quoted as saying.[50] The deteriorating political climate for the test ban has unfortunately begun to affect the PrepCom's work. Whether the gap between political support for the CTBT and technical progress will continue to widen and how it could be bridged are likely to remain the dominant questions for CTBT supporters.

Concretely, states will have to decide at what speed the IMS is to be completed. Treaty supporters argue in favour of undiminished efforts towards completion. However, making progress in the setting up the IMS dependent on progress towards entry into force is short-sighted for a number of reasons:

- A (nearly) complete IMS can demonstrate the verification system's capabilities, convincing treaty sceptics that the CTBT is indeed verifiable.
- If the implementation phase is drawn out there is a risk that support for the treaty will decline as it slips down political agendas.
- Completing the IMS at an early date will minimise the time in which the PrepCom has to cope with the double burden of establishing and operating the IMS.
- IMS data can be better used for scientific and civil purposes if a (nearly) complete IMS is in place.

Progress in Vienna needs to be accompanied and supported by political progress toward entry into force. Several challenges need to be tackled in parallel. It remains important to convince more states to sign and ratify the CTBT. Continued progress towards universality and strong political support from signatory states will demonstrate the treaty's continued relevance. At the time of writing, discussions on a possible third Article XIV conference in 2003 were continuing. In the past, such events have proved useful for governments and NGOs in rallying support for the treaty.

In addition, the international community should continue to press the US to support the CTBT. Outside the Bush administration, there is broad public and scientific support for the test ban. A study on *Technical Issues Related to the Comprehensive Nuclear Test Ban Treaty* released in July 2002 by the US National Academy

of Sciences is illustrative. The report was written by a 19-member scientific committee which included former nuclear weapon scientists, nuclear weapon laboratory directors and military officers. The group concluded that the US could maintain safe and reliable nuclear weapons without testing and that the CTBT was effectively verifiable.[51] The Bush administration needs to be encouraged to take such voices seriously. More public declarations of support for the CTBT like the joint ministerial statement of 18 foreign ministers on the sixth anniversary of the treaty's opening for signature[52] are needed. In the medium term, much will depend on the outcome of the American presidential elections in 2004 and whether Washington reconsiders its current hostility to the CTBT.

In the long run, and if no progress is made towards entry into force, CTBT signatory states may want to consider provisional application or provisional entry into force of the treaty. Such options come with both risks and opportunities. While they would allow the verification system to gain full legal status and be fully implemented, they could also lessen the pressure on key states to join the treaty. Ultimately, if the current situation persists for much longer, provisional entry into force would simply constitute legal recognition of a political reality—a treaty that enjoys broad international support and is being verified by a fully-functioning international organisation and global monitoring system, but which is unable to enter into force simply because of the opposition of a few nuclear weapon states that stubbornly want to keep their nuclear testing options open.

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Endnotes

[1] Among the signatories were Botswana, Cameroon, the Central African Republic and Libya, while ratifiers included Burkina Faso, Costa Rica, Ecuador, Georgia, Jamaica, Latvia, Nauru, Niger, San Marino, Paraguay, Uruguay and Kazakhstan. Up-to-date and detailed information about the status of CTBT signatures and ratifications can be found on the website of the CTBTO Preparatory Commission at www.ctbto.org.

[2] These states, which have the most advanced nuclear industries, are listed in Annex 2 to the treaty.

[3] The conference had originally been planned for 25–27 September, 2001 to mark the fifth anniversary of the opening for signature of the CTBT, but was postponed following the terrorist attacks on New York and Washington,DC, on 11 September 2001.

[4] Kofi Annan, 'Opening remarks to the Conference on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty (CTBT)', New York, 11 November 2001.

[5] 'US statement regarding CTBTO PrepCom participation', Vienna, 21 August 2001.

[6] US$18.2 million compared to the fiscal year (FY 2002) allocation of US$20 million. Phillip C. Bleek, 'White House to seek partial funding; plans to drop support for on-site inspections', *Arms Control Today,* September 2001; and 'Bush requests funds for CTBT monitoring', *Arms Control Today,* March 2002, www.armscontrol.org.

[7] Walter Pincus, 'Report finds shortcomings in Energy Dept. arms testing', *Washington Post,* 3 January 2002, p. A15; and David Ruppe, 'US testing I: no live testing needed for now, US official testifies', *Global Security Newswire,* 15 February 2002, www.nti.org.

[8] Excerpts from the Nuclear Posture Review can be viewed on the *Global Security Newswire* website at www.globalsecurity.org/wmd/library/policy/dod/npr.htm. The Bush administration's nuclear weapons policy is analysed in Mark Bromley, David Grahame and Christine Kucia, 'Bunker busters: Washington's drive for new nuclear weapons', BASIC Research Report 2002.2, British American Security Information Council, London and Washington, July 2002.

[9] Tom Shanker, 'US says Russia is preparing nuclear tests', *New York Times,* 12 May 2002, www.nytimes.com; and Cristina Chuen and Charles Ferguson, 'Renewed US–Russian controversy over nuclear testing', Research Story of the Week, Center for Nonproliferation Studies, Monterey Institute of International Studies, 27 May 2002, www.cns.miis.edu.

[10] VERTIC in co-operation with the PTS organised a public event in Vienna on 18 March 2002 to discuss the challenges facing the treaty. The presentations made at the seminar can be found at www.vertic.org/current/ctbtverseminar/ctbtverisem.html. A report of the event is available at www.ctbto.org/press_centre/featured_articles/vertic_report.pdf.

[11] 'New agreements and accessions', www.ctbto.org, 10 June 2002; and CTBT/PC-17/1/Annex III, Vienna, 15 April 2002, p. 27.

[12] CTBTO Preparatory Commission document CTBT/PC-14/1/Annex IV/Appendix V, Vienna, 24–26 April 2001, p. 32.

[13] CTBTO Preparatory Commission, Provisional Technical Secretariat, *Annual Report 2001*, Vienna, March 2002, p. 6.

[14] 'One hundredth satellite earth station installed in International Monitoring System', 30 May 2002, www.ctbto.org.

[15] CTBTO Preparatory Commission, Provisional Technical Secretariat, 'Background note for the fifth anniversary of the Provisional Technical Secretariat', Vienna, 15 March 2002.

[16] CTBT/PC-18/1/Annex IV, Vienna, 21 August 2002, p. 3.

[17] CTBT/PC-17/1/Annex III, Vienna, 15 April 2002, p. II.

[18] Carol Giacomo, 'China, Iran said balking at test ban pact cooperation', Reuters, Washington, DC, 8 March 2002.

[19] Provisional Technical Secretariat, *Annual Report 2001*, pp. 12–13; and CTBT/PC-18/1/Annex IV, Vienna, 21 August 2002, p. 2.

[20] CTBT/PC-17/1/Annex III, Vienna, 15 April 2002, pp. 9–10.

[21] Previously known as the OpsMan.

[22] There is agreement among states parties that the CTBT and its protocols are 'untouchable'. It seems likely that the final version of the OM will be presented to the PrepCom and adopted after entry into force by the first Conference of States Parties. The OM (including its protocols) could later be altered and adapted by the Executive Council of the future CTBTO.

It has been suggested that Standard Operating Procedures determining the details of future on-site inspections can be drafted by the (Provisional) Technical Secretariat and will be issued by the future Director-General after consultation with states parties.

[23] 'Planning underway for 2002 on-site inspection (OSI) field experiment', February 2002, www.ctbto.org; and CTBT/PC-18/1/Annex IV, Vienna, 21 August 2002, p. 3.

[24] CTBTO PrepCom, Provisional Technical Secretariat, *Annual Report 2001*, Vienna, March 2002, p. 25.

[25] CTBT/PC-17/1/Annex III, Vienna, 15 April 2002, p. 16.

[26] CTBT/PC-18/1/Annex I, Vienna, 21 August 2002, p. 5.

[27] IMS coordinator Peter Basham quoted in David Ruppe, 'CTBT: progress mixed on organization's five-year anniversary', *Global Security Newswire,* 19 March 2002, www.nti.org.

[28] CTBT/PC-18/1/Annex IV, Vienna, 21 August 2002, p. 4.

[29] CTBT/PC-16/1/Annex VIII, Vienna, 29 November 2001, p. 13. This new scale slightly reduces the US contribution to 22 percent of the total budget and redistributes the reduction to other countries. See UN General Assembly Resolution A/RES/55/B-F, 22 January 2001; and Oliver Meier, 'Entering rough waters? The CTBT verification system', VERTIC Briefing Paper 01/04, The Verification Research, Training and Information Centre (VERTIC), London, September 2001.

[30] 'Statement of China', CTBT/PC-16/1/Annex IX, Vienna, 29 November 2001, p. 2. Other countries which disagreed to varying degrees with the decision to adopt the new scale of assessment were Brazil, Chile, Colombia and the Republic of Korea.

[31] 'Kingdom of Netherlands cash contribution', Vienna, 22 November 2001, www.ctbto.org.

[32] CTBT/PC-17/1/Annex 3, Vienna, 15 April 2002, p. 26.

[33] CTBT/PC-18/1/Annex IV, Vienna, 21 August 2002, p. 6.

[34] The treaty states that the Technical Secretariat shall agree and co-operate to establish, operate, upgrade, finance and maintain monitoring facilities and radionuclide laboratories. Protocol to the CTBT, Part I, para. 4. However, the treaty does not oblige the CTBTO to pick up costs for auxiliary seismic stations. See CTBT, Article IV, paras 19 and 20.

[35] CTBT/PC-18/1/Annex I, Vienna, 21 August 2002. Some observers suspect that China may have been motivated by a desire to retaliate for reduced US support for the PTS.

[36] 'Speech by Vice Foreign Minister Wang Guangya at the Opening Ceremony of the Regional Workshop for CTBTO International Cooperation and National Implementation/Ratification Procedures', Beijing, 6 June 2000, www.fmprc.gov.cn/eng/5196.html.

[37] Statement by H.E. Mr John Dauth, Ambassador and Permanent Representative of Australia to the United Nations at the Conference on Facilitation the Entry Into Force of the Comprehensive Nuclear-Test-Ban-Treaty, New York, 11 November 2001.

[38] Stephen Fidler, 'Experts warn on risk if nuclear treaty collapses', *Financial Times,* 1 August 2002, p. 7.

[39] CTBT/PC-15/1/Annex I, Vienna, 21–23 August 2001, p. 8.

[40] CTBT/PC-18/1/Annex III, Vienna, 21 August 2002, p. 12.

[41] CTBT/PC-17/1/Annex II, Vienna, 15 April 2002, p. 17. The team consisted of six experts from Algeria, Canada, China, France, Iran and the US.

[42] Carol Giacomo, 'China, Iran said balking at test ban pact cooperation', Reuters, Washington, DC, 8 March 2002.
[43] Julian Borger and John Gittings, 'China and Iran threaten test ban treaty', *The Guardian,* 26 March 2002, www.guardian.co.uk.
[44] CTBT, Article IV. para. 14.e.
[45] Debora MacKenzie, 'Someone to watch over us,' *New Scientist,* no. 2346, 8 June 2002, pp. 12–13.
[46] CTBT/PC-17/1/Annex II, Vienna, 15 April 2002, p. 5.
[47] 'Senior experts' discussion on civil and scientific applications of CTBT verification technologies: London, United Kingdom, 9–10 May 2002', www.ctbto.org.
[48] 'Seminar on potential civil and scientific applications of CTBT verification technologies', 15 October 2002, www.ctbto.org.
[49] In return, the CTBTO will provide weather data from its monitoring stations to the WMO. The agreement between the two organisations is expected to come into force in 2003. Provisional Technical Secretariat, Press Centre, 'CTBTO agrees to provide weather data to the World Meteorological Organization', Vienna, 2 April 2002, www.ctbto.org.
[50] 'CTBT: China and Iran are slow with reports', *Global Security Newswire,* 8 March 2002, www.nti.org.
[51] US National Academy of Sciences, Committee on Technical Issues Related to Ratification of the Comprehensive Nuclear Test Ban Treaty, *Technical Issues Related to the Comprehensive Nuclear Test Ban Treaty,* National Academy of Sciences, Washington, DC, September 2002, available from www.books.nap.edu.
[52] On 14 September 2002, the foreign ministers of Australia, Canada, Chile, France, Hungary, Japan, Jordan, the Netherlands, New Zealand, Republic of Korea, Nigeria, Peru, the Philippines, Russia, South Africa, Sweden, Turkey and the United Kingdom stated their support for early entry into force of the CTBT and promised to 'make representations as appropriate, individually or together, including at regional and multilateral meetings, in order to make the Treaty a focus of attention at the highest political levels'. 'Joint ministerial statement on the CTBT', New York, 14 September 2002.

4

The OPCW at five: balancing verification in evolving circumstances

Robert J. Mathews

The negotiation of the Chemical Weapons Convention (CWC)[1] began in the Conference on Disarmament (CD) in Geneva[2] in 1969 and concluded in 1992.[3] The CWC was heralded as a major breakthrough in multilateral arms control, as it was the first multilateral treaty that completely banned an entire class of weapons, and went further than any previous treaty in the depth, extent and intrusiveness of its verification provisions. Verification under the CWC includes: compulsory national declarations about relevant industrial and military activities; the destruction of chemical weapons (CW) within a set time-frame with intrusive verification of such activity; and a regime of routine inspections of declared industrial and military facilities. Additional features are the possibility of challenge inspections, whereby a state party can request an inspection of any site in another state party at short notice, and provisions for the investigation of alleged use of CW. Ten years on, the CWC is still regarded as setting the benchmark for verification provisions for multilateral disarmament.

The Preparatory Commission (PrepCom) process (from February 1993 until entry into force on 29 April 1997) and the first two years of operation of the CWC were characterised by political difficulties.[4] However, by the end of 1999 there was a sense that states parties were becoming more co-operative and that the Organisation for the Prohibition of Chemical Weapons (OPCW) was gradually taking shape and heading in the right direction.[5]

This chapter considers progress in the implementation of the CWC from the beginning of 2000 until the conclusion of the Seventh Conference of States Parties (CSP) on 11 October 2002. In this period, three groups of issues have been prominent: the OPCW budget; the management of the Technical Secretariat (TS); and, particularly

since 11 September 2001, the potential role of the OPCW in responding to the heightened awareness of the risk of chemical terrorism. These issues are discussed, followed by a brief report on the status of the CWC as of October 2002. This is followed by a discussion of future challenges, including issues to be addressed at the first CWC Review Conference (Revcon), which is to be held in April/May 2003.

Overview of key issues

After a number of difficulties in the first two years of the OPCW,[6] the year 2000 appeared to begin on a much more positive note. In particular, in the lead-up to the Fifth CSP, which took place in May 2000, there was a sense that the organisation had turned a corner and that states parties had developed a greater maturity and sense of common purpose which would augur well for an effective and efficient OPCW.[7] The United States had managed to submit its industry declarations just prior to the Fifth CSP, thus relieving the concerns of a number of other states parties that their industry facilities were receiving an undue burden of Schedule 2 inspections.[8] The Executive Council (EC) had managed to agree on a draft OPCW budget for 2001 which, together with a much more co-operative approach by most states parties than had been evident at the first four CSPs, resulted in the Fifth CSP being the first such conference to finish on schedule.

In addition, during the Fifth CSP, José Bustani of Brazil was re-elected for a second term as Director-General (DG). This was the most controversial issue of the Fifth CSP. Proponents of his re-election argued that it would provide greater stability to the OPCW as it faced new challenges, but a considerable number of states parties, while not necessarily opposed to his being given a second term, considered that the appointment should have received more consideration.[9] Several states parties expressed serious concerns about the 'hasty, premature process'.[10]

Unfortunately, the general sense of goodwill and co-operation among the states parties was rather short-lived. By the end of 2000, budget issues had become a major concern. As a consequence of the financial problems facing the organisation, very limited verification of chemical industry took place in 2001 and the first part of 2002. This resulted in substantial underutilisation of the inspectorate, which caused considerable frustration and loss of morale within the TS and a loss of credibility of the OPCW.

The OPCW budget

The OPCW budget approved by the Fifth CSP for 2001 was €60.2 million (the same in nominal terms as the 2000 budget), and was intended to provide for 240 inspections. However, there were unanticipated increases in operating expenses during 2000. By the end of 2000, the financial problems had become a major concern, and the DG informed the EC that a supplementary budget for 2001 would have to be sought from the CSP. At the Sixth CSP in May 2001, the decision was taken to apply the OPCW's 1999 cash surplus of €2.7 million towards the deficit incurred in 2000. The Sixth CSP approved a budget of €61.9 million for 2002 (considerably less than the draft proposal originally prepared by the TS). At the beginning of 2002, the estimated cash income available to the OPCW stood at €58 million, as compared to the approved budget of €61.9 million. This called for continued 'austerity measures'.[11] Several states parties have made substantial voluntary contributions to enable the OPCW to maintain a more reasonable level of activities for the remainder of 2002.[12]

The financial problems that occurred between 2000 and 2002, including the resulting €6 million deficit for 2002, were the consequences of a number of factors, including: the decision taken by states parties for a virtually 'zero growth' budget between 1999 and 2001; underestimation of the compulsory increases in the fixed costs of running the organisation, most notably staff-related costs;[13] unrealistic budgeting for income in the areas of reimbursement of Article IV and V verification costs;[14] the slow rate of payment by the possessor states of invoices for CW-related inspections carried out under articles IV and V; and a significant number of states parties' continuing habit of delaying payment of their assessed contributions. As discussed below, a number of states parties also considered that another cause of the financial problems was financial mismanagement by the TS.

The financial problems have had a major impact on the TS. For example, the 2000 budget increased the number of approved fixed-term TS posts from 491 to 507. However, following a decision by the Sixth CSP, the TS continued to keep 30 fixed-term posts unfilled. As of October 2002, only 453 of the 507 approved fixed-term posts were filled. Including staff on short-term and temporary assistance contracts, the total personnel strength was 506, from 70 different states parties. Further, because of the tenure policy, many of the most experienced staff members

of the OPCW (including the originally recruited inspectors) may leave in the next few years.[15]

In April 2002, a draft programme of work and a budget for 2003 of €69.9 million were developed by the TS for consideration by the EC.[16] After extensive negotiation by the EC, the budget eventually agreed by the Seventh CSP was €68.6 million, up 10.7 percent on the 2002 budget.[17] There was a distinct expectation that this budget would enable the full deployment of current TS personnel in 2003 and meet the expected increase in workload.

Management of the OPCW

Decision making by the OPCW, including on verification issues, continued to be slow and difficult, which has added to the frustration of the TS.[18] This in turn exacerbated the difficulties encountered earlier in the respective roles of the EC and the TS in the decision-making processes. For example, some states parties were expressing the view that the TS was making decisions which should have been referred to the EC.[19] There were concerns on the part of some states parties that the financial problems were at least partly a result of mismanagement of the OPCW budget by the TS and that the DG had failed to fully inform the EC about measures to improve financial controls and obtain more accurate estimates of operating costs of the TS. On the other hand, concerns were being expressed by the DG that the EC was attempting to 'micromanage' the TS.[20] The situation within the EC and TS became more strained during 2001 as a result of the financial crisis.

By the end of 2001, the DG had lost the confidence of a number of states parties, including some of the major financial contributors.[21] There was a recognition that, for the OPCW to be successful, all states parties needed to have full confidence in the DG. At this time, the US accused Bustani of poor management, particularly of the OPCW finances, and called for a new DG to be appointed.

Following inconclusive consideration of the DG issue at the 28th session of the EC between 19–22 March 2002, a first Special Conference of States Parties was convened on 21 April 2002 to vote on a motion to end Bustani's tenure. States parties voted 48 in favour, 7 against (with 43 abstentions) to do so. The vote broke largely along regional lines, with the majority of 'yes' votes coming from the Western European and Others Group (WEOG) and the Eastern European (EE) group, and most of the abstentions coming from the remaining three regional groups.[22]

However, it would be simplistic and inaccurate to suggest that all the states parties in WEOG and the EE group wanted Bustani replaced, or that the majority of the states parties of the other three regional groups were indifferent.[23]

Irrespective of how the termination of Bustani's tenure is interpreted, two things are clear. First, despite the management problems that had developed over the previous two or so years, Bustani's energy and enthusiasm had a very positive impact in the first few years of the OPCW's existence. Second, there are still serious systemic problems facing the OPCW, in particular the respective roles of the EC and TS in its decision-making processes and operation, and the differences of view on the OPCW budget and on the optimum size of the organisation (which, as discussed below, will become more acute in the next few years as the requirement for monitoring CW destruction increases). The forthcoming Revcon will be an excellent opportunity to consider these issues. As the then Acting DG, John Gee, stated in his opening statement of the 29th session of the EC, it is important for the OPCW to put the painful issues behind it and look to the future.[24]

The first Special Conference of States Parties was re-convened on 25 July 2002 to appoint Ambassador Rogelio Pfirter of Argentina as the new DG. Since then, Pfirter has undertaken an active programme to improve the transparency of TS management, ensure a greater sense of common purpose between states parties and the TS, and ensure adequate and proper use of financial resources. During the Seventh CSP in October, there was a strong sense that the states parties and the OPCW had moved beyond the difficult situation they had faced earlier in the year. And, while the Seventh CSP had difficult issues to deal with, it managed to conclude almost on schedule (at 2300 hours on 11 October), having agreed on a reasonable budget (see above) as well as agreeing to shift the focus of industry inspections towards a greater emphasis on discrete organic chemical (DOC) plant sites.

Chemical terrorism

The terrorist attacks on the US on 11 September 2001 increased the international community's awareness of the threat posed by non-conventional forms of terrorism, including chemical terrorism. It was recognised that universality (or universal membership)[25] and full implementation of the provisions of the CWC would raise the barriers to chemical terrorism. In particular, the requirement under Article 1 of the convention that all CW be destroyed would make such weapons less accessible

to terrorist groups. The requirements of Article VII that states parties criminalise the prohibitions of the CWC (that is, make it a criminal offence for individuals to engage in activities prohibited by the CWC) and enact effective penal legislation would reduce the possibility that a CWC state party could inadvertently become a safe haven for those who seek CW as a tool of terror, and thus help to reduce the threat posed by chemical terrorism. Likewise, the transfer (export control and monitoring) obligations under Article VI would serve to reduce the risk of diversion of toxic chemicals—either weaponised CW or precursors of military chemical agents (including those listed in the CWC schedules[26]), or other toxic chemicals—for terrorist uses. The provision of emergency assistance under the provisions of Article X was also recognised as a key role for the OPCW in responding to an incident of chemical terrorism.

In response, the EC established an anti-terrorism working group during its 27th session in December 2001.[27] This working group has met several times and discussed the issues of obtaining universality, full implementation of all provisions (including national legislation) to raise the barriers to chemical terrorism, and the provision of emergency assistance following a chemical terrorism incident.

The status of current activities

National implementation obligations

Implementation of the CWC by states parties requires the adoption of a range of legislative and administrative measures to enable each party to enforce its international obligations at a national level, including the collection of information required for declarations and enabling OPCW inspectors to conduct inspections on its territory.[28] Since entry into force there have been several workshops (in The Hague and regional workshops) to help states parties prepare their national legislation. As of October 2002, only 43 percent of states parties had informed the TS that they had legislation in place. Providing legislative support has been a major activity of the TS Legal Division since entry into force, as legislation is necessary to ensure that the TS is able to conduct inspections without delay. Fortunately, no inspections have been delayed so far because of lack of national legislation.

However, the issue has taken on a new dimension with the recognition of the importance of national implementation and criminalisation of the convention's

prohibitions as a means to raise the barriers to chemical terrorism.[29] A solid legal network of implementing legislation would enable the OPCW to fully implement its nonproliferation mandate and eliminate 'safe havens' or loopholes that could be exploited by chemical terrorists. Unfortunately, TS activities to support legislative/implementation assistance have also been delayed by the OPCW's financial problems.[30]

Declarations

The overall poor rate of submission of initial declarations was a major disappointment in the first two years after entry into force of the CWC.[31] Following a concerted effort by the TS in early 2000, all initial declarations had been submitted by the Fifth CSP, including the American industry declaration.[32] However, it has become clear that a considerable number of initial declarations are incomplete. It has also been recognised that the declaration requirements for states parties are complex and that some have experienced difficulty in compiling the required information because of technicalities.[33] The TS, in co-operation with a number of interested states parties, has been assisting those which have had difficulty in completing their declaration requirements.[34] The TS has also been requesting a number of states parties to check and provide more accurate information, including on other chemical production facilities (OCPFs) producing DOCs. More recently, the TS has been undertaking clarification procedures to correlate declared information with chemical production information available from open sources.

Routine inspections

The first OPCW inspection began on 1 June 1997 (just over one month after entry into force). As of 4 October 2002, the TS had carried out 1,246 inspections at 546 sites in 51 states parties.[35] The breakdown of inspections is as follows: 294 inspections at CW destruction facilities; 249 to CW production facilities; 174 to CW storage facilities; 20 to abandoned CW sites; 39 to 'old CW' sites; 102 to Schedule 1 facilities; 196 to Schedule 2 plant sites; 90 to Schedule 3 plant sites; and 82 to DOC plant sites. OPCW inspectors had spent a total of 71,000 person-days on missions. As of 4 October, 130 inspections had been conducted in 2002.

These figures may look impressive. However, since the beginning of 2001, because of financial problems, the TS has been unable to conduct all the industry inspections

originally planned and budgeted for. For example, in 2001 the TS was only able to conduct 28 Schedule 2 inspections (70 percent of the planned number), 12 Schedule 3 inspections (29 percent of those planned) and 17 DOC inspections (53 percent of those planned). More recently, the TS has calculated that it will only be able to conduct just over half of the 307 inspections originally approved for 2002 unless supplementary funding, in the form of additional assessments to the states parties or voluntary contributions, is received during 2002.

Overall, there has been a high degree of satisfaction within the OPCW and among states parties and personnel at industrial facilities at the way industry inspections have been conducted. Although minor problems have occasionally arisen in the course of some inspections,[36] for the most part they have been carried out smoothly and with the full co-operation of the inspected state party.[37] The increased number of states parties being inspected (from 35 at the end of 1999 to 51 by the end of 2001) is a promising trend. This is a consequence of the greater number of inspections of Schedule 3 and DOC plant sites which are being selected for inspection using an algorithm designed to ensure broad geographic distribution.[38] In addition to spreading the inspection load among a greater number of states parties, this results in more inspections being conducted at 'CW-capable' facilities which many experts regard as most relevant with respect to recent CW proliferation programmes.[39] The Seventh CSP agreed on a programme of 132 Article VI inspections for 2003, with 16 Schedule 1, 38 Schedule 2, 18 Schedule 3 and 60 DOC inspections.[40]

CW destruction

By October 2002, OPCW inspectors had verified the destruction of approximately 6,900 tonnes of chemical agents and more than 2 million munitions. The US, India and 'a state party' which has been identified by VERTIC as South Korea[41] have each destroyed a substantial portion of their Category 1 CW. India and South Korea are expected to meet the CWC 10-year CW destruction deadline.[42] Russia is having considerable difficulty in destroying its CW. In 2000, it was granted an extension to an intermediate destruction deadline.[43] In October 2001 it requested an extension of the 10-year destruction deadline and the intermediate timelines, which was approved in principle at the Seventh CSP. Russia is currently receiving both technical and financial assistance from several states parties, including the US and some members of the European Union (EU), to assist it in meeting its CW

destruction obligations. Some semi-official American sources suggest the US may also have difficulty in meeting the 10-year timeline.

Consultations, co-operation and fact-finding

A number of other states parties have also used the informal bilateral consultation procedures, provided for in Article IX of the treaty, to consult and seek clarifications from a number of states parties on the information provided in their declarations. The US has reported that it has used these procedures and in a number of cases has achieved satisfactory resolution of outstanding issues.[44]

No challenge inspections had been requested or conducted by October 2002.[45] However, several practice challenge inspections (PCIs) had been conducted, including a number in collaboration with OPCW inspectors. One of these exercises simulated the entire challenge inspection process from the submission of the request and the convening of a special session of the EC to consider the request through to the preparation of a final report.

These PCIs are seen as valuable experience for the EC, the TS and states parties in preparing for the possibility of a real challenge inspection. The TS has also put into place the necessary internal procedures so that it can react both rapidly and effectively when a request for such an inspection is made, including having members of the inspection team, approved equipment and logistical support in a state of readiness.

Nor had any investigations of alleged use (IAUs) been requested or conducted up to October 2002. There have been a number of exercises on IAU and delivery of assistance, conducted by the OPCW and states parties. These have highlighted the importance of human factors, such as interviewing techniques and the collection of evidence, and the need for appropriate equipment. As in the case of challenge inspections, the TS has put in place the necessary internal procedures to allow it to dispatch an inspection team at short notice.

Unresolved verification issues

By October 2002, most of the issues which could not be fully resolved in the PrepCom, or which had arisen during the early implementation phase of the CWC, had been agreed or had been overtaken by events.[46] The following outstanding issues are currently being considered in the 'industry issues cluster':

- low concentration limits for Schedule 2A and 2A* chemicals;
- the development of common standards for states parties' compilation of their aggregate national data (AND) related to transfers of Schedule 2 and 3 chemicals;
- captive use; boundaries of production (that is, those parts of the plant site to which the inspectors would be given full access);
- transfers of Schedule 3 chemicals to non-states parties; and
- the development of proposals by states parties for the selection of OCPF sites for inspection.[47]

A decision on AND was approved at the Seventh CSP.

Future challenges

Size and budget of the OPCW

Clearly, the budget planning process has caused considerable difficulties in the first five years of the OPCW's life. A major obstacle in developing the annual budgets has been the lack of agreement on the size of the OPCW, with some states parties (primarily some of the major financial contributors) arguing that it should only have very limited (if any) growth, and the TS arguing that for the OPCW to fulfil its mandate there will need to be a substantial increase in its size, requiring an increase in its budget.[48]

The 'zero growth' budget approach will need to be reassessed. For the OPCW to remain credible, there should be at least a sufficient increase in the budget to enable the TS inspectorate to be fully utilised and a reasonable number of industry inspections to be conducted. In his respect, the agreed budget for 2003 is a promising sign.

With a limited budget, there will also be a need to balance competing priorities. This prioritisation task will require careful consideration, a high level of commitment to the basic objectives of the CWC, and a level of maturity not yet demonstrated consistently by some states parties. This will be the major challenge of the forthcoming Revcon and beyond. Another budget issue that will need to be addressed as a priority is the income–cash flow problem caused by the slow rate of payment by the possessor states of invoices for CW-related inspections carried out under Articles IV and V.

CWC timelines

A continuing challenge facing the OPCW is the adherence of all states parties to the various CWC timelines. In particular, there are increasing concerns about national implementation requirements not being met, particularly five years after entry into force.

There are continuing concerns about CW possessor states parties meeting their CW destruction timelines. However, it is important to keep this issue in perspective. The 10-year time-frame for destruction of all CW was agreed in the late 1980s at a time when the US and the former Soviet Union were both confident that they could destroy all their CW within 10 years.[49] From a pragmatic point of view, in the light of the concerns about chemical terrorism, a major issue is that all CW stockpiles are securely stored while they await destruction.

Verification of CW destruction

As discussed above, the majority of inspections conducted so far by the OPCW inspectorate have been associated with verification of the destruction of CW. There are two major reasons for this situation. The first is that the US and Russia never concluded their bilateral destruction agreement, which would have seen the bulk of the verification of destruction of their respective CW stockpiles being conducted by bilateral inspection teams, with OPCW inspectors only providing complementary verification.[50] The second is the interpretation of the CWC text adopted by the PrepCom, which requires the continuous presence of OPCW inspectors during the operation of chemical weapon destruction facilities (CWDFs).[51]

It has recently been estimated that there will be a substantial increase in the inspection workload for CWDFs in 2003 as four additional CWDFs are scheduled to commence destruction operations.[52] There are concerns that there will not be enough resources in the OPCW Inspectorate to provide the level of verification of destruction required. The TS is working closely with the possessor states to develop more cost-effective approaches, including the possibility of using the improved remote verification technologies now available. Unless cost-effective approaches are developed, there are concerns that most of the resources of the inspectorate will be required for verifying CW destruction as the new CWDFs begin operations, which would result in minimal resources being available for verifying non-production by industrial facilities.

Verification of chemical industry

It will be necessary to review and adjust, as appropriate, the proportions of inspection effort under Article VI allocated to Schedule 1, Schedule 2, Schedule 3 and DOC facilities. It became apparent during the negotiation of the CWC that, because of uncertainty about the number of facilities that would be declared under schedules 1, 2, and 3 and as DOC facilities, as well as the relative risks they present to the object and purpose of the CWC, it would be impractical to try to develop rigid solutions in the convention text. The nature of the practical verification problems involved would only become apparent in the course of implementation of the CWC. Accordingly, the Article VI regime was designed to be flexible and open to future adjustment in the light of practical experience gained.[53]

During the first few years after entry into force, there was an obvious focus on the initial inspections of Schedule 1 and 2 facilities, to meet specific convention timelines. However, following completion of the initial inspections, a higher proportion of the available resources have been provided for Schedule 3 and DOC inspections. There will be a need to regularly assess the relative risks posed to the convention of various types of facilities in order to take into account all relevant facilities, including Schedule 3 and DOC facilities.

Export monitoring and transfer obligations

There has been a tendency on the part of a number of states parties in the early operational phase of the CWC to focus exclusively on specific CWC obligations. However, there is also a requirement to adhere to the general obligations of the CWC, such as those in Article 1. For example, considerable attention has been directed to transfers of Schedule 1 chemicals (even in nanogram quantities, which are insufficient to incapacitate one person), with little, if any, consideration of transfers of 'non-scheduled' CW precursors which were acquired and used by CW proliferators in the 1980s.

It will be important as experience develops for states parties to develop a broader perspective on what constitutes 'CWC-relevant chemicals', which clearly goes beyond the chemicals listed in the three schedules.[54]

Also important in this regard is implementation of the general purpose definition of CW, in recognition that other toxic chemicals (not just those listed in the CWC schedules) could be used in a state proliferation programme or by a terrorist group.[55]

The 2003 Review Conference

The EC recommended that the first CWC Revcon should begin on 28 April 2003[56] and run for two weeks, and this was agreed by the Seventh CSP in October 2002. In late September 2001, the EC established an open-ended working group to begin preparations for the Revcon. By October 2002, the group had met several times and discussed the objectives and methodology of the Revcon. Rather than the traditional article-by-article review, the Revcon will review the CWC on the following themes: implementation of the convention (including universality, changes to the security environment and terrorism); destruction of CW and former CW production facilities; nonproliferation measures; verification; assistance; and international co-operation.

A key issue is the future operation of the OPCW, and in particular how much the states parties want the OPCW to do and how much they are prepared to pay. There will clearly be a need to get the various balances right, and adjust the available resources accordingly, between the competing demands of: verification of destruction of CW and production facilities (Articles IV and V); industry verification (Article VI), including allocation of resources for inspections of Schedule 1, Schedule 2, Schedule 3 and OCPFs; and international co-operation and assistance, including support in developing national legislation (Article VII), assistance and protection (Article X), and economic and technological development (Article XI).

It will be necessary to review current verification procedures to ensure that the convention remains effective. For example, many verification-related decisions were adopted on an interim basis on the understanding that the issues would be further considered and refined as the OPCW gained experience. Careful review of verification procedures will be needed, based on the early experiences of the OPCW inspectorate, including issues related to access to records, the extent of access to chemical industry plant sites, and sampling and analysis. It would also be useful to review some of the technical decisions developed during the PrepCom, including the decision on very limited information to be declared for OCPFs,[57] the decision on 'blinded analytical instruments',[58] and the limitation of the OPCW analytical database to those chemicals listed in the CWC schedules and their degradation products.[59]

One of the difficult issues faced over the past five years has been finding an acceptable balance between the need for transparency in the operations of the OPCW

and the need to protect sensitive information. With five years' experience, it will be necessary to review the balance between the protection of confidentiality and the benefits of transparency.

It will also be important to review developments in science and technology and changing industry practices that may have an impact on the CWC. For example, recent developments in chemistry have included novel methods of production of toxic chemicals (including through biologically mediated processes) and novel toxins. The past decade has also seen the development of new monitoring techniques, including miniaturised sensors and portable chemical analysis equipment. Further development of such items may reduce the current levels of 'inspector presence' deemed necessary at CW-related facilities and allow the development of rapid screening methodologies using portable analytical equipment to support verification. There will clearly be roles for the Scientific Advisory Board[60] and scientific advisers of states parties in ensuring that the CWC keeps abreast with, and makes maximum use of, scientific developments.

The CWC text was carefully drafted to allow flexible implementation in order to take into account such changes without the need for frequent amendments to the convention text. Critical to the success of the next phase in the life of the OPCW will be an effective review process, without the political games that have at times undermined the efforts of the PrepCom and early OPCW to have an effective organisation fulfilling the mandate provided by the convention.

Conclusion

In a report on the advent and performance of the OPCW written in early 2000, the present author wrote: 'Being a dynamic organisation, the OPCW will face new and sometimes unexpected challenges and will need to be evolutionary'.[61] Clearly, the OPCW has faced unexpected challenges in the past two years, particularly its financial problems, TS management issues, and the need to develop a response to chemical terrorism.

The problems experienced by the OPCW over the past couple of years, painful as they have been, should be regarded as the teething troubles of a young organisation. It is salutary to contrast the CWC at the five-year mark with the Nuclear Non-Proliferation Treaty (NPT) in its early days. Although the NPT was simpler

than the CWC, and the implementation processes correspondingly easier,[62] there were a number of teething troubles in its early years. These included: delays caused by international disputes unrelated to nuclear weapons;[63] the absence of key countries;[64] disagreements between the International Atomic Energy Agency (IAEA) and the European Atomic Energy Community (Euratom);[65] and delays in the preparation of safeguards agreements.[66] At the first NPT Review Conference in 1975 a number of concerns were expressed and a number of discouraging assessments made.[67] However, the NPT has become a major arms control success.[68]

It is important that the recent problems of the OPCW be seen in this perspective. Despite the problems, the OPCW is performing remarkably well for a young international organisation. Even under the circumstances experienced in recent months, the TS has demonstrated that the CWC verification regime can function as intended, providing the necessary confidence that states parties are complying with their obligations under the CWC and providing an effective deterrent to states which may be considering violating the treaty. There are also positive signals that the OPCW is already moving beyond the difficulties it faced earlier in the year. Notable signals include the increased budget for 2003, approved at the Seventh CSP, which should enable the OPCW inspectorate to be fully and effectively employed in 2003, and the development of credible responses to chemical terrorism. In addition, thorough preparations are being made for the first Review Conference, which should facilitate a detailed review of all aspects of the operation of the CWC in the light of the changing international climate, the early experience of the OPCW, and scientific and technological developments.

The OPCW still faces serious challenges. The next few years will be critical to the long-term prospects. Challenges include:

- universality;
- full adherence by all states parties to the CWC declaration and legislative requirements;
- the need to balance competing priorities within the limited OPCW budget;
- making optimal use of new monitoring techniques in order to make verification of CW destruction less resource-intensive;
- maintaining a credible number of industry inspections with a broad geographical distribution;

- a better appreciation of export licensing issues;
- further development of the OPCW response to chemical terrorism; and
- greater transparency in the operations of the OPCW.

There are good reasons for optimism that the OPCW will rise to meet these challenges.

Finally, the potentially positive impact of the CWC on other arms control issues should be recognised. In the current international climate, a number of significant states are reluctant to accept compliance monitoring measures for other arms control treaties (such as a protocol to strengthen the BWC, which is currently stalled). A successful OPCW will provide a strong argument for effective verification measures being included in other arms control regimes.

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Endnotes

[1] Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction, opened for signature 13 January 1993; entered into force 29 April 1997.

[2] At the time, this committee was called the Eighteen Nation Disarmament Committee. It became known as the Conference of the Committee on Disarmament in 1969, and then the Committee on Disarmament in 1979. This was renamed as the Conference on Disarmament in 1984.

[3] Martine Letts *et al.,* 'The conclusion of the Chemical Weapons Convention: an Australian perspective', *Arms Control,* vol. 14, 1993, pp. 311–332.

[4] Robert J. Mathews, 'Preparing for implementation of the Chemical Weapons Convention: progress during 1996', in *Verification 1997*, Verification Technology Information Centre, London 1997, pp. 81–105; and Robert J. Mathews, 'Entry into force of the Chemical Weapons Convention', in *SIPRI Yearbook 1998: Armaments, Disarmament and International Security,* Oxford University Press, Oxford, 1998, pp. 490–500.

[5] Robert J. Mathews, 'Chemical disarmament: advent and performance of the OPCW', in Trevor Findlay (ed.), *Verification Yearbook 2000,* The Verification Research, Training and Information Centre (VERTIC), London, 2000, pp. 71–86.

[6] The first four CSPs experienced considerable difficulties in decision making and a considerable amount of extra time was required to negotiate various issues which could not be agreed before the CSP. Of the issues facing the second, third and fourth CSPs, the budget issue was the most protracted. See Mathews, 'Chemical disarmament: advent and performance of the OPCW', 2000.

[7] In late 1999, in an attempt to improve communication between the organs of the OPCW, an informal bureau was established which included the chairs of the EC and the Committee of the Whole, and the DG. This bureau met on a regular basis to review issues currently under consideration and plan future work.

[8] For example, at the Fourth CSP in May 1999, Germany (speaking on behalf of the European Union) expressed concern that the 'failure by a state party with a major chemical industry to provide declarations has led in 1998 to 64 percent of Schedule 2 inspections and 54 percent of Schedule 3 inspections being carried out in member states of the European Union'.

For the purposes of routine verification, the CWC specifies three schedules of chemicals. Schedule 1 chemicals are those which pose a high risk to the purposes of the convention, and include nerve and blister CW agents; Schedule 2 chemicals are those which pose a significant risk and include key precursor chemicals to nerve and blister agents; and Schedule 3 chemicals are those which pose a risk, and include toxic chemicals and precursor chemicals which are widely used in industry. There is also a fourth category, discrete organic chemicals (DOCs). Facilities that produce 'scheduled' and DOC chemicals above specified thresholds are required to make declarations and are subject to routine inspections.

[9] The DG's original contract was to expire on 13 May 2001, a day or so before the likely date of the Sixth CSP (14 May 2001). In the lead-up to the Fifth CSP, it was the general view that the position of the DG would be considered in the latter part of 2000 and a decision taken at the Sixth CSP. However, to the surprise of many states parties, on the Friday before the start of the Fifth CSP, Brazil circulated a draft decision for the Fifth CSP on the renewal of Bustani's appointment. This proposal appeared to gain early support from a considerable number of states parties, including those in the Latin American and Caribbean Group, the US and Russia. However, many states parties were clearly not prepared for consideration of the issue at the Fifth CSP and had to hurriedly seek instructions from their national capitals after the start of the meeting.

[10] One state party (Canada) requested that its concerns on the issue be released as a National Statement. See Canada, Statement on the Renewal of the Appointment of the Director-General, EC-MX/NAT.2, 16 May 2000.

[11] 'Full programme delivery' in 2002 (i.e., accomplishment of all planned activities by the TS) would have required a budget of €64.1 million. On the budget problems see also 'Getting verification right: proposals for enhancing implementation of the Chemical Weapons Convention', The Verification Research, Training and Information Centre (VERTIC), London, 2002, available at www.vertic.org.

[12] Of particular note was a contribution of US$2 million by the US in September 2002. A number of states parties have also provided voluntary contributions to support the fund for assistance (Article X) and the associate programme (Article XI), and hosted training courses, regional workshops and seminars.

[13] The actual cost increase for staff costs over two years was about 9.6 percent (€2.1 million) whereas the budgeted increase for staff costs was only 3.5 percent.

[14] Budgeting was based on overoptimistic assumptions about the amount of time for which CWDFs would be operating during the following calendar year.

[15] Although there was agreement at the Fourth CSP that the maximum tenure of TS staff should be seven years (based on agreement among states parties that the OPCW should not offer 'career positions'), the Conference was unable to agree on a starting date for the introduction of the policy and requested the Council to decide on this—which it has so far not done.

[16] This would comprise €64 million from assessed contributions (a 10 percent increase over the approved 2002 budget), with the remaining €5.9 million to be generated from reimbursements of the costs of verification under Articles IV and V.

[17] This budget is based on €64 million in regular assessed contributions (up 9.9 percent on the assessed contributions of 2002), an estimated €3.9 million to be reimbursed during 2003 from CW possessor states parties of Articles IV and V verification costs, and €0.6 million in bank interest.

[18] There have been delays in many verification-related decisions by the EC, and this has caused considerable delays to the verification activities of the TS, perhaps most notably the approval of facility agreements.

[19] A meeting of the EC was requested by the US in July 1999 specifically to discuss the roles and functions of the EC. The American delegation stressed the need for the EC to provide executive oversight to the TS without micromanaging its affairs and suggested that the organs of the OPCW review their roles, areas of authority, reporting responsibilities and consultative processes. However, this issue was not resolved to the satisfaction of all states parties.

[20] For example, at the Fourth CSP, the DG stated: 'The pioneering work of the OPCW cannot be held ransom to short-sighted acts of micromanagement and, on occasion, to individual idiosyncrasies'. C-IV/DG.12, 28 June 1999.

[21] States parties' loss of confidence in the DG was also related to the disappointment felt by a substantial number of states parties in the process by which the DG was reappointed during the Fifth CSP (see above).

[22] '[T]he vote broke largely along regional lines, with all but nine of the yes votes coming from WEOG and EE, and all but 4 of the abstentions coming from Africa, Asia or Latin America and the Caribbean. The seven states voting no were Belarus, Brazil, China, Cuba, Iran, Mexico and Russia. Notably, India was among the yes votes with France and South Africa among the abstentions.' Pamela Mills, 'Developments in the Organisation for the Prohibition of Chemical Weapons', Quarterly Review no. 38, *CBW Bulletin,* issue 56, June 2002, p. 8.

[23] There were states parties in each of the five regional groups which were satisfied with Bustani's performance, just as there were others within each regional group who felt that his tenure should be terminated. Other states parties were not necessarily convinced that Bustani was still the best person for the job but felt it would be less damaging for the OPCW to allow him to finish his term than to pursue the potentially divisive process of removing him mid-term.

[24] EC-29/DG.10, 25 June 2002.

[25] By October 2002, there were 147 states parties including: the US and Russia (the two largest possessors of CW); the major chemical-producing and -exporting states of Europe and Asia; and many of the major

developing states with chemical production capability. There were still 27 signatory states which had not ratified, and 20 states which had neither signed or ratified the convention. Of particular concern is that a number of countries of CW-proliferation concern have not signed the CWC, including Egypt, Iraq, Libya, Syria and North Korea. A significant number of developing countries have also yet to ratify the CWC.

[26] On the schedules, see note 8.

[27] This group will co-operate with the UN Security Council's Counter-Terrorism Committee, which was established on 28 September 2001 in accordance with UN Security Council Resolution 1373, 28 September 2001.

[28] Robert J. Mathews and Timothy L.H. McCormack, 'Entry into force of the Chemical Weapons Convention: national requirements and prospective timetable', *Security Dialogue,* vol. 26, no. 1, 1995, pp. 93–107.

[29] A number of states parties which already have national legislation are reviewing it to ensure that it fully reflects CWC obligations. For example, some states parties limited their original legislation to chemicals listed in the three schedules, without covering other toxic chemicals which could be used as CW.

[30] For example, a meeting of the network of legal experts for Latin America and the Caribbean, which was scheduled to be held in May 2002, has been postponed indefinitely.

[31] For example, only 36 percent of initial declarations were submitted within the specified timeline, and by the end of 1999, 26 percent of the states parties still had not submitted their initial declarations.

[32] The submission of the US chemical industry declarations was a particular relief. Concerns had been expressed both in the EC meetings and during CSPs of the serious implications of this 'technical non-compliance' for the successful implementation of the convention, including the application of Article VI (chemical industry) verification in a fair and balanced manner. As reported earlier, certain states parties had attempted to limit the number of re-inspections of Schedule 2 facilities until all states parties had submitted their industry declarations and received their initial inspections. Mathews, 'Chemical disarmament: advent and performance of the OPCW', 2000.

[33] In addition, many states parties have failed to notify points of entry for inspection teams and failed to give notification of their national authorities, which complicates inspection planning by the TS.

[34] This has included the establishment of an OPCW Declaration Network of experts from states parties who are available to help other states parties in completing their declaration obligations.

[35] This number includes rotations of inspection teams at operating CW destruction facilities, where OPCW inspectors conduct systematic verification through on-site inspection on a continuous basis. A rotation is counted as a new inspection.

[36] For example, as of October 2002, there had been eight recorded uncertainties involving lack of access to parts of a Schedule 2 plant site to verify the absence of Schedule 1 chemicals, and five uncertainties involving lack of access to records deemed necessary by the inspection team to confirm non-diversion of the declared Schedule 2 chemical. In two states parties, access beyond the declared Schedule 2 plant was not granted because of differences in the interpretation of para. 25 of Part VII and its references to para. 51 of Part II of the CWC Verification Annex. However, all these matters were subsequently resolved.

[37] For a detailed account and analysis of the conduct of industry inspections, see John Hart, 'Chemical industry on-site inspections', VERTIC Research Report no. 1, The Verification Research, Training and Information Centre (VERTIC), London, October 2001.

[38] The original selection methodology, based on a proposal by Australia and the Republic of Korea, is currently being further developed and refined. See Australia and Republic of Korea, 'Methodology for selecting Schedule 3 and discrete organic chemical (DOC) plant sites for inspection', OPCW EC.XVI/NAT.5, 16 September 1999.

[39] For example, Iraq used a number of Schedule 3- and DOC-type facilities in its CW production programme in the 1980s. See John Gee, 'The destruction, removal or rendering harmless of Iraq's chemical warfare capability', *Disarmament,* vol. 15, no. 2, 1992, pp. 77–93.

[40] The distribution agreed for 2002 was 18 Schedule 1, 40 Schedule 2, 42 Schedule 3 and 32 DOC inspections.
[41] 'Getting verification right: proposals for enhancing implementation of the Chemical Weapons Convention', 2002.
[42] Under the CWC, each state party possessing CW is required to destroy them within 10 years (with a possible five-year extension) of entry into force.
[43] In accordance with the CWC Verification Annex Part IV(A), para. 17, states parties are required to destroy not less than 1 percent of their Category 1 stockpile (which includes CW based on nerve and blister agents) not later than three years after entry into force (i.e., by 29 April 2000).
[44] 'News chronology', *CBW Conventions Bulletin,* 28 June 1999.
[45] The US has expressed concerns that some states parties are not in full compliance with the CWC but so far has chosen to seek clarification through bilateral consultations, rather than request a challenge inspection.
[46] For example, the lack of agreement on the model facility agreements by the PrepCom resulted in delays in concluding some facility agreements but was not the major problem that some predicted in implementing the CWC, as many states parties which possess facilities which require a facility agreement used the most recent 'red-lined' version of the Model Facility Agreement as the basis for their negotiations with the OPCW.
[47] The issues of captive use and boundaries of production were actually agreed during the end-game of the CWC in 1992, but unfortunately were reopened during the PrepCom.
[48] There have been other contributing factors to the financial problems, including the lack of flexibility in the approved annual budget approach and the difficulty in planning a budget for the following calendar year in the month of May. The latter problem should be overcome this year with the Seventh CSP.
[49] For example, at the time, the former Soviet Union had just completed the construction of a CW destruction facility at Chapayevsk. However, the facility was never approved for operation, partly because of environmental and safety concerns raised by local residents.
[50] In accordance with Article IV, para. 13.
[51] This 'convention requirement' is based on a particular interpretation of the words 'verification through continuous monitoring with on-site instruments and physical presence of inspectors', which appear in the CWC Verification Annex, Part IV(A), para. 59(b) (with respect to destruction of CW), Part V, para. 40 (with respect to destruction of former CW production facilities), and Part V, para. 83 (with respect to conversion of former CW production facilities). When the text was negotiated, it was the author's understanding that the word 'continuous' referred to 'monitoring with on-site instruments' and that there was no convention requirement for inspectors to be continuously present. During the PrepCom, the more stringent interpretation was adopted.
[52] John Gee, 'The CWC and the task of eliminating chemical weapons: the first five years', Opening Address to the International Chemical Demilitarisation Conference, The Hague, 21–23 May 2002, available at www.opcw.org/html/global/speeches/dera_2k2.html.
[53] Robert J. Mathews, 'Intention of Article VI: an Australian drafter's perspective', *OPCW Synthesis*, November 2000.
[54] This issue has long been recognised. For example, in a 1996 PrepCom Working Paper, Iran recognised the relevance of a number of non-scheduled chemicals for export licensing purposes. Islamic Republic of Iran, 'Implementation of Article XI in the field of chemical trade', PC-XV/B/WP.6, 5 November 1996.
[55] Indeed, a more pragmatic view has been taken by many states parties as a consequence of the greater recognition of the potential terrorist threat from toxic chemicals not on the CWC schedules.
[56] In accordance with the CWC, Article VIII, para. 22.
[57] In some cases, states parties are providing less information than is available in companies' brochures and on their websites.
[58] Blinded analytical equipment uses special 'blinded software' and a restricted database to provide only 'presence/absence' information on CWC-related chemicals.

[59] The lack of analytical data for the majority of members of the various families of scheduled chemicals is regarded as a serious gap, which should be addressed as a priority. In the interest of effective verification, it is also hoped that spectra of other relevant chemicals will be promptly added to the OPCW analytical database.

[60] The Scientific Advisory Board (SAB) is tasked with providing independent scientific advice to the DG on a number of scientific and technical issues. It has met several times already and considered a range of issues, including destruction technologies, ricin production, saxitoxin, salts of scheduled chemicals, low concentrations of scheduled chemicals and analytical procedures. See Claude Eon, 'The Scientific Board of the OPCW: an overview', Paper presented at the International Union of Pure and Applied Chemistry Workshop on Impact of Scientific Developments, Bergen, Norway, 30 June–3 July 2002.

[61] Mathews, 'Chemical disarmament: advent and performance of the OPCW', 2000, p. 81.

[62] For example, the NPT did not require the establishment of a new international organisation and had considerably less detailed national implementing measures for prospective states parties than the CWC; moreover, many of those requirements were not required to be in place before entry into force of the NPT. See Robert J. Mathews and Timothy L.H. McCormack, 'Entry into force of the Chemical Weapons Convention: national requirements and prospective timetable', *Security Dialogue,* vol. 26, no. 1, 1995, pp. 93–107.

[63] For example, ratification by the US was delayed by several months as a result of the Soviet invasion of Czechoslovakia in August 1968. See *SIPRI Yearbook 1968/69,* Almqvist & Wiksell, Stockholm, p. 165.

[64] As of 31 December 1975, only about two-thirds of states had ratified or acceded to the NPT. At that time, the non-states parties included two nuclear weapon states (China and France) and several non-nuclear weapon states which were deemed to have the technical capability to produce nuclear weapons. See *SIPRI Yearbook 1976,* Almqvist & Wiksell, Stockholm, and MIT Press, Cambridge, Mass. and London, 1976, pp. 388–392.

[65] For example, there was a delay in new ratifications and accessions to the NPT while some countries (the non-nuclear weapon states in Euratom, Belgium, the Federal Republic of Germany, Italy, Luxembourg and the Netherlands) waited for safeguards negotiations between the IAEA and Euratom to be concluded.

[66] By the end of 1973, only 29 states parties had concluded safeguards agreements with the IAEA, as required by the NPT, that is, 36 percent of those under obligation to do so; 15 additional states had signed agreements but were not yet bound by them as notification requirements had not yet been met; and four more agreements had been approved by the IAEA Board of Governors but had not been signed. See *SIPRI Yearbook 1974,* Almqvist & Wiksell, Stockholm, and MIT Press, Cambridge, Mass. and London, 1974, p. 441.

[67] For example, 'It is hard to see how the NPT can now contribute towards the establishment of an effective non-proliferation regime'; and 'The [review] conference succeeded in not breaking down. But it failed in solving the problems essential for the survival of the NPT'. *SIPRI Yearbook 1976,* pp. 11, 391.

[68] For example, in the early 1990s Australia's Foreign Minister described the NPT as 'the single most effective and widely supported arms control agreement in existence: without it we would by now be facing a world with perhaps twenty or thirty nuclear weapons states'. See Gareth Evans and Bruce Grant, *Australia's Foreign Relations in the World of the 1990s*, 2nd edn, Melbourne University Press, Melbourne, 1995, p. 84.

5

Continued turbulence over BWC verification

Jenni Rissanen

Hopes that the international community could act together against the scourge of biological weapons, the daunting effects of which the world had just witnessed with the anthrax attacks in the United States, came crashing down on 7 December 2001. Diplomats at the Fifth Review Conference for the 1972 Biological Weapons Convention (BWC) walked the corridors of the Palais des Nations in Geneva in anger and disbelief after the conference became deadlocked at the last minute. The issue was all too familiar—the future of the negotiations on a verification protocol for the convention, which had been derailed just months before. A year's suspension of the Review Conference was the only way to avoid total failure.

This chapter describes developments related to the BWC verification issue during the period August 2001–October 2002. It focuses on the aftermath of the failure of the verification protocol negotiations and on developments leading up to the Review Conference in November–December 2001. These developments occurred in a new international environment following the 11 September terrorist attacks on the US. The chapter summarises verification- and compliance-related proposals and deliberations at the Review Conference, outlines the ensuing governmental and non-governmental steps and proposals for a way forward, and looks at the prospects for the resumed session of the Review Conference, to be held in Geneva on 11–22 November 2002.

The rejection of the protocol: aftermath

The year 2001 was eventful for the 30-year-old BWC.[1] It was meant to be the year in which the convention would be improved by a new tool—a legally binding verification protocol that would strengthen it and boost confidence in its imple-

mentation. However, the decade-old process turned sour in August 2001. The Ad Hoc Group (AHG) of states parties negotiating the protocol ended its final scheduled (24th) negotiating session without agreement after the US refused to support the Chair's 'Composite Text' or even to continue negotiations on it. The US announced that it no longer saw the protocol as a useful way of tackling the biological weapons (BW) problem. The group was so divided that it was even unable to drafts its report, and bitter recriminations continued until the early hours of 18 August.[2] The future of the AHG and the protocol looked uncertain, and diplomats hoped that the Fifth Review Conference, scheduled for three months later, would bring clarity and direction.

But then a series of events unfolded that changed the nature and scope of the debate on the protocol and the BW threat. First, on 4 September the *New York Times* reported three previously unknown US government biodefence projects which some experts argued were in violation of the BWC.[3] The three secret projects involved the building, construction and testing of a model of a Soviet-designed anthrax bomblet, the construction of a mock germ factory and plans to reproduce a genetically modified, allegedly vaccine-resistant strain of anthrax that had been produced by Russian scientists in the early 1990s.[4] Although the US Defense Department defended its work as being consistent with US treaty obligations because it was defensive in nature, the fact that the US had reportedly not been open and had not reported the work in the annual confidence-building measure (CBM) declarations to the United Nations[5] added to suspicions that the government knew the work was questionable. Indeed, the news appeared to give additional insight into why the US had wanted to block the protocol—to avoid international scrutiny of its questionable biodefence work.[6]

Some four weeks after the 11 September terrorist attacks, another set of events unfolded that attracted worldwide attention. Heightened fears about possible chemical or biological terrorist attacks became a reality on 4 October[7] when the death of a man from anthrax in Florida turned out to be the result of a deliberate bioterrorist attack, using the ordinary mail as a delivery system. By the time the attacks were over, more than 20 cases and five deaths were reported.[8]

There were hopes that the US would change its mind on the protocol in the light of the changed international environment and strengthened fears of BW use. These

hopes evaporated quite quickly after Avis Bolen, Assistant Secretary of State for Arms Control, told the First Committee of the UN General Assembly that 11 September had only reinforced the American view that the focus should be on BW use.[9]

Having rejected the protocol, President George W. Bush on 1 November proposed seven alternative measures, ranging from investigations of treaty violations to a code of conduct for scientists. The measures included:

- procedures for addressing compliance concerns;
- the enactment of national criminal legislation with extradition requirements;
- the improvement of international disease control and, in the event of a disease outbreak, the dispatch of expert response teams;
- the establishment of national oversight mechanisms for the security and genetic engineering of pathogenic organisms; and
- the promotion of responsible conduct in the study, use, modification and shipment of pathogenic organisms.

Bush described these measures as 'part of a comprehensive strategy for combating the complex threats of weapons of mass destruction and terrorism'.[10] Some of those involved in the protocol process, both inside and outside government, were, however, less impressed with the proposed measures, feeling that, although they could be useful in themselves, they did little for verification. Indeed, even collectively they did not add up to what the protocol would have been, and some of the measures, such as investigations, were in fact included in the proposed protocol text. Although most states were reluctant to respond to the American proposals, some privately acknowledged they would need to be greeted favourably for political reasons, particularly after the bioterrorist attacks in the US.

The Fifth Review Conference

Ninety-one states convened in Geneva for the convention's Fifth Review Conference on 19 November 2001. While the conference addressed a multiplicity of issues, including advances in science and technology, bioterrorism, compliance, export controls, scientific and technological co-operation, and universality, the derailed protocol negotiations emerged as the dominant theme. Much was at stake, not only the future of the protocol but also the credibility of the convention itself.

The President of the Review Conference, Ambassador Tibor Tóth, reminded delegations that their 'action or lack of action [would] shape the future of the biological weapons prohibition regime much beyond the Fifth Review Conference',[11] while UN Secretary-General Kofi Annan urged them 'to come together, overcome [their] differences, and take these next crucial steps in history of this landmark Convention'.[12]

What followed next, however, made 'coming together' more difficult. Delivering the American statement, Under Secretary for Arms Control and International Security John Bolton accused four states parties—Iraq, Iran, North Korea and Libya—plus Sudan (a non-state party) and Syria (a signatory) of operating clandestine BW programmes. He added that there were also others that the US could have named, and which it would be 'contacting privately'.[13] Iran, Iraq and Libya angrily rejected the American accusations as groundless.

The naming of names—an unusual diplomatic proceeding—took many delegates and observers by surprise. The accusations exacerbated the already tense and bitter atmosphere left over from the AHG's 24th session. Some suspected that the US was seeking to divert attention away from its rejection of the protocol and perhaps avoid questions about its own previously unknown biodefence activities.

Bolton also attacked the draft protocol, saying that the US would continue to reject such 'flawed texts' 'recommended to us simply because they are the product of lengthy negotiations or arbitrary deadlines' but which were 'not in the best interest of the United States and many countries represented here today'.[14] Others generally regretted the AHG's inability to conclude its work, or even to draft a procedural report, in time for the Review Conference.

As for the way forward, approaches varied greatly. Some delegations wanted to reconvene the AHG. Ironically, China, Cuba, Iran, Indonesia, Libya and Pakistan—which in 2001 were among those states resisting attempts to propel the AHG process into a final phase by moving talks from the heavily bracketed 'Rolling Text' to the Chair's compromise 'Composite Text'—were now (together with Russia, which kept a low profile throughout the AHG negotiations) among those most eager to reconvene the negotiations.[15] Others, including many Western countries, resigned themselves to the very remote possibility that the AHG could be reconvened in the near future, and spoke more vaguely of the importance of multilaterally agreed and legally binding measures.

For many states, ranging from Iran to the Rio Group,[16] and the European Union (EU), the AHG's mandate was untouchable. The EU, for example, considered it 'essential' that the group's mandate remain 'fully in force' and be 'successfully implemented' but stopped short of saying that the AHG should be reconvened.[17] Generally, there was a willingness, particularly on the part of Western countries and 'moderate' members of the Non-Aligned Movement (NAM), to move on and try to accomplish what was realistically achievable in current circumstances, but without abandoning the AHG altogether. Positions on the future of the group were so diametrically opposed that it was felt better to let the question lie dormant than allow the reawakened controversy to wreck the review process. There was also general willingness to consider some of the American proposals.

Bolton stressed the importance of national implementation measures, including arrangements to enhance criminal extradition agreements with respect to BW offences and legislation making it a criminal offence for persons to engage in activities prohibited by the BWC. Furthermore, he argued, countries should: adopt and implement regulations restricting access to dangerous micro-organisms, as well as on domestic and international transfers; report internationally any releases or adverse events that could affect other countries; and sensitise scientists to the risks of genetic engineering, explore national oversight of high-risk experiments and establish a code of conduct for scientists working with pathogens. Furthermore, the US was seeking the elaboration of a mechanism for international investigations of suspicious outbreaks of disease or alleged BW incidents. It also advocated a voluntary cooperative mechanism for clarifying and resolving compliance concerns by mutual consent.

Under Secretary Bolton further proposed that countries adopt and implement strict biosafety procedures, based on World Health Organization (WHO) or equivalent national guidelines; support the WHO's global disease surveillance and response capabilities; and develop a capacity for rapid emergency medical and investigative assistance in the event of a serious outbreak of infectious disease. The US believed this range of measures to restrict access, strengthen international disease detection tools and provide assistance in the event of an outbreak would 'enhance collective security and collective well-being'.[18]

With hopes dimming for agreement on the resumption of negotiations on a protocol in the AHG, and in view of ongoing and rapid advances in biotechnology, many

countries, including Australia, Canada, Japan, Norway and South Korea, and the EU, argued that states parties needed to meet more frequently. There was talk of annual meetings of states parties, preparatory committee meetings for the next Review Conference in 2006 and expert meetings.

Despite the many statements on the protocol and the AHG, proposals as to their fate were few, coming mainly from the NAM and the EU. Both regretted the failure to complete the negotiations, but they differed in their approach to the future. The NAM wanted the conference to recognise 'the particular importance of strengthening the Convention through multilateral negotiations for a legally binding Protocol' and to reaffirm that the AHG's 1994 mandate 'remains valid and determines any future work', stressing the importance of restarting and continuing the group's work.[19] The EU wanted the conference to recognise the role of verification in the strengthening of the convention but, unlike the NAM, did not call for the protocol negotiations to be completed or for the AHG to be reconvened.[20] For its part, the US did not mention the protocol or the AHG in any of its original proposals to the committee, holding its position on these crucial questions until the last day.

As the conference progressed, the question of the protocol and the AHG became increasingly interlinked with the question follow-up meetings. With little prospect that states parties would continue to be able to meet regularly in the AHG format, some states wanted to ensure that they would not have to wait for another five years to meet again. Proposals focused on annual meetings and preparatory committee meetings for the Sixth Review Conference, as well as meetings of expert groups. Australia, Canada and New Zealand wanted 'more frequent meetings of states parties to take action on the implementation of the Convention and Review Conference commitment, to reinforce compliance and to strengthen accountability'.[21] Japan supported 'a strong follow-up mechanism by convening intersessional meetings of states parties to discuss measures to strengthen the BWC including new proposals put forward during this Conference'.[22] The US submitted a modest proposal, suggesting that states parties meet between the fifth and the sixth Review conferences to consider and assess progress in the implementation of 'the new measures' adopted at the Fifth Review Conference, as well as to consider any additional steps or mechanisms.[23] Although this is not made clear from its proposal, the US apparently only envisaged one meeting.

The most detailed proposal came from the EU. It wanted annual meetings of states parties, beginning as early as in 2002, 'to explore further means and mechanisms to strengthen the convention' prior to the next Review Conference. At their first meeting, states parties could establish 'open-ended governmental expert groups to examine and elaborate on further means and mechanism to strengthen the Convention'. The EU further proposed that the President of the Review Conference hold informal open-ended meetings prior to the 2002 meeting to facilitate the implementation of the Review Conference decisions and to explore additional measures to further strengthen the convention.[24]

The EU proposal was generally well received, with many, including 'moderate' NAM states (among them Brazil and Chile), regarding it as an honest attempt to find common ground and give the convention a short-term boost. Some countries, however, including China, Cuba and Libya, reportedly complained that the proposal made no mention of the AHG. The US was reserved in expressing its view on the European suggestions but was clearly concerned that the establishment of expert groups might be an avenue for reopening the protocol negotiations.

Ambassador Tóth, who had also chaired the AHG, produced a compromise closely modelled on the EU's thinking. Tóth envisaged annual meetings of states parties to check progress made in implementing measures adopted at the conference and to multilaterally study, elaborate and negotiate further measures to strengthen the convention through a legally binding document. At these annual meetings, states parties could decide to set up subsidiary bodies for this purpose or to convene further meetings. The annual meetings would be prepared by an open-ended General Committee. Before they took place, the president and states parties would hold informal open-ended meetings to facilitate the implementation of the conference decisions and to look into possible additional measures.

The issue of non-compliance

The controversial issue of non-compliance received much attention during the final days and hours of the conference. Early on, the US sought tough wording on the question, wanting the conference to call on non-compliant states parties to comply fully and terminate their offensive BW programmes. It further wanted the conference to agree that any non-compliance could undermine confidence in the convention.

The proposal was met with resistance, and not only by the countries accused of cheating. A number of states reportedly feared that the suggestion could undermine the BWC by acknowledging the operation of clandestine BW programmes, especially if no action was taken in response within the framework of the convention. To address non-compliance, the US wanted a clarification procedure based on 'mutual consent' and an international investigation procedure for 'suspicious disease outbreaks and/or alleged biological incidents.' Under this procedure, states could request an investigation by an international team, commissioned by the UN Secretary-General. Investigated states parties would be required to provide access to the site of an outbreak, but the investigation area would remain under the control of the state being investigated.[25]

The EU also stressed the need to deal 'effectively and promptly' with compliance issues and proposed the establishment of an investigation mechanism 'under an appropriate international body to investigate suspicious outbreaks of disease, alleged use and suspicious facilities', thereby seeking to extend investigations to facilities.[26] Many NAM states, notably Iran, advocated a third approach, proposing that any alleged breach be dealt with within the framework of a comprehensive, legally binding instrument. Furthermore, Iran and Libya, expressing offence at American accusations and concerned about possible abuse, wanted the conference to ask states to refrain from making arbitrary and baseless allegations and from taking any unilateral and discriminatory action. Iran urged that countries insist that any complaint about non-compliance should 'include factual and concrete evidences and documents confirming its validity'.[27] Towards the end of the conference, the consultations on investigations revealed no significant bridging of differences. On non-compliance, some negotiating room seemed to be opening after the Americans softened their demands.

The conference adjourns

However, the whole, seemingly 'make or break', issue of compliance suddenly became irrelevant when, less than two hours before the conference was scheduled to close, the American delegation tabled drastic new language on the AHG and follow-up action. Apparently conceding fresh ground, the proposal suggested that the conference decide to hold annual meetings, starting in November 2002, to 'consider and assess progress by states parties in implementing the new measures

adopted at the Fifth Review Conference' and to 'consider new measures or mechanisms for effectively strengthening the BWC'. The annual meetings, moreover, could be allowed to establish expert groups, although these would not be allowed to 'negotiate measures'. In exchange the US demanded the termination of the AHG's mandate.[28]

Countries from all regional groups expressed dismay and disappointment at the American attempt to bury the AHG and at its jeopardizing the conference by introducing an obviously controversial proposal at such a late stage. The heated corridor discussions revealed a general sense that the American action was a deliberate last-minute attempt to derail the conference. One convincing theory is that it was the Defense Department which had insisted that the follow-up mechanism could only be offered in return for the scrapping of the AHG and the irretrievable collapse of the protocol negotiations.

The solution to the chaos on the floor was to adjourn the conference until 11 November 2002. Left over from the three weeks of deliberations, in the words of Tóth, was a final declaration that was '95 percent ready'.[29]

Post-conference developments

There were already signs in December 2001 and January 2002 that some key players were preparing the ground for the resumption of Review Conference and considering how to tackle the BW threat. On 10 December the EU launched a new initiative exploring 'the implications of the terrorist threat on the non-proliferation, disarmament and arms control policy of the EU'.[30] The initiative resulted in a list of 42 'concrete measures', adopted by the EU on 15 April 2002.[31] The list has been characterised as 'an ambitious step in the development of an EU arms control, disarmament and non-proliferation agenda'.[32]

The EU promised to support the universality of multilateral instruments, including the BWC, work for their effective implementation, support international organisations and reinforce them. Detailed plans included: lobbying for the removal of reservations by states to the 1925 Geneva Protocol;[33] strict application of national implementation legislation; timely, consistent and full implementation of reporting obligations (CBMs); and the creation of the necessary conditions for their translation and processing so that they could be placed in usable databases. On the reinforcement of

multilateral instruments, however, the absence of any mention of the protocol, and even more the use of the vague term 'strengthening' of the BWC, appeared striking, given the EU's consistent and strong support for the process. The document merely stated that the EU would work towards the successful conclusion of the Review Conference. The EU did, however, subsequently issue a political declaration with Latin American and Caribbean leaders in May 2002 in which they underlined their 'conviction that the [BWC] is best enhanced by the adoption of a legally binding instrument to oversee the [BWC] prohibition'.[34] Attached to the EU document was also a promise to consider the adoption of common positions and joint actions—a particularly opportune idea, especially with regard to the BWC, since the EU's latest joint position dated back to 1999.

The United Kingdom, a BWC depositary and an active protocol negotiator, released a Green Paper on 29 April 2002 to try to give new momentum to the debate on strengthening the convention.[35] Calling the failure to conclude the protocol 'undoubtedly a disappointment', the paper proposed 11 such measures, to be pursued at both the national and the international levels. On the unresolved question of the protocol itself, the paper offered no proposals, stating only that 'given the failure of the AHG to reach consensus . . . and the failure of the 2001 Review Conference to identify a way forward, it is important to remain flexible on how the international community might best tackle the pressing need to strengthen the Convention'.

The 11 measures proposed were:

- investigations of possible non-compliance;
- assistance in the event of a threat of the use or the actual use of BW;
- national criminal legislation;
- the setting up of a Scientific Advisory Panel;
- revised CBMs;
- a new convention on the physical protection of dangerous pathogens;
- a new convention criminalising the violation by individuals in the prohibitions of the CWC and the BWC;
- increased disease surveillance efforts;
- codes of conduct;
- universal membership of the BWC; and

- the withdrawal of the 1925 Geneva Protocol reservations. Many of the proposals were familiar from the 2001 Review Conference and overlapped with other countries' proposals, including that of the US.[36]

From the verification point of view, the most interesting were the proposals for revised CBMs and investigations. The Green Paper proposed revisiting the CBMs to see whether there is 'room for improving their scope or level of detail to ensure more useful annual returns'. There had been several proposals on CBMs at the 2001 Review Conference, by South Africa in particular.[37] In this connection, the UK raised the possibility of voluntary visits to facilities agreed between participating states parties. Independent experts welcomed the proposal but also pointed out that, in order to make real progress, the CBM returns should be collated and translated by a small secretariat and made available to states parties.[38] Curiously, the Green Paper made no mention of the idea of making some CBMs mandatory, as proposed by the EU in 2001. The omission stood in contrast to the recognition that the fact that the CBMs have been politically but not legally binding 'has had an adverse effect on their success'.[39]

The British paper also called for the creation of an investigation process for allegations of non-compliance, including misuse of facilities, unusual outbreaks of disease and alleged use of BW. It proposed that this could be done either by expanding and revising the existing procedures for the UN Secretary-General to investigate alleged use[40] or by creating a free-standing or combined international agreement that also covered other relevant topics such as assistance in the event of attack. Unlike the American proposal in November 2001, the British proposal wanted investigations to cover facilities as well. However, it is unclear whether the British proposal would authorise investigations in states parties that withheld their consent (under the existing investigation procedures the state party to be investigated must agree). Some analysts have argued that it is unlikely that states parties would agree to extend the procedures in terms of either scope (facilities) or circumstances (in the event of refusal). Hence they have maintained that the second option, negotiation of an international agreement, would be more viable.[41]

In general, the Green Paper was received well. Although it offered few new ideas, it was an honest attempt to propose ways to strengthen the BWC, steer states into constructive action and facilitate a positive outcome for the resumed Review

Conference. Nevertheless, even keeping realities in mind, the fact that the paper failed to reiterate the UK's support for a comprehensive, legally binding multilateral verification regime has been met with some disappointment.[42]

Meanwhile, the US was making it clear it was not going to back down on the protocol or the AHG. Instead, it tried to convince others to drop the talks and focus on enforcing compliance.[43] Under Secretary Bolton returned in January 2002 to Geneva and reiterated to the Conference on Disarmament—the birthplace of many multilateral arms control and disarmament agreements—that his government would 'flatly oppose flawed diplomatic arrangements that purport to strengthen the BWC but actually increase the spectre of biological warfare by not effectively confronting the serious problem'.[44] Just days later, the compliance issue was tackled at the highest level when President Bush accused Iran, Iraq and North Korea of attempting to acquire weapons of mass destruction and called them and their terrorist allies the 'axis of evil'.[45] But it was clear that the US was also concerned about other countries, including Russia, one of the BWC depositaries. In April, the US administration decided against certifying that Russia was in compliance with its obligations under the BWC, thus hampering the implementation of the Defense Department's Cooperative Threat Reduction (CTR) programme aimed at reducing the threat from Russia's weapons of mass destruction complex.[46]

Prospects for the resumed Review Conference in November 2002 looked unpromising after Tóth's consultations on 2–4 September 2002 in Geneva. The US had further toughened its stance: now it would even oppose the follow-up meetings between the fifth and sixth review conferences that it had itself proposed in November 2001. It now wanted a brief convening of the conference that would agree to hold the Sixth Review Conference in 2006. This meant that the US was ready to give up the adoption of the draft final declaration, which included its own proposals for strengthening the convention that it had been advocating as an alternative to the protocol as well the follow-up process that would have monitored their implementation and proposed new measures. The change in the American position was sure to further complicate the conclusion of the conference, denying many others their minimum position.

One proposal on how to bring the conference to a conclusion came from South Africa on 2 October 2002. It proposed, as Tóth had explored in his presidential

consultations in the summer, that states parties conclude the conference rapidly, without raising the divisive issues that would prevent agreement and without mentioning the AHG and the protocol. Furthermore, states parties would agree to hold annual meetings and establish expert groups that would meet annually to deal with specific issues. South Africa additionally proposed strengthening the UN Secretariat to assist in this work.

The proposal was a sound one in the prevailing circumstances: avoiding the controversial questions of the AHG and the protocol would give a chance for agreement. The adoption of a future-oriented plan would show common political will to tackle the threat of BW multilaterally and establish measures that all had signed up to. Annual meetings would maintain pressure on member states to implement them, and expert meetings would keep the regime responsive to new developments. Furthermore, a strengthened UN Secretariat would help nurture the work. However, it looked uncertain at the time of writing whether this could be achieved. Regrettably, there were also no signs that, in the event of a profound split, the majority of the states parties would take decisive action to defend the convention, including resorting to the unusual step of voting.

Civil society responds

The various negative developments in 2001 and 2002 have had at least one positive result—more active and focused involvement by civil society in the BW debate. Troubled by the lack of multilateral progress, setbacks to the BWC and the violation of the norm against the use of BW, a group of eight non-governmental organisations (NGOs) working on BW issues began in late 2001 to consider how they could help to support and strengthen the BW regime.[47] Innovative models of civil society contributions in other areas, such as corruption, human rights, small arms, landmines and the environment, had demonstrated the value and effectiveness of independent monitoring and reporting. The group decided to explore the adoption of civil society-based monitoring in the biological weapons context. Aware of the challenges but convinced of the usefulness of such a project, the group formed the BioWeapons Prevention Project (BWPP) in early 2002.[48]

The BWPP plans to monitor and report on the state of the norm around the world. It will regularly and systematically gather information on relevant political, security,

scientific, technical and legal developments at the national, regional and international levels, collecting data from a wide range of sources. The BWPP will be an independent monitor which tracks how governments and other entities are working to reduce the BW threat and implementing their political and legal obligations under treaties that codify the norm—the annual submission of CBM declarations being one example. The BWPP's findings will be published in an annual publication. The BWPP was officially launched during the resumed session of the BW Review Conference on 11 November 2002.

Conclusion

Although the anthrax attacks in the US should have awoken the world to the dangers of BW, the process of attempting to strengthen the BWC has continued on a ruinous path. In just one year many difficult concessions were made: when the protocol talks were derailed, there was talk about at least reiterating or preserving the AHG's mandate. When there was little hope for that, thoughts turned to at least ensuring that states parties met regularly within the context of the convention, in annual meetings. On the eve of the continued session of the conference, even that looked uncertain.

At the same time, non-compliance with the multilaterally unverified BWC received much attention. Yet action did not seem any closer. Although the US talked about non-compliance, it was less clear what it was proposing as concrete action, within the parameters of the BWC and international law in general. From a prevention point of view, its proposals for national criminal legislation, extradition agreements and assistance to victims appear to be too little, too late. Voluntary clarification mechanisms and investigation procedures which do not cover facilities and give control over the investigated area to the investigated party are inadequate.[49] To address non-compliance seriously, more stringent measures are needed. Indeed, the US's talk about non-compliance—an important question that undoubtedly warrants serious consideration—inadvertently strengthened the case for an effective verification mechanism: with it in place there would be less room for loose accusations and polemics and instead a means of investigating allegations and taking collective, legitimate action against proven violators.

A failure to jointly, effectively and in a sustained manner strengthen the convention will send a wrong message to those states that contemplate cheating or are

already cheating: it will show that the international community is divided and helpless in the face of BW proliferation and that the BWC is becoming obsolete. Such a message will undermine the norm and prohibition, create uncertainty and, in some cases, even serve as an invitation to BW development and possession. The risk of the 30-year old treaty remaining the weakest of the three treaties that underpin the weapons of mass destruction prohibition regime is ever greater—at a time when the threat from biological weapons seems most acute. The consequences of passivity and inaction might not be seen for several years but may reveal themselves in highly destructive ways. Repair of the regime might be too late then: that time is now.

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Endnotes

[1] 10 April 2002 was the 30th anniversary of the BWC's opening for signature.

[2] On the Composite Text and the AHG's 24th session, see Marie Chevrier, 'The Biological Weapons Convention: the protocol that almost was', in Trevor Findlay and Oliver Meier (eds), *Verification Yearbook 2001,* The Verification Research, Training and Information Centre (VERTIC), London, December 2001, pp. 79–97.

[3] Judith Miller, Stephen Engelberg and William Broad, 'US germ warfare research pushes treaty limits', *New York Times,* 4 September 2001, p. A1.

[4] Judith Miller, Stephen Engelberg and William Broad, *Germs: The Ultimate Weapon,* New York: Simon & Schuster, 2001. See also Peter Eisler, 'US, Russia tussle over deadly anthrax sample', *USA Today,* 19 August 2002, available at www.usatoday.com/news/acovmon.htm.

[5] The CBM declarations are not available publicly. However, diplomatic sources say that the US did not report on the biodefence work in question in its annual declarations to the UN. Private communications with the author.

[6] 'News chronology, 4 September', *CBW Conventions Bulletin,* issue 54, December 2001, p. 34. On the US biodefence programmes see *SIPRI Yearbook 2002: Armaments, Disarmament and International Security,* Oxford University Press, Oxford, 2002, pp. 678–683.

[7] 'News chronology, 4 October', *CBW Conventions Bulletin,* issue 54, December 2001, p. 44.

[8] 'Public health dispatch: update: cutaneous anthrax in a laboratory worker . . . Texas, 2002', 7 June 2002, available at www.cdc.gov/mmwr/preview/mmwrhtml/mm5122a4.htm.

[9] Statement by Avis Bohlen, US Assistant Secretary of State for Arms Control, First Committee, UN General Assembly, New York, 10 October 2001.

[10] The White House, Office of the Press Secretary, 'Strengthening the international regime against biological weapons', Statement by President George Bush, 1 November 2001. See also Judith Miller, 'US seeks changes in germ war pact', *New York Times,* 1 November 2001, p. A1.

[11] Opening remarks of Tibor Tóth, President of the Fifth Review Conference and Ambassador of Hungary, Fifth Review Conference of the BWC, Geneva, 19 November 2001.

[12] Statement by Jayantha Dhanapala, Under Secretary-General for Disarmament Affairs, on behalf of the UN Secretary-General Kofi Annan, Fifth Review Conference of the BWC, Geneva, 19 November 2001.

[13] Statement by John Bolton, US Under Secretary of State for Arms Control and International Security, Fifth Review Conference of the BWC, Geneva, 19 November 2001.

[14] Statement by John Bolton, 19 November 2001.

[15] These countries expressed their views about the Composite Text in BWC/AD HOC GROUP/WP.451, 4 May 2001.

[16] The Rio Group is a body for political consultation and coordination. It consists of Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, the Dominican Republic, Uruguay, Venezuela and Guyana.

[17] Statement by Jean Lint, Ambassador of Belgium, on behalf of the EU, Fifth Review Conference of the BWC, Geneva, 19 November 2001.

[18] Statement by John Bolton, 19 November 2001.

[19] 'The work of the Ad Hoc Group to the Biological Weapons Convention', Working paper by NAM and other states, BWC/CONF.V/COW/WP.13, 26 November 2001.

[20] 'Proposals', Working paper of the European Union, BWC/CONF.V/COW/WP.23, 27 November 2001.

[21] Working paper of Australia, Canada and New Zealand, BWC/CONF.V/COW/WP.30, 27 November 2001.

[22] Working paper of Japan, BWC/CONF.V/COW/WP.14, 26 November 2001.

[23] 'Proposals', Working paper of the United States, BWC/CONF.V/COW/WP.17, 26 November 2001.

[24] Informal in-room paper on Article XII of the EU, 3 December 2001.
[25] 'Proposals', Working paper of the United States, BWC/CONF.V/COW/WP.17, 26 November 2001.
[26] 'Proposals', Working paper of the European Union, BWC/CONF.V/COW/WP.23, 27 November 2001.
[27] Iranian proposal under Article VI, BWC/CONF.V/COW/WP.1, 30 November 2001.
[28] Informal in-room paper on Article XII of the United States, 7 December 2001 (around 1600 hours).
[29] Tibor Tóth, Ambassador of Hungary, President of the Conference and Chair of the AHG, press conference after the Fifth Review Conference of the BWC, Geneva, 7 December 2001. The draft declaration, as it was on the morning of 7 December, is available on the Acronym Institute's website at www.acronym.org.uk/dd/dd62/62bwapp.htm.
[30] Decision by the Council of the European Union, Conclusions of the 2397th Council meeting, General Affairs, 15078/01 (Presse 460), Brussels, 10 December 2001.
[31] Decision by the Council of the European Union, Conclusions of the 2421st Council meeting, General Affairs, 7705/02 (Presse 91), Luxembourg, 15 April 2002, pp. II–VI.
[32] Daniel Feakes, 'The emerging European disarmament and non-proliferation agenda on chemical and biological weapons', *Disarmament Diplomacy,* no. 65, July/August 2002, www.acronym.org.uk/dd/dd65/65op2.htm.
[33] 'In signing and/or ratifying the Geneva Protocol, over 40 states entered reservations. These upheld the right to employ chemical weapons against non-parties to the Protocol, or in response to the use of these weapons by a violating party, or even against allies of the violator that had not committed a violation. See Jozef Goldblat, *Arms Control: The New Guide to Negotiations and Agreements,* Sage Publications for the Peace Research Institute Oslo (PRIO) and the Stockholm International Peace Research Institute (SIPRI), Thousand Oaks, Calif., London and New Delhi, 2002, p. 136. Many states parties have withdrawn their reservations.
[34] 'The Madrid commitment', Political Declaration, European Union–Latin America and Caribbean Summit, 8802/02 (Presse 133), 17 May 2002.
[35] United Kingdon, Secretary of State for Foreign and Commonwealth Affairs, *Strengthening the Biological and Toxin Weapons Convention: Countering the Threat from Biological Weapons,* The Stationery Office, London, April 2002 (Cm 5484).
[36] For an analysis of the UK Green Paper see Graham Pearson, 'Return to Geneva: the United Kingdom Green Paper', Strengthening of the Biological Weapons Convention, Review Conference Paper no. 6, University of Bradford, June 2002. For an analysis of the UK Green Paper, states parties' statements and working papers submitted at the Review Conference, see 'Return to Geneva: a comprehensive list of measures', Strengthening of the Biological Weapons Convention, Review Conference Paper no. 6, University of Bradford, August 2002. Both are available at www.brad.ac.uk/acad/sbtwc/.
[37] See 'Strengthening confidence-building measures', Working paper by South Africa, BWC/CONF.V/COW/WP.1, 16 November 2001.
[38] Graham Pearson, 'Return to Geneva: the United Kingdom Green Paper', p. 14.
[39] S*trengthening the Biological and Toxin Weapons Convention: Countering the Threat from Biological Weapons,* p. 10.
[40] UN Security Council Resolution 620 (1988) encouraged the UN Secretary-General to carry out prompt investigations in response to allegations of use of BW. Further detail to these procedures was elaborated in United Nations, 'Chemical and bacteriological (biological) weapons: report of the Secretary-General', UN document A/44/561, 1989.
[41] Graham Pearson 'Return to Geneva: the United Kingdom Green Paper', pp. 10–11.
[42] 'VERTIC's response to the UK Green Paper', VERTIC, London, 3 September 2002.
[43] Greig Seigle, 'BWC: US pushing countries to drop negotiations', *Global Security Newswire,* 15 January 2002, available at www.nti.org/d_newswire/issues/2002/1/15/4s.html.

[44] Statement by John Bolton, US Under Secretary of State for Arms Control and International Security, Conference on Disarmament, Geneva, 24 January 2002.
[45] President George Bush, State of the Union Address to Congress, Washington, DC, 29 January 2002.
[46] 'News chronology, 8 April', *CBW Conventions Bulletin,* issue 56, June 2002, p. 39. See also Philipp C. Bleek, 'Bush refuses to certify Russian chem-bio compliance', *Arms Control Today,* May 2002.
[47] The founding group consists of the British American Security Information Council (BASIC), UK; the Centre for Conflict Resolution (CCR), South Africa; the Department of Peace Studies, University of Bradford, UK; the Federation of American Scientists (FAS), US; the Harvard Sussex Program (HSP), Science and Technology Policy Research, University of Sussex, UK; the International Network of Engineers and Scientists for Global Responsibility (INES), Germany; the Sunshine Project, USA–Germany; and the Verification Research, Training and Information Centre (VERTIC), UK.
[48] For more information on the BWPP, see www.bwpp.org.
[49] See the US proposals at the Fifth Review Conference in BWC/CONF.V/COW/WP.17, 26 November 2001.

6

The Trilateral Agreement: lessons for biological weapons verification

David C. Kelly

In late 1989, Dr Vladimir Pasechnik, a key research director of what turned out to be a clandestine Soviet biological weapons (BW) facility, defected to the United Kingdom. This eventually led to an attempt by the UK and the United States to end the secrecy surrounding the Soviet BW programme, which was in violation of the 1972 Biological and Toxin Weapons Convention (BWC), and to ensure that all such activities in the successor state, Russia, were verifiably ended. This effort was formalised in the so-called Trilateral Agreement on biological weapons concluded by the UK, the US and Russia in 1992.

The Trilateral Agreement failed dramatically, as Russia proved unwilling to acknowledge and fully account for either the former Soviet programme or the BW activities that it had inherited and continued to engage in. This included refusing access by American and British inspectors to its military biological sites.

The lessons learned during the process contributed indirectly to the strategy of the UN Special Commission on Iraq (UNSCOM) between 1991 and 1999 in seeking the biological disarmament of Iraq. They were also factored into British thinking on the design of compliance measures for the BWC verification protocol that was being negotiated between 1995 and 2001.

The failure of the trilateral initiative has implications for future attempts to design verification procedures for the BWC, the development of confidence-building measures, the conversion to peaceful uses of facilities that were (and may still be) a part of the Russian programme, and the redeployment of biological warfare scientists and technicians. It also demonstrated the difficulty of applying traditional arms control principles to dual-use facilities—those capable of being used for both peaceful and military purposes.

Pasechnik's defection occurred during the turbulent final years of the Soviet Union, which dissolved in December 1991. Russia became an independent state and inherited the Soviet role of depositary of the BWC. Soviet President Mikhail Gorbachev presided over this transition until Boris Yeltsin assumed the presidency of Russia in June 1991. This was a complex political environment in which to investigate an illicit Soviet BW programme. In particular, it tended to moderate the political pressure that could be applied to further the investigation. On the other hand the investigation could not conceivably have taken place at all in earlier times.

Prelude to the agreement

The West had become sensitised to a Soviet biological weapons programme in 1979 in the aftermath of the inadvertent release of anthrax spores from a biological weapons factory at Sverdlovsk (now Yekaterinburg), but no concerted international response was initiated. By the mid-1980s the UK and the US had acquired an impressive catalogue of intelligence information which raised concerns that after 1975, when the BWC entered into force, the Soviet Union had begun an offensive BW programme. However, it took the defection of Pasechnik to provide sufficiently credible intelligence information about the nature and scale of activity to attract the attention of high-level American and British policy makers. This led to American President George Bush and British Prime Minister Margaret Thatcher directly challenging President Gorbachev with the information. As the three depositary states for the BWC, with special responsibilities and obligations, it seemed imperative that they should co-operate to resolve this serious compliance issue as expeditiously and transparently as possible.

Between 1990 and 1992, the US and UK put considerable diplomatic and political pressure on the Soviet Union, and then Russia, to admit that it possessed an offensive BW programme. In 1990, in response to that pressure, President Gorbachev invited American and British representatives to jointly visit facilities associated with Biopreparat, where Pasechnik had worked. Biopreparat was established in 1973 as a 'civilian' cover for offensive BW research, development and production within the Soviet Ministry of Health.

Extensive diplomatic and technical negotiations were required before the British–American team could be dispatched. Details which required negotiation included

the duration of site visits, conditions of access, site definition, recording conditions, vaccination requirements, the number of facilities to be visited and team size. It also required the host side to provide an outline definition of the sites so that appropriate preparations could be made. The precise facilities to be visited were also agreed at these meetings. Unfortunately, the protracted negotiations allowed the Soviet authorities time to 'clean up' and develop 'legenda' for the establishments.

Four All-Union Scientific Research Institutes were visited in January 1991:

- the Institute of Immunology, Chekhov;
- the Institute of Microbiology, Obolensk;
- the Institute of Molecular Biology, Koltsova; and
- the Institute of Ultrapure Preparations in Leningrad (later St Petersburg).

All were part of Biopreparat, supposedly as part of the Ministry of Medical Industry. The sites were chosen because they had been well known to Pasechnik and recent detailed information had been obtained about them. All undertook fundamental and applied research devoted to the creation and enhancement of effective biological weapons and the development of novel bacterial and viral agents.

The visits did not go without incident. At Obolensk, access to parts of the main research facility—notably the dynamic aerosol test chambers and the plague research laboratories—was denied on the spurious grounds of quarantine requirements. Skirmishes occurred over access to an explosive aerosol chamber because the officials knew that closer examination would reveal damning evidence of offensive BW activities. At Koltsova access was again difficult and problematic. The most serious incident was when senior officials contradicted an admission by technical staff that research on smallpox was being conducted there. The officials were unable to properly account for the presence of smallpox and for the research being undertaken in a dynamic aerosol test chamber on orthopoxvirus, which was capable of explosive dispersal. At the Institute of Ultrapure Preparations in Leningrad (Pasechnik's former workplace), dynamic and explosive test chambers were passed off as being for agricultural projects, contained milling machines were described as being for the grinding of salt, and studies on plague, especially production of the agent, were misrepresented. Candid and credible accounts of many of the activities at these facilities were not provided.

In October 1991 a meeting was held in Moscow to discuss the reciprocal visit of a Soviet delegation to the US and UK. In the event the UK was not asked to host a visit. The Soviets designated four sites of concern in the US:

- the Baker Test Facility, Dugway Proving Ground, Utah;
- the United States Army Medical Research Institute for Infectious Diseases (USAMRIID), Fort Detrick, Maryland;
- the National Centre for Toxicological Research, Jefferson, Arkansas (Pine Bluff Arsenal); and
- the Salk Institute, Government Services Division, Swiftwater, Pennsylvania.

Three were military sites which had contributed to the American offensive programme at various times between 1946 and 1969. The fourth was a government contractor which provided vaccines for military use. A Soviet team visited the sites in December 1991, observed by a small British team. The Soviet side saw evidence of the American offensive programme before 1969, including dilapidated BW storage bunkers, agent production fermenters and derelict weapons-filling lines at Pine Bluff; pilot-scale agent production capability and partially dismantled aerosol test chambers at Fort Detrick; and functional weapons test grids at Dugway.[1] They thus claimed that the US had a mothballed capability—an obvious attempt to match US and UK concerns about the active Soviet capability.

While the visits were obviously unsatisfactory for both sides from a variety of perspectives, it was commercial and defence confidentiality that proved to be the dominant issue rather than the visit process itself. Time constraints meant that detailed investigation of key issues was not attempted on-site. In the course of the visits in Russia it was impossible to deal with documents, sampling was a matter of contention, discussions were stilted, site access was constrained and quarantine restrictions were arbitrarily applied. Formalisation of the process was required, especially after the profound political changes in Russia in 1991–92, to prevent the exercise from collapsing. The result was the Trilateral Agreement.

The agreement

The 14 September 1992 Trilateral Agreement took the form of a Joint Statement on Biological Weapons by the governments of the United Kingdom, the United

States and the Russian Federation, issued after a meeting in Moscow between senior officials on 10 and 11 September 1992.[2] It reaffirmed the three states' commitment to full compliance with the BWC. It also noted that Russia had ceased offensive BW research, dismantled weapon production lines, closed test facilities and dissolved the department in the Ministry for Defence that was responsible for the offensive BW programme. It acknowledged that President Yeltsin had ordered an investigation into activities at the Institute of Ultrapure Preparations.

Russia agreed to accept visits to any *non-military* biological site at any time to remove ambiguities, subject to the need to respect proprietary information; provide information about the dismantlement of its programme; and clarify information in Form F[3] relating to past BW activities submitted to the UN as part of the politically binding BWC confidence-building measures agreed in 1991. Prominent scientists would be invited to participate in any investigation into BWC compliance.

Six trilateral working groups were to be established to consider the following:

- visits to non-military sites (subject to proprietary rights protection) to review measures to monitor compliance; to review potential modalities to test such measures; and to examine the physical infrastructure of the biological facilities in the three countries to determine whether there was specific equipment or capacity that was inconsistent with their stated purpose;
- co-operation in biological defence;
- ways of promoting co-operation and investment in conversion of facilities;
- the exchange of information on a confidential, reciprocal basis concerning past offensive programmes;
- the provision of periodic reports to legislatures and publics describing biological research and development (R&D) activities; and
- the encouragement of exchanges of scientists at biological facilities on a long-term basis.

Apart from visits to non-military facilities, none of these ideas was implemented, primarily because the focus quickly centred on procedures for visits to military biological facilities.

The agreement also envisaged that a number of rounds of visits, in batches of four, would be conducted in all three countries. It was never clear, however, whether

there was to be equivalence between Russia on the one hand and the UK and US jointly on the other, or whether the three would be treated equally. In any case, regardless of the original intention, the number of sites of legitimate concern in Russia would eventually have created an imbalance in the process.

In order to accommodate the time needed to travel within both the US and Russia, each visit was to be on 24 hours' notice, but this was so short that for the inspected facility the visits were effectively no-notice inspections. (In practice, because of transport difficulties, a longer lead in time was sometimes provided, usually by giving notice on the Friday preceding a visit scheduled for the following Monday.) An 'expression of concern' formally delineating non-compliant features was to be provided by the visiting side at notification and on arrival at the site.

The trilateral working group on visits negotiated a proprietary rights agreement by 12 May 1993 which defined the visits procedure further. It required the receiving side to:

- arrange a briefing about the site by representatives of the facility, including on its current activity, the products manufactured and the research undertaken;
- ensure that staff were present and authorised to discuss past activity; and
- provide information on the site with reference to hazard and safety and medical requirements.

The agreement also defined limitations on the use of audio and video recording and sampling. The principles of 'managed access' were introduced, imposing significant limitations on the investigations.

The visits

Curiously, the first initiative under the Trilateral Agreement was not a visit to a facility but an invitation for the UK and the US to observe the Russian Commission of Inquiry into the work at the Institute of Ultrapure Preparations.

The commission was undertaken on the orders of President Yeltsin after a démarche by British Foreign Secretary Douglas Hurd and American Deputy Secretary of State Lawrence Eagleburger on 22 August 1992, following the receipt of further defector information on non-compliance and the involvement of the Institute. It met from 18–21 November 1992 and comprised senior Russian academics. The stated objective was 'to analyse the activities to see if any are in violation of BWC'.

In the event it was the American and British observers who actually asked the questions, while the Russian inquirers observed. The Russian observers from Biopreparat, the Ministry of Public Health and the Ministry of Defence played a passive role. The Commission of Inquiry concluded that nothing untoward was currently being done at the institute. The observers, on the other hand, were deeply frustrated at the nature of the work that was continuing at the institute and the superficiality of the inquiry.

Actual visits to Russian facilities were made in 1993/94 to:

- the All-Union Scientific Research Institute of Veterinary Virology, Pokrov;
- the Chemical Plant, Berdsk;
- the Chemical Plant, Omutninsk; and
- the All-Union Scientific Research, Institute of Microbiology, Obolensk (for the second time).

The sites were visited in pairs in October 1993 (Pokrov and Berdsk) and January 1994 (Omutninsk and Obolensk). The visits in January 1994 immediately preceded a summit meeting between American President Bill Clinton and Russian President Yeltsin, and their focus—particularly that of the visit to Obolensk—was to detect evidence of change, especially dismantlement and change of use.

Since the parties were entitled under the agreement to visit only four sites, a problem immediately arose, with regard to three of the four sites, as to how to define them. The facilities at Berdsk and Omutninsk shared locations with other organisations of concern. Ultimately a legal rather than geographic or functional determination prevailed, effectively denying the American–British observers the opportunity to fully explore contiguous facilities. Pokrov's relationship with an associated research institute was also denied. The Russians were prepared to allow access to contiguous sites but only if other sites were sacrificed.

Despite these restrictions, the visits to Pokrov, Berdsk and Omutninsk all revealed evidence of biological activity since 1975, such as large-scale production in hardened facilities, aerosol test chambers, excessive containment levels for current activity and accommodation for weapons-filling lines.

During their visits the American–British teams provided reports only to Washington and London, not to their Russian hosts. Final reports were made after departure

from the country. No assessment was made in-country by any of the three parties during visits. The reports on the visits, which are the only records of the process, were compiled in different ways. Before the Trilateral Agreement they had been compiled by 'rapporteurs' who were familiar with Soviet non-compliance and were able to provide a politically and technically focused account based on verbal accounts provided by the 'visitors'. After 1992 the team leaders wrote the reports, basing them on contributions from delegated team members. The products of both processes remain classified but were of good quality and remain valid today.

Return visits were made by the Russians to the US in February 1994 to:

- Pfizer US Pharmaceuticals, Vigo, Indiana;
- Pfizer US Pharmaceuticals, Groton, Connecticut; and
- the US Department of Agriculture's Plum Island Animal Disease Center, Greenport, New York.

In March 1994, they visited Evans Medical Limited in Liverpool in the UK.

The visit to Vigo confirmed that at the end of World War II the US had established capabilities for large-scale fermentation (for anthrax) and weapons filling, but the archaeological evidence was clearly of 1940s vintage. The facility had long ago become been dilapidated (although, unfortunately, it was not destroyed because of the cost involved). The visit to Pfizer Groton was undertaken the following week. Both visits were conducted on 48 hours' notice.

Although challenging and uncomfortable, the visits were unlikely to compromise commercial interests, but they created controversy which has had long-term ramifications. Pfizer was so concerned about the protection of commercial proprietary information at both locations that it took the personal intervention of Vice-President Al Gore before it would permit the visits to proceed. This raised the profile of the visits markedly and sent shock waves through the American pharmaceutical industry which still resound today.

The visit to Evans Medical was justified by Russian concern that it made anthrax; in fact it packaged anthrax vaccine produced elsewhere by another agency for use by British troops during the 1990–91 Gulf War, but was not doing so at the time of the Russian visit. The company, assisted by a joint team of advisers from the British Foreign and Commonwealth Office and Ministry of Defence, was able to

deal comfortably with Russian requests for access and to demonstrate that the site was not currently, and had not at any time been, engaged in activities prohibited by the BWC.

The meetings

Following the round of visits to facilities in the UK, the US and Russia, technical discussions were held in London and Moscow in mid-1994. The London meeting, held from 26–28 April 1994, discussed, among others, the following issues:

- confidential disclosure of past American, British and Soviet offensive programmes;
- an expression of concerns about current Russian activity;
- assessment of the trilateral visits undertaken;
- 'Rules of the Road' for future visits; and
- access to military sites.

The first indicators of the extent of the Russian side's willingness to co-operate were the Rules of the Road. These defined the conditions for the selection of sites and the operational procedures for assessing them, conducting on-site activity and recording information. Time limits on visits (two days), site definition (precluding access to all components of a geographical location) and the need for mutually agreed objectives for visits all constrained interaction between the visiting team and facility personnel, thereby limiting the openness and transparency of activity on site. The UK and the US also presented a confidential account of their former offensive activities, but Russia did not reciprocate.

On 11 and 12 October 1994 the three sides met in Moscow to discuss the past Soviet/Russian programme; the funding of Biopreparat projects; the Rules of the Road; commercial confidentiality; the definition of military BW facilities; access to biological facilities operated by the three states outside their territories; and the timing and number of visits. On this occasion Russia gave a presentation on its offensive activities. However, it significantly failed to match American and British expectations, calling into question the openness and urgency with which the Russian Government was addressing the issue.

On 15 October 1995 the commemoration of the UN's 50th anniversary in London provided an opportunity for the diplomatic principals of the three sides to meet. This resulted in the question of biological warfare sites that had been active before

1975 being added to the list of unresolved issues. But no other progress was made. The problem of access to relevant sites in countries other than those involved in the trilateral process, such as the other republics of the former Soviet Union besides Russia, proved insurmountable. No further meetings ensued and the process foundered as a result of a lack of collective resolve to continue. This was apparent from the last act in the process—an April 1996 letter from Russian Foreign Minister Yevgeniy Primakov to American Secretary of State Warren Christopher which went unanswered.

Other independent initiatives

Since the signing of the Trilateral Agreement a number of initiatives independent of the agreement have been undertaken, including exchange visits between the American and Russian intelligence services, military and commercial exchanges under the auspices of the International Science and Technology Center (ISTC) in Moscow,[4] and the American–Russian Cooperative Threat Reduction Programme. These initiatives have helped to build some confidence about the change of direction of the Russian programme and about the dismantlement of facilities and the retention of scientists associated with it. The initiatives have rarely, however, provided insight into past programmes or provided convincing verification of Russia's present compliance with the BWC.

The outcome

Despite the failure to determine whether Russia was in compliance with the BWC, the Trilateral Agreement was a significant achievement. Participation in one inquiry, three rounds of site visits and three technical meetings confirmed the accuracy and insight of Pasechnik's revelations in 1989 with regard to the sites visited and established confidence in his appraisal of other facilities and activities. The process also provided evidence of Soviet non-compliance from 1975 to 1991. It encouraged President Yeltsin's admission in 1992 of past Soviet non-compliance with the BWC and influenced his decision to drop the Soviet reservation to the 1925 Geneva Protocol which preserved the right to retaliate in kind if attacked with BW. The trilateral process was, however, a lost opportunity for Russia to demonstrate unambiguously its current compliance with the BWC.

The process did not allow investigation of all the facilities within Biopreparat which were (and remain) of concern, and did not extend to the military dimension of the programme, which still remains concealed. It did lead to the destruction and dismantling of some facilities and equipment at Obolensk and a change in the use at some Biopreparat facilities, including Berdsk and Omutninsk, although whether this was entirely due to the trilateral process is unclear.

The visits confirmed American and British intelligence assessments of Soviet-Russian non-compliance with the BWC after 1975, but did not provide the proverbial 'smoking gun'. The biggest challenge was maintaining political momentum and attention on the agreement. This became increasingly difficult in the mid-1990s, since it was competing with other sensitive policy issues with regard to Russia which were more likely to be resolved. The failure of the process to complete its mission means that serious concerns remain.

The intensely negative reaction of the Pfizer Corporation and subsequently the Pharmaceutical Research and Manufacturers of America (PhRMA) to the Russian visits to American commercial sites was a contributory factor in the American rejection of the draft verification protocol for the BWC in July 2001.[5]

Lessons learned

1. An accused party may react strongly to an allegation of non-compliance by demanding strict reciprocity. Reciprocity is a standard feature of inspections under arms control and disarmament agreements, but in this case, in the absence of internationally agreed procedures, it featured increasingly even though the UK and the US were essentially seeking a challenge inspection process, which is by its nature not reciprocal.

Initially, President Gorbachev's invitation to the US and UK to visit facilities of concern was unilateral and unreserved. By the time the initial technical meetings were held in late 1990, the Soviet side was indicating that it expected return visits in order to satisfy its putative concerns about Western facilities. Moscow undoubtedly had internal presentational reasons for doing this. A demand for reciprocity would also have helped secure acquiescence to inspections among facility directors and personnel suffering culture shock from being asked to open up their secret facilities to the gaze of foreigners. Nonetheless, the insistence on reciprocity was

the first step in the erosion of American and British confidence in the process, since it served to deflect the emphasis of the inquiry away from Russia and enabled it to make counter-allegations about Western activities. Reciprocity did, however, at least ensure that the process continued.

It was difficult to avoid reciprocity, but tougher negotiation to counter unfounded allegations might have prevented this route being followed.

2. A second lesson was the importance of intelligence information for the planning and conduct of on-site visits. In the absence of clear statements and disclosure of activities, visits relied on intelligence as the baseline by which to judge activity and the explanations provided by officials. The information provided by credible and knowledgeable defectors was crucial in reaching definitive conclusions. By the time of the trilateral visits to Russia a second defector, Kantajan Alibekov, had arrived in the US and his information proved of considerable value. Alibekov had been a deputy director of Biopreparat and had a better overview of activities within Biopreparat than Pasechnik.[6] He had also participated on the Soviet side in the (pre-trilateral) visits in the Soviet Union and US, and was able to confirm that there had been deception on the Soviet side both during and prior to the visits. The use of intelligence was invaluable in evaluating the credibility of the defector and the nature of the challenged sites. Intelligence, both satellite imagery and defector information, helped considerably in planning the subsequent site visits.

3. There is a clear value in an unambiguous account of past BW activity being provided by BWC states parties, preferably in writing, although an oral presentation could suffice. In a confidential forum details that are inappropriate for open release can be disclosed, thereby minimising the risks of proliferation and providing valuable technical insights.

By contrast, Measure F in the 1991 confidence-building measures requires only that R&D after 1946 is accounted for and is too minimalist to provide a sound basis for assessment of the scale and achievements of a programme or discussion of full disarmament. Total and full disclosure is essential if there is to be real confidence that a programme no longer exists.

4. As in any arms control undertaking, clear technical objectives are required for an effective inspection regime. Within the overarching objectives there is a require-

ment to have a subset of observable and implementable goals, and this can be difficult to define in the absence of appropriate disclosure of non-compliant activities or indeed of apparently legitimate activity. All the sites visited in Russia were capable of being used for both peaceful and non-peaceful purposes. With the viability of institutes such as that at Obolensk markedly affected by Russia's economic downturn, conversion to legitimate uses had occurred for economic rather than arms control reasons.

5. True short-notice inspections are in practice difficult to achieve. Short-notice visits were undertaken in Russia to gain an understanding of current activity at the inspected sites. Being government facilities, they were clearly prepared for such visits. In the US, inspections of private industry were more truly 'no-notice'. Although the company concerned responded with great professionalism and allowed a considerable degree of access, the experience triggered a profound reaction.

6. The redeployment of BW technicians and scientists to legitimate civilian activity is strongly advocated by many of those concerned with Russian 'conversion' and BW disarmament. However, many senior directors of Biopreparat facilities who have been directly involved in illicit activity still remain in post. This calls into question the commitment of the Russian Government to terminating the programme.

7. Technical assessments of observations made in the course of on-site visits may be coloured by political interpretations based on other intelligence, which is to a certain extent inevitable when full accounts are not provided by the party being inspected. This certainly occurred in the case of Western assessments of Russian facilities. The consequence is that there is now a considerable divergence of opinion as to the extent and significance of the Russian programme and whether it is currently operational, dormant or incapable of mobilisation. Limited access techniques were practised in the course of these inspections, especially in 1992 and later. Essentially these failed because, for success, the level of co-operation has to be high. Constraints on full access are naturally viewed in conjunction with the explanations and accounts offered by the hosts for the 'hidden' resource. Abuse of managed access can create additional suspicion and concern.

8. Team composition and selection are important. The initial American–British team was the first ever to conduct BW inspections,[7] and their success was remarkable considering that, despite their individual professional knowledge and skills, they

had little arms control verification experience. The pre- and post-trilateral teams were limited to 15 individuals, including linguists and logistical support. Forging individuals with varying diplomatic, technical and intelligence expertise into a balanced and effective team was a challenge.

The teams provided by the UK and the US were capable of undertaking preliminary evaluation, but follow-up required a broader range of expertise and logistic support. The conditions encountered in the course of the visits were sometimes harsh and teams needed to be physically fit.

Key inspectors from all three countries were to become crucially involved in UNSCOM's attempt to disarm Iraq. The experience gained in the trilateral process by all of the parties proved invaluable in dealing with Iraq's wilful resistance to giving up its illicit weaponry.

Conclusions

The Trilateral Agreement is effectively dead and unlikely to be resurrected in its old format. In hindsight it was too ambitious; its disarmament objective deflected by issues of reciprocity and access to sites outside the territories of the three parties. Many subsidiary aspects were never addressed, especially those of benefit to Russia, like facility conversion and technical co-operation.

Russia's refusal to provide a complete account of its past and current BW activity and the inability of the American–British teams to gain access to Soviet/Russian military industrial facilities were significant contributory factors to the failure of the trilateral process. Biopreparat was at the periphery of the programme, providing an external veneer of respectability, as well as expertise, insight and resources and an ability to transfer technology into the military programme. An extensive account and appraisal of Biopreparat and its activities is still outstanding.

The political cost of the Trilateral Agreement was high. It demanded attention when the US and Russia were busy attending to other political consequences of the demise of the Soviet Union. It will require political pressure at the highest level for any Russian BW transparency and/or disarmament process to recommence, whether with the UK and the US or with the UN or some other international organisation. Convincing new intelligence will be required to rekindle political interest and impetus for resolving the Russian BW issue, although earlier intelligence still stands.

Covert non-compliance with the BWC is easy because verification procedures are not in place. Any attempt to develop BW verification procedures involving field and facility investigations should address the issues raised by the investigations in Russia, as well as initiatives of the ISTC in Moscow, the UNSCOM experience and inspections undertaken by other arms control agencies. Site access dilemmas, commercial confidentiality and legitimate defence requirements will have to be taken into account and managed access procedures refined to ensure that assessment of site activity can be made with confidence.

Other initiatives, particularly those aimed at redeploying weapons technicians to civilian industry, are useful in reducing the opportunity for Russian development and production of BW but do not provide information of the quality and range required to make it possible to certify compliance. It is of considerable concern that the senior research directors of facilities that contributed extensively to the Soviet/Russian programme remain in control.

In certain respects the investigation of the Soviet/Russian programme parallels that by UNSCOM in Iraq. Both countries wholly denied non-compliant activity and undertook concealment and deception until a significant defector provided credible accounts of an illicit programme. Thereafter a partial acknowledgement of a programme was made, but serious concerns about retained capability remained. It is remotely possible that both countries have truly terminated their programmes, but failure to co-operate fully and account for past and current activities, particularly at military installations, ensures that distrust remains.

The trilateral process could be resurrected but would require considerable refocusing and modification, and its adversarial legacy would not be conducive to progress. It is far more probable that an American–Russian bilateral arrangement could be put into place.

Should a verification mechanism or protocol for the BWC eventually be established, the portents are that it will be incapable—at least under any investigative procedure devised so far—of determining whether Russia has permanently relinquished BW. An attempt could be made to have the UN Security Council authorise an inquiry under Article VI of the BWC, although it is likely that Russia would veto that. After the experience of UNSCOM, with its remarkably intrusive inspection regime, there is little prospect that even a remotely similar regime could be established for verifi-

cation of a Russian BW programme. It really rests with Russia to demonstrate compliance to an international audience through the uncomfortable process of a total admission of past and current activities.

The trilateral process achieved many successes but was not allowed to take all the steps which could have dispelled suspicions and uncertainties about Russia's BW programmes. The precedent has been important, but if similar circumstances ever arise again the states concerned know that they will have to do better.

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Endnotes

[1] These open-air testing sites were used to evaluate dissemination of potential BW agents and were part of defensive efforts in the context of the 1990–91 Gulf War.

[2] The text is available at http://projects.sipri.se/cbw/docs/cbw-trilateralagree.html.

[3] Form F relates to past activities in offensive and/or defensive biological R&D programmes after 1 January 1946. The confidence-building measures were agreed at the Third BWC review conference in 1991.

[4] The primary objective of the International Science and Technology Center (ISTC) is to give weapons scientists and engineers, particularly those in Russia who possess knowledge and skills related to weapons of mass destruction or missile delivery systems, opportunities to redirect their talents to civilian activities. The centre was developed to counter the threat of a 'brain drain' from the Soviet Union to countries wishing to acquire nuclear, biological or chemical (NBC) weapons.

[5] See Marie Chevrier, 'The Biological Weapons Convention: the protocol that almost was', in Trevor Findlay and Oliver Meier (eds), *Verification Yearbook 2001,* The Verification Research, Training and Information Centre (VERTIC), London, December 2001, pp. 79–97.

[6] For his memoirs see Ken Alibek (with Stephen Handelman), *Biohazard: The Chilling True Story of the Largest Covert Biological Weapons Program in the World Told by the Man Who Ran It,* Arrow Books, London, 2000.

[7] Technically, the Western European Union (WEU) was the first to conduct such inspections (technical information visits), in West Germany during the 1950s and 1960s under the 1948 Brussels Treaty (amended 1954). See Stockholm International Peace Research Institute (SIPRI), *The Problem of Chemical and Biological Warfare: CB Disarmament 1920–1970, vol. 4,* Almqvist and Wiksell, Stockholm, 1971, pp. 224–225.

7

Verifying a missile accord with North Korea

Leon V. Sigal

The verification of any arms control agreement is a political question in technical guise. This is especially so for a potential missile accord between the United States (US) and North Korea (the Democratic People's Republic of Korea, DPRK). North Korea views talks on missiles as a means towards the political goal of ending its life-long enmity with the US and is prepared to tolerate verification as part of a possible bargain. For its part, the US seeks 'verifiable constraints on the North's missile programs'.[1] Those in the US Administration who favour negotiating a missile accord with North Korea insist on stringent monitoring to satisfy the sceptics in Washington, while those who are ideologically ill-disposed towards arms control want to block a deal by seeking on-site inspections so intrusive that Pyongyang is sure to reject them.

To North Korea an end to enmity means, above all, being treated like a sovereign equal and no longer being the object of military threats. It also means political and economic engagement instead of isolation and sanctions. High-level talks with the US, which have been held periodically since 1992, have been a step in that direction, though not a decisive one (after all, talks could be an occasion for issuing threats). The establishment of diplomatic relations is another such step (although, as North Korean diplomats have pointedly reminded their American interlocutors, Japan went to war with the US even when the two countries had diplomatic relations). What North Korea seems to have in mind is a fundamental improvement in its political relations with the US.

Such a change would not require the withdrawal of American forces from the Korean Peninsula. Quite the contrary—ever since January 1992 Pyongyang has been telling Washington, in effect, that, so long as the US remains its enemy, American

troops are a threat and must be withdrawn, but once relations were no longer hostile they would no longer be a threat and could remain.

An end to enmity

Faced with deepening international isolation and the prospect of economic implosion, North Korea's long-time ruler Kim Il Sung decided in the late 1980s to reach out to all three of Pyongyang's rivals—Japan, South Korea and the US—only to have the first Bush Administration impede closer South Korean and Japanese ties with North Korea and insist that, as a condition of engagement, North Korea stop trying to develop nuclear weapons. Concluding that the US held the key to opening doors to South Korea and Japan, North Korea decided to trade in its known nuclear arms programme in order to befriend the US. At the same time it kept its nuclear option open as leverage on the US to live up to its part of the bargain. It continues to do so.

Tit for tat

North Korea's bargaining tactics led critics to conclude that it was engaging in blackmail in an attempt to obtain economic aid without giving anything in return. It was not. It was playing 'tit for tat', cooperating whenever the US cooperated and retaliating when the US reneged on cooperation, in an effort to get Washington to end the enmity between them.[2] Table 1 summarises the principal stages in North Korea's strategy of tit for tat since January 1992.

If North Korea had been determined to acquire nuclear arms early in the 1990s, as most people in Washington believed at the time, it could have shut down the reactor at its main nuclear site in Yongbyon at any time between 1991 and 1994, removed the spent nuclear fuel and quickly reprocessed it to extract plutonium, the main explosive ingredient in nuclear weapons. Yet it did no reprocessing at Yongbyon from 1991 onward and allowed international inspectors to verify this in 1992. In fact, it only shut down the Yongbyon reactor in May 1994, long after it was expected to. Its actions showed that from 1991 it was exercising some self-restraint in the hope of concluding a nuclear deal with the US. In May 1992 it offered to trade in the Yongbyon reactor for a replacement that would lend itself less easily to proliferation of nuclear materials, but was unwilling to give it away for nothing.

Uncertain about North Korea's nuclear intentions and slow to recognise its change of course, the US ignored the offer and threatened sanctions or worse if North Korea did not fulfil its obligations under the 1968 Nuclear Non-Proliferation Treaty (NPT). In February 1993 the International Atomic Energy Agency (IAEA) requested special inspections and warned that technical assistance could be suspended. North Korea, in turn, warned in March that it would renounce the treaty and restricted but did not foreclose the inspectors' access to Yongbyon. While allowing the IAEA to monitor its Yongbyon facilities to impede any diversion of plutonium in 1993 and 1994, it resisted IAEA efforts to determine how much reprocessing it had done before 1991.

The US and North Korea stumbled to the brink of war in June 1994 before a bold mission to Pyongyang by former American President Jimmy Carter undermined the American sanctions strategy and convinced Kim Il Sung to suspend North Korea's programme for reprocessing plutonium for bombs and accept a summit meeting with South Korea.[3] Despite Kim's death on the day talks resumed, it took just four months to conclude the October 1994 Agreed Framework, whereby North Korea agreed to freeze and eventually dismantle its nuclear arms programme in return for two new light water reactors (LWRS) for nuclear power generation, an interim supply of heavy fuel oil, some relaxation of American economic sanctions, and modest movement towards establishing diplomatic ties. The IAEA was charged with monitoring the freeze.

When Republicans took control of the American Congress in elections just weeks later, they denounced the deal as appeasement. Unwilling to challenge Congress, the administration of President Bill Clinton back-pedalled on implementation by failing to deliver heavy fuel oil on time and doing little to ease sanctions. North Korea was deeply disappointed. After all, it reasoned, if the US were willing to supply nuclear reactors it would surely begin putting an end to enmity. In 1997, when the US was slow to live up to the terms of the October 1994 accord, North Korea threatened to break it. Carrying out that threat, it warned that it needed to reopen sites at Yongbyon. It also resumed excavating an underground site at Kumchang-ni, leading American intelligence to conclude—wrongly—that the long-suspect site was nuclear-related.[4] Most significantly, its efforts to acquire equipment for enriching uranium may date from this point.

Missiles as a bargaining chip

At the same time North Korea resolved to try again to improve relations, this time using its missiles as an inducement. Had it wanted missiles that were worth deploying, it should have been testing and perfecting its three medium- and longer-range missiles, the No-dong, Taepo-dong I and Taepo-dong II. Yet it has conducted just two tests of its longer-range missiles over the past decade—neither of which was fully successful. Both were examples of tit for tat.

In an attempt to isolate North Korea and keep the focus on its nuclear programme, the US intervened in March 1993 to stop Israel from negotiating an end to North Korean missile exports to the Middle East. Shortly afterwards Pyongyang invited prospective buyers from Pakistan and Iran to witness its first and only test of the medium-range No-dong on 29 May 1993. In June the US intervened again to block Israel from consummating a deal on exports, but the latter opened missile negotiations of its own with Pyongyang in April 1996.[5] In the ensuing two years it held just two rounds of talks. Again, North Korea resorted to tit for tat. It threatened to conduct missile tests on at least two occasions, only to call them off at US request after American intelligence detected the test preparations.[6] On 16 June 1998 it made a public offer to negotiate an end not only to its missile exports but also to testing and production. The statement, carried in English by the Korean Central News Agency, was a breakthrough:

> The discontinuation of our missile development is a matter which can be discussed after a peace agreement is signed between the DPRK and the United States and the US military threat [is] completely removed. If the US concern about our missiles is truly related to the peace and security of Northeast Asia, the United States should immediately accept the DPRK-proposed peace agreement for the establishment of a durable peace mechanism on the Korean Peninsula.[7]

By a peace agreement North Korea meant a declared end to enmity, not a peace treaty in the usual sense. Nor was removal of the 'US military threat' synonymous with removing the American military presence from South Korea. Since American forces could still strike North Korea from offshore, only a basic improvement in political relations would remove the threat as North Korea perceives it. The 'peace

mechanism' referred to in the statement is a three-way military-to-military channel involving the US and North and South Korea, which North Korea has long sought as a replacement for the Military Armistice Commission established after the Korean War to deal with ceasefire violations. The mechanism would not only fulfil that role but also be the forum for negotiating force cuts and other measures to reduce the risk of war on the peninsula.

With the 16 June offer came a threat to resume missile tests, which North Korea carried out on 31 August 1998 when it launched a three-stage Taepo-dong I in a failed attempt to put a satellite into orbit. At the time, the US had just opened talks with North Korea to seek access to the suspect nuclear site at Kumchang-ni. The US resumed those talks after a brief recess, and North Korea refrained from testing its longer-range Taepo-dong II—a test that American intelligence had assessed as 'likely'. As a result of the talks, North Korea allowed American inspectors to visit the Kumchang-ni underground site twice to ascertain that nothing was amiss. It also expressed interest in setting up a joint venture which would, in effect, permit permanent monitoring of the site. Although North Korea has not said so, this could be a precedent for monitoring not only dismantlement of its uranium enrichment sites but also its missile production facilities and other sites as part of a missile deal.

Reviewing North Korean policy, former American Secretary of Defense William Perry went to Pyongyang in May 1999 and proposed high-level talks in Washington, affirming that the US was at last ready to negotiate in earnest and make good its promises. The Perry policy paid off in September 1999 when North Korea agreed to suspend its missile tests while negotiations proceeded. In return, the US promised to end the sanctions imposed on North Korea under the 1917 omnibus Trading with the Enemy Act—a pledge it did not carry out until just after the first-ever North–South Korean summit meeting of June 2000. The Clinton Administration helped to make that summit possible by signalling its readiness to cooperate with Pyongyang in late March 2000, when it handed North Korea a draft communiqué, to be issued after high-level talks in Washington, declaring an end to enmity.

North Korea wanted the US to end sanctions not only under the Trading with the Enemy Act but also under American anti-terrorism law. Instead the two sides agreed to a joint statement of 6 October 2000 in which North Korea renounced

terrorism and the two sides 'underscored their commitment to support the international legal regime combating international terrorism and to cooperate with each other in taking effective measures to fight terrorism', and in particular 'to exchange information regarding international terrorism'.[8]

The resolution of these issues prompted Kim Jong Il, Kim Il Sung's successor, to send his second-in-command, Vice-Marshal Cho Myong Rok, to Washington on 10 October 2000. After three days of talks the two sides affirmed that 'neither government would have hostile intent toward the other'.[9] This statement—the declared end to enmity that North Korea had sought—opened the way not only to a missile deal but also to negotiations on conventional forces, which could begin once a missile deal was concluded and implemented.

The joint communiqué also obliquely addressed verification: 'The sides agreed on the desirability of greater transparency in carrying out their respective obligations under the Agreed Framework. In this regard, they noted the value of the access which removed US concerns about the underground site at Kumchang-ni'. Such transparency was needed not only to clear up suspicions at a nuclear site but also to verify a missile ban.

The makings of a missile deal

Two weeks later, Secretary of State Madeleine Albright became the first American official to meet Kim Jong Il when she visited Pyongyang. In the course of the talks, Kim agreed to end exports of all missile technology, including those in fulfilment of existing contracts, and to freeze the testing, production and deployment of all missiles with a range of more than 500 kilometres (km). That would cover the No-dong, the Taepo-dong I and II and, arguably, the SCUD-C. In return, the US agreed to launch two or three North Korean satellites a year.[10] To replace the revenue forgone by halting missile exports, North Korea agreed to accept compensation in kind, not cash. Although Albright did not say so, the US was prepared to arrange for US$200–300 million a year in investment and aid for Pyongyang.[11] Above all, North Korea wanted President Clinton to visit Pyongyang to seal the deal as the consummation of its 10-year campaign to end enmity. Without Clinton's commitment to come, the talks stalled.

Instead of picking up the ball where Clinton had dropped it, the new American President, George W. Bush, moved the goalposts. He picked a fight with South

Korean President Kim Dae Jung in March 2001 by publicly repudiating reconciliation and privately discouraging him from concluding a peace agreement with North Korea. After completing its Korea policy review, the US Administration reneged on past promises and tried to reinterpret agreements with North Korea unilaterally.

First, President Bush sought 'improved implementation' of the 1994 Agreed Framework, in effect rewriting it to expedite North Korean compliance with IAEA inspections without offering anything in return. Second, he sought 'a less threatening conventional military posture' on the part of North Korea. Yet, given its military inferiority, the country cannot adopt a less threatening military posture on its own.[12] Third, the Bush Administration decided that, as a matter of policy, progress towards a missile deal would depend on progress being made on the other issues that concern it. That policy will probably ensure that no progress is made on any issues at all.

Most important of all, in his State of the Union address on 29 January 2002, President Bush repudiated the 'no hostile intent' pledge of 12 October 2000 when he said of North Korea that: 'States like these, and their terrorist allies, constitute an axis of evil, arming to threaten the peace of the world'.[13] Subsequently he said he would 'confront the worst threats before they emerge', strongly implying a strategy of preventive war against proliferators.[14]

As a result, no negotiations with North Korea on missiles or any other issue took place between November 2000 and October 2002, although North Korea did maintain its moratorium on missile test launches. North Korean missile exports continued and so did missile development. North Korea also gave new impetus to covert work on uranium enrichment. The existence of that programme has been known to US intelligence for well over a year. When Assistant Secretary of State James Kelly confronted the North Koreans with evidence of this in talks in Pyongyang in October 2002, they acknowledged it, thereby putting the covert enrichment programme on the negotiating table.

North Korea's 'confession' has hardliners to advocate punishing it, but the crime-and-punishment approach has not worked in the past and there is little reason to believe it will succeed now. If it does not, the US may eventually find itself back in negotiations with the North Koreans, not only about its nuclear concerns but also about other outstanding security issues, including missiles.

Future issues for a missile agreement

For the current freeze to be turned into an outright ban, significant issues remain to be resolved. One is the 'elimination' of North Korea's missiles. The Taepo-dong I and II are not yet deployed, but North Korea will probably withhold any commitment to eliminate its No-dong missiles as a form of leverage on Japan, which is a potential source of the lion's share of compensation for the missile deal. It will not yield until Japan accelerates talks on the normalisation of relations and declares an end to enmity.

A second unresolved issue is the extension of the freeze to all North Korea's missiles with a range of over 300 km.[15] That would cover shorter-range SCUD-B missiles, which North Korea regards as part of its conventional deterrent. It might be persuaded to dismantle them, but only in the course of conventional force negotiations with South Korea and the US.

A third issue is how to turn the freeze into a verifiable ban. On-site monitoring to verify a ban on production and deployment—which negotiators were calling 'transparency' and 'confidence-building measures on missiles'—was discussed during Madeleine Albright's talks in Pyongyang and in greater detail at talks between Robert Einhorn, assistant secretary of state for nonproliferation, and Jang Chang-chon, director general for American affairs of the North Korean Foreign Ministry, in Kuala Lumpur, Malaysia, from 1–3 November 2000; but North Korea was unwilling to make any commitment to verification, even in principle, until it had President Clinton's commitment to come to Pyongyang.[16]

North Korea has in fact already taken the single most important step towards limiting the missile threat it represents—a moratorium on test launches. Without more tests, it will not have new types of missile worth deploying or selling. While a handful of states have been willing to buy a few untested missiles in order to develop them further on their own, that market is limited. The test moratorium can be monitored with high confidence by national technical means (NTM) alone.

Sceptics argue that North Korea could continue developing missiles even under a verifiable test ban. North Korea's No-dong and Pakistan's Ghauri, they say, are the same missile and Pakistan, in effect, has been testing the No-dong for North Korea, rather than reverse-engineering it and adding its own or Chinese-made components. They also claim that North Korean observers were present at the first

Ghauri test and that this proves that Pakistan is fully sharing the data from its tests with North Korea. Yet the two assumptions have never been fully substantiated.[17] That does not keep sceptics from claiming that Pakistan will transfer the Ghauri to North Korea once it is fully proven and operational.

Transparency measures for deployed missiles

A deployment freeze and a production freeze pose much more of a problem for verification than a freeze on testing. A freeze on the numbers of missiles already deployed would also be more difficult to monitor than a complete ban (if a deployed missile is detected this is clear violation of a ban on deployed missiles, but numbers of deployed missiles are more difficult to establish). On-site verification may not be of much help. Indeed, it is not clear whether American intelligence has ever detected the deployment of a single No-dong missile. What it may have sighted is a truck which transports, erects and launches missiles and is believed to be associated with the No-dong.

The mobility of its launchers makes North Korean cooperation essential to the monitoring of a freeze on deployment. A number of cooperative transparency measures would be needed to help ensure that no militarily significant violations of a deployment freeze had occurred.

One is a declaration of the numbers and types of deployed missiles, along with timely notice of any change in the data.

A second is the 'fencing in' of the missiles' patrol or deployment zones. This transparency measure would take advantage of the fact that the No-dongs are liquid-fuelled and cannot therefore roam freely. They need to be tethered to base to permit rapid fuelling prior to use. They can move far afield temporarily, but not for long periods. Their off-road mobility is also likely to be very limited: they cannot move fast, even on roads, which are seldom well-paved. The more they move around, the more likely this is to affect their reliability. The locations of missile operating bases and deployment areas would also need to be spelled out. Depending on North Korean operating practices, missile launchers might be permitted to roam only within 30 miles of each operating base. Until they are withdrawn to elimination sites, No-dong missiles, missile stages and launchers could be located only within or en route to support facilities and deployment areas, and could not be co-located with shorter-range missiles. Timely notification would be required if they were

destroyed by accident or before they were transported off-base for repair. Transit time would be limited. Article VIII of the 1987 Intermediate-range Nuclear Forces (INF) Treaty could serve as a model for these arrangements.

A third transparency measure would be periodic parades of missiles. The US would have the right to request, say, up to 20 such parades a year, at one North Korean base at a time. On six hours' notice North Korea would have to open the roofs of any fixed structures at the base and its associated deployment zones, remove all the missiles and launchers from concealment, and display them out in the open for at least six hours. This would permit satellite verification of the number of missiles at each base in turn, while not making the missile force as a whole vulnerable to a pre-emptive attack. If the No-dong missiles are to be eliminated, parades at shorter-range missile sites would allow verification that they have not been relocated. A comparable arrangement operated under the INF Treaty.

North Korea would have to remove missiles and support equipment regiment by regiment, rather than one by one, eliminating all the missiles from one site before moving on to the next. The as yet undeployed Taepo-dong I and Taepo-dong II missiles might be scheduled for elimination first. The missiles and associated support equipment would be dismantled at predetermined sites according to pre-set procedures and then displayed in the open for days to permit monitoring by NTM. Missile operating bases and associated support structures and deployment areas would also be dismantled *in situ*. Once they had been dismantled, but before the parts had been removed, North Korea would give at least 30 days' notice to allow the US to verify the dismantling. The agreement would specify arrangements for on-site inspection, if needed. The INF Treaty, especially articles IX and X and the protocol on elimination, offers suitable procedural precedents, but with some exceptions. For instance, destruction by launching might not be permitted.

Transparency measures for missile production

The US can monitor a freeze on production by using surveillance satellites and other NTM, but effective verification may require on-site monitoring at missile factories. The scope of on-site monitoring depends on whether all missile production is prohibited or only production of missiles with a range of 300 km or more.

A complete ban on North Korean missile production would be easier to monitor than an agreement that allowed production of short-range missiles to continue. If

North Korea is willing to halt all missile production, NTM may suffice to monitor inactivity at its missile plants. Yet North Korea's habit, dating from the Korean War, of locating factories underground where they are less vulnerable to detection or destruction from the air will make some sceptics insist on more intrusive, 'any time anywhere', on-site challenge inspections.

If North Korea continued to produce shorter-range SCUDs, all final assembly plants for missiles would need to be subject to continuous on-site monitoring to impede production of prohibited missile types. Arrangements for portal monitoring under the INF Treaty could be a model, but those arrangements were reciprocal.

What would North Korea want in return for letting the US monitor its missile production sites? Although it has yet to say so in negotiations, it might be induced to accept on-site monitoring along the lines of the access it allowed at the suspect nuclear site at Kumchang-ni. It might even be willing to convert its missile factories to civilian production if it received the necessary investment in return. That is the implication of the 'joint venture' formula it talked about for Kumchang-ni. That formula also underlines the importance of the political relationship for verification: the extent of North Korean cooperation in facilitating monitoring will probably depend on US willingness to move to a less adversarial relationship.

Working out arrangements in detail would take time. That was not the case with the Agreed Framework, which was able to capitalise on existing IAEA inspection protocols to facilitate verification.

Transparency measures for exports

The monitoring of exports of missiles, missile components and technical assistance is inherently difficult and will largely depend, as it does now, on NTM. It is doubtful how much challenge inspections in ports or at sea would help, since equipment and experts can be shipped by other than North Korean carriers, which could not be inspected. A ban on production would give the US greater confidence about verifying an export ban.

A step-by-step approach to a verifiable missile accord

If arms control negotiations on missiles were to proceed according to the model provided by the American–Soviet nuclear reduction agreements of the Cold War, all the detailed arrangements would have to be spelled out before an agreement

could be concluded. The 1994 Agreed Framework offers an alternative model: the sides agree to a 'road map' of reciprocal steps, carefully choreographed, without the formality of a ratified agreement. This model may turn out to be better suited to achieving an arms control accord with North Korea. Similarly, moving from a freeze to a ban may be done in discrete but synchronised steps, with verification measures being gradually phased in along with political and economic quid pro quos.

Bans on missile tests and missile exports clearly have priority. Arrangements to facilitate a test ban would be relatively simple to negotiate, perhaps accompanied by a formal reaffirmation of an end to enmity and compensation in kind for a halt to exports. A joint venture to convert missile production facilities might be negotiated next as a quid pro quo for on-site verification of a production ban. Much more significant economic assistance might finally be negotiated in return for a verifiable ban on the deployment of all missiles with a range of 300 km or more.

In negotiating verification of a missile accord, those in the American Government who are opposed to a deal may be tempted to repeat the experience of the Joint Declaration on the Denuclearisation of the Korean Peninsula of 31 December 1991, in which North and South Korea agreed not to 'test, produce, receive, possess, store, deploy or use nuclear weapons'.[18] Going beyond their obligations under the NPT, the two sides also pledged not to 'possess facilities for nuclear reprocessing and enrichment'. On 14 March 1992 North Korea agreed provisionally to establish a Joint Nuclear Control Commission (JNCC) to monitor the denuclearisation accord, but the then Bush Administration pressed South Korea to insist on elaborate and intrusive inspections of each other's nuclear facilities which would have been so demanding that, as one senior official put it, 'if the North accepted them, the South might have to reconsider'.[19] A US official who was intimately involved adds: 'To anyone who had an arms control background, these inspections were totally unworkable, totally unacceptable'.[20] In the words of a State Department analyst, 'the South Koreans were spun up by us'.[21] The JNCC has been moribund ever since.

Conclusion

In most arms control negotiations, demands for stringent verification by each side are limited by the expectation that the other side will insist on reciprocity. No

such reciprocal arrangements would apply to a US–North Korea missile deal. Instead, reciprocity has a different meaning, one that addresses the very source of the mistrust between the two sides—their hostile relationship. A missile freeze can be turned into a verifiable ban, but not if the US asks for more access to North Korea than it needs, and only if it reaffirms its willingness to end its enmity towards North Korea.

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Table 1 Dialogue with North Korea on missiles

22 January 1992 High-level US–North Korea talks: Pyongyang hints at willingness to negotiate on missile exports; US bars further high-level talks unless North Korea fully implements IAEA and North–South inspections, and says further improvement in relations will then depend on an end to missile exports

June 1992 Preparations for No-dong test

Late 1992 No-dong test cancelled

October 1992 On initiative of North Korea, senior Israeli Foreign Ministry and Mossad (intelligence) officials hold talks in Pyongyang to discuss economic investment and protest against North Korea missile exports to Middle East

January 1993 To head off purchase of No-dongs by Iran, senior Israeli Foreign Ministry official visits Pyongyang, offering significant investment and diplomatic recognition in return for end to missile exports to Middle East

March 1993 After North Korea announces its intention to withdraw from NPT, US persuades Israel to halt missile talks

March 1993 Iranians visit Pyongyang to discuss purchase of No-dong missiles

29 May 1993 First and only North Korea test of No-dong missile; Iranians and Pakistanis present at test

June 1993 After North Korea suspends its withdrawal from the NPT, Israel resumes missile talks with North Korea; Foreign Minister Shimon Peres goes to Pyongyang to close a deal and establish diplomatic relations

26 December 1993 US welcomes temporary deferral of North Korea missile sale to Iran

May 1994 No-dong test cancelled after talks with US

31 May 1994 North Korea tests Silkworm anti-ship cruise missile

October 1994 Agreed Framework signed; alludes to missiles by holding out prospect of full diplomatic relations 'as progress is made on other issues of concern to each side'

January 1996 US Deputy Assistant Secretary of State Thomas Hubbard proposes missile talks in letter to North Korea

20–21 April 1996 First round of US–North Korea missile talks in Berlin, Germany

10–11 June 1996 Talks between US and South Korea; South Korea to join Missile Technology Control Regime (MTCR)

September 1996 US calls off second round of missile talks after submarine incursion into South Korean waters

September 1996 North Korea begins preparations for No-dong test

18 October 1996 North Korea calls off preparations at US request at meeting in New York

11–13 June 1997 At second round of missile talks in New York, US offers deal on exports and tests; no North Korean response

December 1997 North Korea warns it will not be bound by the Agreed Framework if US does not implement it

16 June 1998 North Korean publishes proposal to end missile exports, testing and production; threatens to resume tests

31 August 1998 North Korea tests Taepo-dong I; satellite launch fails

21 August–5 September 1998 US–North Korea talks in New York; agreement to resume missile talks

30 September–1 October 1998 Third round of missile talks; no progress

25–28 May 1999 Former US Secretary of Defense William Perry in Pyongyang indicates US willingness to lift sanctions and normalise relations if North Korea takes steps to end its nuclear and missile programmes, but does not ease sanctions or unfreeze assets. North Korea continues missile test preparations

9–12 September 1999 Berlin talks resume; North Korea agrees to announce a missile test moratorium after US announces intention to end sanctions under Trading with the Enemy Act

Late March 2000 US gives North Korea date for ending Trading with the Enemy Act sanctions and draft of joint communiqué pledging 'no hostile intent'; North Korea then agrees to summit meeting with South Korea

13–15 June 2000 North–South Korean summit in Pyongyang

6 October 2000 US–North Korea Joint Statement on Terrorism

9–12 October 2000 Vice Marshal Cho Myong Rok in Washington; joint communiqué declares 'no hostile intent'

23–25 October 2000 US Secretary of State Madeleine Albright and North Korean President Kim Jong Il sketch out elements of missile deal

6 June 2001 White House announces comprehensive approach to North Korea, with broadened agenda to include improved implementation of Agreed Framework

and less threatening military posture, not just verifiable constraints on missile programmes and a ban on missile exports

18 June 2001 North Korean Foreign Ministry spokesman responds that US should first discuss implementation of Agreed Framework and the 12 October 2000 joint communiqué

28 June 2001 North Korean Foreign Ministry spokesman links nuclear inspections to compensation for loss of electricity because of delay in delivery of first nuclear reactor, suggesting a deal, but warning that North Korea will end nuclear freeze if it does not receive compensation

October 2002 When confronted by the US with evidence that it was attempting to commence a uranium enrichment programme, North Korea admits it.

Endnotes

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[3] For the nuclear crisis and Carter's role, see Sigal, *Disarming Strangers,* chapter 6; Don Oberdorfer, *The Two Koreas: A Contemporary History,* Addison-Wesley, New York, 1998, chapter 13; and Selig Harrison, *Korean Endgame: A Strategy for Reunification and US Disengagement,* Princeton University Press, Princeton, NJ, 2001.

[4] Interviews with US officials.

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[7] Korean Central News Agency (Pyongyang), 0416 GMT, in English, 16 June 1998.

[8] 'Joint US–DPRK statement on terrorism', 6 October 2000.

[9] US–DPRK Joint Communiqué, 12 October 2000, Washington, DC.

[10] Michael Gordon, 'How politics sank accord on missiles with North Korea', *New York Times,* 6 March 2001, p. A-1.

[11] Interviews with US officials.

[12] Center for Strategic and International Studies (CSIS), *Conventional Arms Control on the Korean Peninsula,* Working Group Report, CSIS, Washington, DC, August 2002; and Michael O'Hanlon, 'Stopping a North Korean invasion: why defending South Korea is easier than the Pentagon thinks', *International Security,* vol. 22, no. 4, spring 1998, pp. 135–70.

[13] President George W. Bush, Text of the State of the Union address to the US Congress, Washington, DC, 29 January 2002.

[14] The White House, Office of the Press Secretary, 'Remarks by the President at 2002 Graduation Exercise of the United States Military Academy West Point', Washington, DC, 1 June 2002.

[15] That standard was drawn from the Missile Technology Control Regime, which functions as an international cartel to regulate the export of missiles and missile technology.

[16] Interviews with North Korean and American officials.

[17] Interviews with US officials.

[18] Joint Declaration on the Denuclearisation of the Korean Peninsula, 31 December 1992.

[19] Interview with senior US Administration official, 27 February 1992.

[20] Interview with US State Department official, 6 April 1996.

[21] Interview with US State Department official, 27 February 1996.

8

A role for verification and monitoring in small arms control?

Kate Joseph and Taina Susiluoto

There was a time when controlling the transfer and use of small arms and light weapons was thought to be not only impossible but also undesirable. Small arms and light weapons are used legitimately in large numbers by armed forces and police services around the world. Many civilians also own small arms for hunting or sporting purposes. Their widespread availability in many societies made the idea of small arms control seem rather like trying to put a genie back in a bottle. It seemed far more useful to concentrate on reducing armaments which posed a 'serious' threat to stability. Heavy weapons can cause many more casualties over a shorter time, while weapons of mass destruction, besides being horrifying in their potential effects, can also drastically alter the strategic balance. In comparison, small arms seemed to be small fry.

Yet, just a few years later, small arms control is no longer perceived as a naive and frivolous objective but instead as a serious and, in some ways, increasingly accepted policy option. The impetus has not necessarily come from traditional arms control quarters. Humanitarian aid groups, development agencies, medical organisations and law enforcement bodies have all recognised the damage caused by the spread of small arms and light weapons and have sought solutions.

As a result, a relatively complex web of regulations, standards and projects has grown up which is aimed at dealing with specific aspects of the problem, but does not necessarily constitute a comprehensive regime. The United Nations Programme of Action on Small Arms and Light Weapons is itself more a menu of measures than a binding system of controls.

Largely as a consequence, verification and monitoring barely feature on the small arms control agenda.

Ultimately, a more rigorous control and verification system in the field of small arms control would be useful. Without some form of accountability it is unlikely that agreed norms and standards will be fully respected. Any verification and monitoring, will, however, need to be tailored to suit the peculiarities of the issue and to take account of the size and dynamics of the illicit trade which is by its very nature not amenable to verification or inspection.[1]

Background

Impact

Even though small arms have many legitimate uses, there is no doubt that their excessive accumulation and uncontrolled spread can have devastating effects. Small arms and light weapons[2] are now recognised as causing the majority of deaths and injuries in combat and non-combat situations. Many of the low-intensity conflicts which have characterised the years since the end of the Cold War have been fought largely with small arms and light weapons. Often used indiscriminately, these weapons can be responsible for just as many fatalities among civilians as among combatants. In fact, the International Committee of the Red Cross (ICRC) has estimated that, in certain situations, up to 64 percent of the casualties in conflict areas are borne by civilians, often women and children.[3] Taking into account non-combat situations, the Small Arms Survey estimates that over half a million people are killed by small arms and light weapons each year, either intentionally or unintentionally, in combat or because of crime. Many more die from forced displacement, malnutrition and disease resulting from gun-related intimidation.[4] The humanitarian impact is incalculable.

Characteristics of small arms and light weapons

Unlike heavy conventional weapons, such as tanks or artillery, small arms and light weapons are widely available and relatively easy to produce. Small arms are cheap and easy to conceal, which means they are highly portable and can be smuggled relatively easily across borders. Rapid-fire military assault rifles are becoming increasingly widely available, particularly among rebel groups, terrorist organisations and organised criminal gangs. Even shoulder-fired rockets, mortars and light anti-tank weapons have found their way into the hands of individuals and non-state groups. Often, their firepower now outperforms that of the police or military. Furthermore,

automatic assault rifles, such as the Russian-designed AK-47 or the German G-3, are reasonably durable, require little or no logistical support, and are relatively easy to use. Even children and teenagers can be trained to use them.

Where do small arms come from?

The increased attention being devoted to the control of small arms and light weapons probably does not stem from increased availability or trade. In fact, transfers of small arms and light weapons, both legal and illegal, appear to be relatively stable, or even gradually declining. The sheer numbers already in circulation, however, are not reassuring. The UN has estimated that there are over 500 million small arms and light weapons in circulation around the world, but the real number may be considerably higher.[5]

Many of these weapons are decades old and are recycled from conflict to conflict. Others have been transferred from government stocks, particularly in Central and Eastern Europe, following the end of the Cold War.[6] Increasingly considered obsolete and falling foul of North Atlantic Treaty Organization (NATO) standards, these weapons were viewed as a ready source of hard currency by countries in transition. The 1990 Conventional Armed Forces in Europe (CFE) Treaty prohibited the sale of heavy weaponry but did not cover small arms and light weapons. As a consequence, many were sold to countries involved in violent conflict or to abusive regimes, sometimes in violation of UN arms embargoes.[7]

A control vacuum

Small-arms control has focused on combating illicit trafficking, but there is increasing acceptance among governments that almost all illegally-held and -transferred weapons, including those used for criminal purposes, are originally transferred perfectly legally. Many nations, even those with stringent laws governing the export of military technologies, lack legislation which takes into account the peculiarities of small arms and light weapons. For example, many legal small arms shipments have been relatively easily diverted to illegal organisations. An increasing number of international arms brokers have exploited loopholes in legislation which effectively allow them to ship weapons anywhere, including to areas of conflict or abusive governments.[8] A lack of common standards for export documentation, particularly end-use certificates, means that they can be easily forged.

Illegal small arms and light weapons are a primary cause of concern for governments. Illegal weapons are used by secessionist groups, terrorist organisations and organised criminal networks, threatening internal security and stability. Yet, according to the Small Arms Survey, illegal transfers probably account for only 10–20 percent of the global small arms trade.[9] The legal trade is far more substantial and can have significant destabilising effects. Patterns of legal supply can often reveal where major arms shipments are going. Keeping watch on regions that are becoming noticeably saturated with small arms and light weapons can provide vital warning of impending conflict or instability.

International agreements and restraints

International action and initiatives

Initially, it was civil society groups and research institutes that identified the problems caused by the proliferation of small arms and light weapons. Encouraged by the success of the campaign to ban anti-personnel landmines, a vocal group of non-governmental organisations (NGOs) began to press for stricter controls and enhanced transparency for small arms and light weapons transfers.

The failure or absence of comprehensive disarmament as part of peacekeeping and peace enforcement operations, of which Somalia is a particularly conspicuous example, also convinced the UN that small arms control should be addressed more comprehensively at the national and international level. In his 1995 'Supplement to *An Agenda for Peace*', UN Secretary-General Boutros Boutros-Ghali identified the control of small arms and light weapons, particularly through 'micro-disarmament', as a priority for the world organisation.[10] Later, the UN General Assembly established a Panel of Governmental Experts on Small Arms, which made a number of far-reaching recommendations.[11] By 1999, the General Assembly had agreed to convene a major international conference on the illicit trade in small arms and light weapons by the end of 2001, and at this conference a comprehensive, if somewhat vague, Programme of Action to Prevent, Combat and Eradicate the Illicit Trade in Small Arms and Light Weapons was agreed.[12]

Almost concurrently, the European Union (EU) also began work on a number of agreements on conventional weapons, including the EU Code of Conduct on Arms Transfers, a regional agreement with common criteria for arms exports,[13] and the

EU Joint Action on Small Arms, a legally binding document which encourages member and non-member states to reduce the destabilising accumulation of small arms through a variety of different measures.[14] A number of other regional organisations also began to examine the issue. In December 2000, the Organization of African Unity (OAU) agreed a common position on small arms and light weapons.[15] NATO's Euro-Atlantic Partnership Council (EAPC), which includes both NATO allies and partners, developed a small arms work plan including provision for tailored assistance.[16] The Organization for Security and Co-operation in Europe (OSCE) agreed its Document on Small Arms and Light Weapons in late 2000, containing standards and measures to deal with various aspects of the issue.[17]

Standard-setting agreements

Most of the agreements reached to date on small arms and light weapons are of a norm- and standard-setting character. The OSCE document, for example, contains detailed standards and procedures governing arms import and export documentation and procedures, but has no legal status. Although it is politically binding, its provisions are not mandatory. As a result, verification and monitoring can only play a limited and somewhat ad hoc role. Nor is the EU joint action subject to verification or monitoring, even though it is a legally binding agreement. The joint action only places obligations on EU member states in terms of external co-operation and assistance, not in terms of their internal procedures. This encourages them to provide assistance for small arms initiatives, particularly outside the EU. It is the statement of intent that is legally binding, not the measures themselves.

Efforts at the UN to secure a legally binding agreement with strong commitments on member states foundered at an early stage. A multifaceted issue, small arms control did not lend itself well to agreement at the global level. Strong resistance to any form of control from some countries only left room for a compromise agreement—the UN Programme of Action.

Negotiated in three preparatory committees, numerous *ad hoc* meetings and the final conference of July 2001, the Programme of Action is a non-binding document containing largely recommendatory language, which 'leaves wide margins for states to exercise discretion or interpretation through frequent use of such clauses as "where applicable", "as appropriate", "where needed", or "on a voluntary basis"'.[18] There are no provisions for monitoring and verification. An attempt to introduce

an ad hoc mechanism to monitor progress towards implementation was stymied during negotiations, largely because it was felt that this might impinge on states' domestic small-arms policies.[19] Proposals for biennial national reports were also dropped shortly before the final text was agreed. As a result, any follow-up will be limited to the biennial review meetings provided for in Section IV of the Programme of Action.

Legally binding agreements

It would, however, be incorrect to say that there are no legally binding agreements in the field of small arms control. While the idea of a global conference on small arms was being discussed in New York, the UN in Vienna approached the issue from another perspective—that of crime and law enforcement. In 1998, the General Assembly mandated an ad hoc committee of the Economic and Social Council (ECOSOC) to negotiate a convention on transnational organised crime with three supplementary protocols, one of which was to deal with illegal firearms trafficking. The Firearms Protocol was agreed in early 2001, and is the first global legally binding agreement dealing with small arms and light weapons.[20] It took as its model the Convention against Illicit Firearms Trafficking agreed by the Organization of American States (OAS) in 1997.[21] Both are legal agreements which are subject to signature and ratification and require substantial changes in legislation related to controls over the manufacture, marking and transfer of weapons, but, again, their implementation is not subject to verification or monitoring.

Targeted assistance programmes

While many organisations have focused on standard-setting agreements, others have developed assistance programmes which focus on the demand side of the equation and attempt to alleviate the suffering and poverty exacerbated by the availability of small arms. The best example is the work of the UN Development Programme (UNDP). Its interest in the issue grew out of a recognition that security and stability are vital prerequisites for sustainable development, investment and growth—the so-called 'security first' approach. The prevalence of small arms in societies was shown to impede development by contributing to an insecure environment.[22] Initial activities focused on 'weapons-for-development' schemes, under which development incentives, such as the offer of schools or roads were made in

return for collected weapons. Since then the UNDP has been active in a number of countries around the world. One of its newest projects, to be conducted in Kosovo, will adopt a more comprehensive approach, with a package of assistance, training and technical support for the region.

These activities are examples of the demand-side measures which are just as important in tackling the proliferation of small arms as those undertaken on the supply side. Many NGOs and civil society groups have increasingly focused on reducing the demand for weapons through public awareness campaigns that highlight the dangers of weapons ownership while at the same time emphasising the need for security sector reform.

In post-conflict settings, the demobilisation of former combatants and their full reintegration back into normal life are also vital in reducing weapons availability and trafficking. For many ex-combatants, faced with difficult economic situations, small arms become tools for making a living, often through intimidation or violent crime. Here, however, demand-side initiatives are a long-term challenge and the results are sometimes difficult to evaluate, especially in the absence of baseline data. Again, these programmes do not necessarily lend themselves naturally to verification in the traditional sense.

The emphasis on such activities comes primarily from the bottom up, but there is also a top–down element. Among governments, particularly those that regularly provide financial or technical assistance for small arms control, there is an emerging trend away from agreements, statements of common intent and lengthy negotiations, and towards practical initiatives which bring concrete benefits to populations plagued by gun-related violence. There is a perceived need among both donor and recipient governments to translate words into action. This is a healthy development, indicative of the maturation of the issue, but it may lead the international community away from stronger control measures which could be subject to monitoring and verification.

Difficulties of monitoring and verification

Why monitor and verify small arms control?

The lack of verification and monitoring as part of small arms control agreements certainly stands out in the arms control field. The lack of such procedures may

simply be due to the relative infancy of the issue: even just six or seven years ago, the idea of a universal agreement on small arms negotiated under UN auspices seemed fanciful. Control measures can take decades to agree and develop. The political climate needs to be favourable and governments must be persuaded that control is in their interests. Tougher standards, incorporating verification and monitoring, may develop over time, but it would be unrealistic to expect a comprehensive regime to be established in just a few years. Yet the prevalence of political—rather than legal—agreements in the field of small arms control would seem to indicate that there is something about the very nature of small arms and light weapons that precludes strict verification and monitoring.

There are strong reasons to promote verification, however. These include its potential role as a confidence-building measure where issues of international security and stability are at stake. Verification also has value when agreements require countries to co-operate for the common good over and above their national interests, as with environmental agreements. In these kinds of agreement there is a temptation for countries to try to 'free ride'—that is, to benefit from the positive impact of an agreement without actually upholding it themselves. In the case of small arms and light weapons, all states have a national interest in combating arms trafficking.

No small arms ban

Verification involves measures to detect non-compliance as a means of encouraging compliance with, and confidence in, agreements. Often this involves a focus on the production, testing and deployment of proscribed weapons systems and their component parts. Systems subject to a total ban, such as those covered by the 1987 Intermediate-Range Nuclear Forces (INF) Treaty, lend themselves to verification. Small arms and light weapons, on the other hand, are not banned and are legitimately traded and used every day. Regulations are still relatively weak and are built around restrictions governing production and transfer, although not usually use. The implementation of the vast majority of multilateral small arms agreements remains a national prerogative and is conducted almost entirely at the national level.

Alternatively, challenge and on-site inspections may be used to verify that states have not exceeded certain agreed thresholds for weapons holdings, as they are under

the CFE Treaty. However, many states resent the intrusive nature of inspections conducted under such regimes and are unwilling to agree to monitor small-arms holdings. More fundamentally, multilateral small-arms agreements have yet to actually incorporate any such thresholds or limits for holdings. Although the idea has been suggested in some forums, discussion on the issue has not been taken seriously thus far. Too many states, including some which are usually leaders in small arms control, still jealously guard information regarding their stocks of small arms and light weapons, which they perceive, rightly or wrongly, to be sensitive information central to national security. Reporting on holdings of small arms and light weapons would, it is feared, reveal too much information about defence posture and planning, and the size and capacity of the armed forces, as well as any reserve capacity. The fact that much of this information is either readily available or easy to infer from published or specialist sources seems to be irrelevant.

Illicit trade is unverifiable

In principle, the verification and monitoring of illicit small arms trafficking are impossible because of the clandestine nature of the trade. First, there is clearly no record of current stocks of illicit arms circulating around the world. Second, even if figures did exist, they would change continually due to increases in diversion from legal transfers to illegal markets or decreases as a result of confiscation and destruction. In addition, verification of measures taken to suppress trafficking could hamper criminal investigations and the activities of police, border and other law enforcement officials.

Verification opportunities

Selective verification

Verification could play a role in preventing diversion to illegal markets. Here it would have a value beyond mere confidence building and actually become part of the solution. One area where further work is clearly needed is the harmonisation of end-use assurances. Strict export control regimes are vital in preventing the diversion of small arms to illegal markets and to unintended end-users. Exporting countries require end-use and end-user assurance documentation as a means of exerting some control over their exports once they have left their territory and

preventing their subsequent transfer to other states or actors. No uniform end-use assurance documentation or practices currently exist, so certificates or documents can be easily forged. Common standards for end-user assurances would reduce the opportunities for forgery, but they must also be accompanied by procedures to verify delivery according to end-user certificates. This can be done through embassies or foreign trade representations at the point of import or arrival of shipments. Even though most countries do not have the resources to verify all deliveries at the point of import and use, the possibility of such inspections could have a useful deterrent effect, such as has been demonstrated with the Convention on International Trade in Endangered Species (CITES).

There is also potential to introduce more comprehensive verification or monitoring of the destruction of surplus and seized weapons, a practice which has become a common feature of many small arms programmes. Examples include the verification and monitoring carried out by the EU Stability Pact for South Eastern Europe in Croatia and the Federal Republic of Yugoslavia. These measures could be expanded to other states as the OSCE document encourages observation by neighbouring countries. Verification and monitoring of weapons collection and destruction programmes can also be an important confidence-building measure, since they help convince the public that weapons removed from civilian ownership are actually destroyed and not returned to legal or illegal circulation.

One element in support of verification would be a comprehensive database of weapons collected and destroyed. In principle, this kind of data could be compared against data shared within multilateral forums such as the OSCE (see below). The question what action should be taken in the event of discrepancies being found is another matter entirely. In the absence of legally binding obligations, engaging in a political dialogue would be the principal option for interested parties.

Monitoring of transparency

Heightened transparency in the legal trade in small arms and light weapons has been the clarion call of NGOs for years. Gradually, it is becoming a reality. The importance of transparency in this sphere cannot be overestimated. Not only can it led to greater accountability, and therefore restraint in the legal trade, but it can also help identify the nature and extent of the illicit trade, an important step on the road towards control.

Transparency and information exchange were left out of the UN Programme of Action but they have formed a part of other multilateral agreements. Arguably the most comprehensive information exchange regime on small arms is that established by the OSCE's Document on Small Arms and Light Weapons. It provided for the exchange of information on policy and practice related to various aspects of the small arms issue, including controls over manufacture; national marking systems; controls over export and import, including brokering activities; stockpile management and security procedures; and techniques for the destruction of small arms and light weapons. In adopting the document, OSCE participating states also agreed on the annual exchange of information on small arms exports to and imports from other OSCE states, as well as numbers of weapons destroyed.

This exchange on small arms transfers it the first of its kind—small arms and light weapons are included neither in the categories of conventional arms covered by the UN Register of Conventional Arms nor in reporting under the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies. Although limited to transfers within the OSCE region (which, some may argue, are not usually those of concern), a fundamental step has been taken towards openness and transparency.

Crucially, the information exchanged within the OSCE is not publicly available, but is restricted to the governments of OSCE participating states. This reduces the opportunities for monitoring and verification by outside organisations. However, there is an emerging trend among governments to do so. EU member states and others already produce annual reports on arms exports which are scrutinised by parliaments and the public. This in itself creates opportunities for monitoring. Furthermore, increasing numbers of countries may choose to make their OSCE submissions public—Germany, for example, has just put its OSCE submission on the website of its Ministry for Foreign Affairs.[23]

Although the OSCE document does not contain provisions for information exchanges to be reviewed, the OSCE participating states decided to assess the results of the first round of information exchanges at a workshop in Vienna in February 2002.[24] As a result, recommendations were made to improve information exchange, and as a follow-up templates and guidelines for completing them in the form of a 'model answer' were designed. Yet there is no provision in the OSCE document or

any other information exchanges on small arms for reviewing the information provided or ascertaining whether the policies and practices reported on are fully implemented. Nor is there any verification of statistical data exchanged on transfers or destruction of weapons, although it is possible to conceive of verification of figures in both cases.

A role for NGOs in verification and monitoring

Without a legally binding agreement or convention, there will be less scope for mandatory verification or for supranational verification bodies such as the Comprehensive Test Ban Treaty Organization (CTBTO) or the International Atomic Energy Agency (IAEA). Although there is some scope for legally binding agreements on small arms, they would probably deal with specific technical aspects of the issue, such as the regulation of arms brokers or the marking and tracing of small arms. Other elements are likely to remain subject to only politically binding or even voluntary controls.

It may be that NGOs are best placed to work within this environment. Indeed, NGOs are playing an increasing role in the field of verification and monitoring. NGOs have taken the lead in monitoring the implementation of the 1997 Ottawa Convention on Anti-Personnel Landmines. The International Campaign to Ban Landmines (ICBL) has created a network of civil society organisations that monitors and reports on compliance with the convention. Although the convention includes reporting requirements which are obligatory for states parties, it is the ICBL's *Landmine Monitor* which is increasingly seen as the authoritative source of information on implementation.[25]

It is possible that NGOs will come to play a similar role in monitoring the implementation of non-legally binding agreements as well.[26] Organisations such as the Small Arms Survey, Saferworld, the Stockholm Peace Research Institute (SIPRI) and the Bonn International Center for Conversion (BICC) have already begun to move in this direction. The UK-based NGO International Alert (IA) is presently undertaking a mapping of states' implementation of their international commitments, including the UN Programme of Action, the OSCE Document on Small Arms and Light Weapons, and others. This will help to shed light on levels of implementation of these largely voluntary and non-binding agreements. The initial mapping of activities in a large number of countries is likely to be somewhat

superficial, but IA is working more closely with selected governments to review not only their implementation of these agreements but also their capacity to do so, as well as generating explanations for their level of commitment or progress. This exercise will serve a dual purpose: it will provide information about implementation of international agreements, and it will help governments identify gaps and needs in their own policies and practices.

The involvement of NGOs in monitoring and verification is a promising development in the field of small arms control. However, the international community must be careful to avoid relying exclusively on such a method. NGOs have limited resources but, more importantly, in some situations they may have difficulties working with governments in order to collect the information they need. NGO monitoring should not become a substitute for more intrusive verification that brings with it a sense of accountability and responsibility.

Conclusion

Methods of verification and monitoring of small arms control are bound to differ substantially from those used in other arms control fields. A new approach will be needed for small arms—one that is innovative and creative. A variety of a different approaches may have to be combined in order to monitor and verify various different aspects of the implementation of small arms control initiatives. These approaches will lean more towards monitoring than verification, as the intrusive nature of verification regimes are likely to be resisted by states that are keen to preserve their national sovereignty, keep issues related to national security under wraps, and protect the commercial interests of their arms industries.

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Endnotes

[1] According to the Guidelines of the UN Disarmament Commission, the term 'illicit' can be defined as all transfers which are in contravention of both national and international law.

[2] There is no internationally accepted definition of small arms and light weapons. However, a UN panel defined small arms as those manufactured to military specifications for use as lethal instruments of war. Small arms, which are those designed for 'personal use', include revolvers and self-loading pistols, rifles and carbines, sub-machine guns, assault rifles and light machine guns. Light weapons, which are designed for use by several persons serving as a crew, include heavy machine guns, portable anti-aircraft guns, portable anti-tank guns and recoilless rifles, portable launchers of anti-tank missile launchers and rocket systems, portable launchers of anti-aircraft missile systems, and mortars with calibres of up to 100 millimetres (mm). Ammunition, explosives, munitions and landmines are also included in this definition. United Nations, Report of the Panel of Governmental Experts on Small Arms, UN document A/52/298, 27 August 1997.

[3] International Committee of the Red Cross, 'Arms availability and the situation of civilians in armed conflict', ICRC, Geneva, 1999.

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[12] United Nations, Programme of Action to Prevent, Combat and Eradicate the Illicit Trade in Small Arms and Light Weapons in All its Aspects, UN document A/CONF/192/15, adopted 20 July 2001, available at http://disarmament.un.org/cab/poa.html.

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[14] European Union, 'Joint Action of 12 July 2002 on the European Union's contribution to combating the destabilising accumulation and spread of small arms and light weapons (Council Joint Action 2002/589/CFSP)', *Official Journal of the European Communities*, L 191, 19 July 2002.

[15] Organization of African Unity, Bamako Declaration on an African Common Position on the Illicit Proliferation, Circulation and Trafficking of Small Arms and Light Weapons, adopted at the OAU Ministerial Conference, Bamako, Mali, 1 December 2000, available at www.small-arms.co.za/Bamakodec01.html.

[16] NATO, EAPC Partnership Work Programme, EAPC(PC)(SALW)WP(1)(Final), adopted 9 July 1999.

[17] Organization for Security and Co-operation in Europe, OSCE Document on Small Arms and Light Weapons, adopted on 24 November 2000 in Vienna, available at www.osce.org/docs/english/fsc/2000/decisions/fscew231.htm.

[18] 'Reaching consensus in New York: the 2001 UN Small Arms Conference', in *Small Arms Survey 2002,* p. 230.

[19] 'Reaching consensus in New York: the 2001 UN Small Arms Conference', p. 228.

[20] Protocol against the Illicit Manufacturing of and Trafficking in Firearms, their Parts and Components and Ammunition, supplementing the United Nations Convention against Transnational Organized Crime (A/RES/55/255) 8 June 2001, available on the website of the UN Office for Drug Control and Crime Prevention at www.undcp.org/odccp/crime_cicp_convention.html#final.

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[22] See, for instance, Peter Batchelor and Robert Muggah, 'Development held hostage: assessing the effects of small arms on human development', UN Development Programme, April 2002, available at www.undp.org/erd/smallarms/pubs.htm.

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[26] For a discussion of their potential contribution to verification see Oliver Meier and Clare Tenner, 'Non-governmental monitoring of international agreements', in *Verification Yearbook 2001*, pp. 207–227.

the environment

9

Verification under the Kyoto Protocol

Molly Anderson

In December 1997, parties to the 1992 United Nations Framework Convention on Climate Change (UNFCCC)[1] adopted the Kyoto Protocol[2] in order to strengthen international efforts to combat human-induced global warming. Although the convention aims for the 'stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system',[3] it does not set a specific emission reduction target, instead committing the parties to the 'aim of returning individually or jointly to their 1990 [emission] levels'[4] by 2000. It became clear that many parties would not meet this goal.[5] Yet, at the same time, scientific consensus was pointing, with increasing levels of certainty, to the need for faster and tougher action to reduce anthropogenic greenhouse gas (GHG) emissions.[6] The Kyoto Protocol emerged out of this background of contradictory indicators, setting, for the first time, legally binding emission reduction targets for a 'basket' of GHGs.[7] Overall, parties to the protocol commit themselves to reduce emissions to 5.2 percent below 1990 levels between 2008 and 2012. This goal has been divided into unequal targets for each of the Annex I (developed) nations[8] on the basis of 'common, but differentiated, responsibilities',[9] as enshrined in the convention.

Although the basic framework for implementing the terms of the protocol were agreed in Kyoto, Japan, it was clear that key countries would not consider ratification until the details were elaborated. This process of adopting a protocol but delaying ratification while the implementation details were worked out appears to be unique to multilateral environment agreements. However, negotiation of the Kyoto Protocol has extended the model furthest because of the high level of technical, scientific and economic complexity involved.[10]

The Fourth Conference of the Parties (COP4), held in Buenos Aires, Argentina, in November 1998, established a Plan of Action, setting a timetable and defining the scope of negotiations on the outstanding detail. These were to be completed by COP6 in The Hague, Netherlands, in November 2000. However, the failure of the talks and the subsequent withdrawal of the US from the Kyoto process meant that, for a time, it was unclear whether the protocol could enter into force. The remaining parties decided to proceed with negotiations at a resumed session of COP6, held in July 2000 in Bonn, Germany. There, in an eleventh-hour political deal,[11] they reached agreement on the rules for implementing the protocol. However, the late-night brinkmanship left negotiators no time to formalise these rules in legal text. This task was carried forward to COP7, which was held in Marrakech, Morocco, from 29 October–10 November 2001. It was at COP7 that the parties finally agreed, a year late, on the necessary detail to pave the way for the protocol's entry into force. The Marrakech Accords,[12] the conference's final document, are regarded as a comprehensive rule book for implementing the Kyoto Protocol.

The unusual way in which the protocol has evolved means that, in order to implement it, parties need to comply with not one, but three documents: the text of the convention, the protocol text itself and the Marrakech Accords. The accepted view is that the Marrakech Accords 'flesh out' the 'bones' of the protocol text as agreed in Kyoto in 1997. It sets out more precisely what parties must do to meet their obligations, leaving less room for misinterpretation and disputes when the agreement enters into force. The fact that parties negotiated so energetically throughout the process indicates how much room the detail left for them to extract national advantage.

To enter into force, the protocol needs to be ratified by at least 55 parties to the convention, including the Annex I (industrialised) countries responsible for 55 percent of Annex I countries' emissions in 1990. At the time of writing, 96 parties had submitted their instruments of ratification.[13] This number includes 25 of the 35 Annex I countries, which account for 37.4 percent of industrialised country emissions in 1990. Poland, responsible for 3.0 percent of emissions, will add to this total, having recently completed its national ratification process. Russia, Canada and New Zealand used the World Summit on Sustainable Development, held in Johannesburg, South Africa, between 26 August and 4 September 2002, to

reconfirm their intentions to ratify the treaty. Significantly, Russia's Prime Minister, Mikhail Kasyanov, stated that his country would ratify in 'the very near future'. Since Russia was responsible for 17.4 percent of Annex I emissions in 1990 its ratification alone would trigger entry into force. There is hope that this will occur by the first quarter of 2003.

Chapters in the last two editions of VERTIC's *Verification Yearbook*[14] have followed the negotiation of the Kyoto Framework, and specifically its compliance and verification regime. Since publication of *Yearbook 2001,* most of the detail of the system has been finalised and adopted in the Marrakech Accords. For the first time, it is possible to describe in detail the scope, principles and operational rules for reporting, review and compliance assessment under the Kyoto Protocol. What follows in this chapter is a guide to the newly agreed system.

Meeting the Kyoto emissions targets

Each party's emission reduction target can be expressed as an 'assigned amount'—the volume of carbon dioxide equivalent that a party is allowed to emit over the first commitment period (2008–2012). This is calculated by combining its emissions during the 1990 base year with its negotiated emissions reduction target (expressed as a percentage) and multiplied by five (the number of years of the commitment period).[15] Under the protocol, countries are encouraged to develop domestic policies and measures to reduce their emissions below this level.

However, the protocol also provides parties with additional instruments to help them stay within their assigned amount. Parties can use the so-called flexible mechanisms: emissions trading (ET), joint implementation (JI) and the Clean Development Mechanism (CDM).

Emissions trading will allow parties that are struggling to meet their targets to buy carbon allowances from those countries that have exceeded their commitments by making extra reductions. Alternatively, under the JI mechanism, countries can earn extra allowances by implementing emission reduction projects in another Annex I country. Finally, the CDM enables Annex I parties to claim allowances for projects established in developing (non-Annex I) countries. Advocates of the flexible mechanisms claim that putting a price on a tonne of carbon will exploit the advantages of global markets and achieve the most cost-effective reductions. However,

the use of the flexibility mechanisms is intended to be 'supplemental' to domestic action, which is supposed to remain 'a significant element of the effort made by each party'[16] to meet its target. This rather vague concept will unfortunately make this a difficult requirement to enforce once the flexible mechanisms become operational.

Countries will also have the option of using 'sinks' to stay within their assigned amount. Forests, vegetation and soils absorb carbon dioxide from the atmosphere, providing a type of natural storage. However, there are problems associated with the monitoring and verification of such activities, making them unsatisfactory as long-term contributors to climate change mitigation. The inclusion of sinks activities proved to be controversial at COP6, with the Umbrella Group of countries[17] achieving significant concessions as the price of their continued support for the protocol. First, the list of activities that countries can use sinks domestically to meet their target was expanded,[18] subject to an individually negotiated cap[19] on the overall level that can be claimed. Canada, Japan and Russia negotiated generous allowances. Second, parties agreed that afforestation and reforestation projects were eligible under the CDM, subject to a cap of 1 percent per year for the five years of the first commitment period.

At the end of the first commitment period, a party is judged to be in compliance with its emissions reduction obligation provided that:

Emissions between 2008 and 2012 < Assigned amount + CDM allowances + JI allowances + allowances acquired via ET + removals by sinks.

Other Kyoto commitments

While the prime objective of the protocol is to achieve real and measurable cuts in anthropogenic emissions of greenhouse gases, parties will also commit themselves to a range of complementary objectives designed to promote sustainable development, facilitate technology transfer to developing countries and take preventative action against the climatic and economic impacts of global warming.

According to the International Panel on Climate Change (IPCC), there is strong evidence that the poorest and most vulnerable countries are likely to suffer the worst consequences of climate change.[20] At COP7, three new funds were established

to address these concerns, successfully promoted by the Alliance of Small Island States (AOSIS)[21] and the group of least developed countries (LDCs).[22] Canada and Ireland have committed approximately US$10 million to the so-called LDC fund, which will help the poorest countries to identify priority actions in order to cope with the adverse impacts of climate change. The second fund, the Special Climate Change Fund, will help a wider group of developing countries with adaptation and mitigation measures. The European Union has committed US$410 billion; however, it is not yet clear how this money will be divided between the funds or whether it will be additional to money already channelled through the Global Environment Facility. Finally, the Kyoto Protocol Adaptation Fund will be financed through a levy on the CDM and is designed to support 'concrete adaptation projects and programmes in developing country parties that have become parties to the Protocol'.[23]

While these aspects of the protocol are not quantitative like the emissions reduction targets, they are nonetheless an important part of tackling the climate change problem.

The importance of verification

The successful implementation of the Kyoto framework will be heavily dependent on its verification and compliance regime. It is clear from the hard bargaining during negotiations in The Hague, Bonn and Marrakech that the stakes are high. While there are obvious environmental objectives for the process, each country is also influenced by the economic consequences of implementing its share of the deal. In fact, many countries consider the Kyoto Protocol to be as much an economic agreement as an environmental one.

Given these economic implications, each party needs to be reassured that there will be no 'free riders' and that the burdens of implementation are shared fairly.[24] For this reason, the verification and compliance mechanisms need to be robust, fair, transparent and effective. This has to be balanced, however, by efficiency and a pragmatic approach that does not overload parties with unnecessarily complicated monitoring and reporting requirements.

First, and foremost, the Kyoto Protocol's verification system is designed to establish clearly and transparently the compliance or non-compliance of each of the parties. It provides parties with an opportunity to clearly demonstrate their compliance,

provides 'early warning' to parties in danger of not meeting their obligations and discourages flagrant non-compliance. Where a country fails to meet its emissions reduction target in the first commitment period, from 2008 to 2012, the Marrakech Accords stipulate that it is bound to make up the shortfall, plus a 'penalty' of an extra 30 percent, in the second period. In addition, parties will be asked to prepare an action plan showing how they will return to compliance. During the period when a party is not in compliance with its emissions target, its eligibility to use the flexible mechanisms will be suspended.

The assessments of compliance for each party will, in turn, be used collectively to judge the overall success of the treaty and whether it has met its environmental, economic and development objectives. It is clearly important to review, periodically, the effectiveness and efficiency of international action. Are emissions falling? Are countries doing enough? Are resources being effectively targeted? This type of analysis is dependent on the open and transparent exchange of information between parties. Access to high quality data will also encourage parties to learn from each other, assisting the development of best practice in policy development, projects and the sharing of expertise.

The Kyoto Protocol's verification regime should also facilitate civil society involvement. The availability of national information on the Internet gives non-governmental organisations and other groups the opportunity to undertake independent monitoring in parallel with the Kyoto process. By operating outside the usual diplomatic niceties, these groups can be openly critical of countries which are not complying with either the spirit or the letter of the agreement. Where necessary, they also have greater capacity to exert domestic pressure on governments to ensure that they meet their international obligations, in the first instance, and thereafter to exceed them.

Verification of the Kyoto Protocol

The workings of the verification system are stated in articles 5, 7 and 8 of the protocol and build on the provisions for monitoring, self-reporting and expert review established under the UNFCCC. However, the new operational elements of the protocol, including sinks activities, the flexible mechanisms and the process for compliance assessment, mean that parties will need to establish new institutional

and legislative structures and supply extra layers of detail during the reporting process. Moreover, clear rules are needed for accounting (summing up) emission reductions and tracking the issuance and trading of credits under the flexible mechanisms. The linkages between articles 5, 7 and 8 and these other aspects of the Kyoto framework had to be carefully respected in order to ensure that the system would be workable and free from loopholes.

National systems

Under Article 5.1 of the Kyoto Protocol, Annex I parties are required to establish by 2007 'a national system for the estimation of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol'.[25] The word 'system' refers to the institutional and legislative arrangements and the methodological developments necessary to prepare an annual GHG inventory.

Since 1996, Annex I parties have been expected to submit an annual inventory under the Framework Convention. To meet this requirement, many countries have already established systems for the preparation of their submissions. However, it is only under the protocol that these systems become mandatory and are required to meet the standards set out in the guidelines adopted at Marrakech.

GHG emissions arise from diverse sources, most of which are not under government control. Furthermore, these sources can be small, diffuse or even mobile, as in the case of transport. This often makes it impossible or impractical to measure emissions directly at source. Instead, inventories are based on activity data and emission factors[26] are used to estimate the contribution of individual key sources to the overall emissions of a country. In order to produce high-standard inventories on time, national systems must establish reliable and timely access to this type of data, preferably implemented through national laws or agreements negotiated with individual providers.

The guidelines go further and require that parties delegate the responsibility for planning, preparing and managing the national inventory to a single authority. This body should have sufficient capacity—human and financial—to fulfil its role, which includes:

- the collection and processing of activity data and emission factors, and preparation of the inventory;

- the quantitative assessment of the uncertainties associated with emission estimates;
- the development and operation of quality control (QC) and quality assessment (QA) procedures;
- the archiving of relevant material in a single location; and
- facilitation of the expert review carried out under Article 8 of the protocol (see below).

The guidelines are designed to specify the objectives and responsibilities of the national systems rather than the means they use to meet them. Each country will need to consider the best institutional and legislative model to suit its circumstances. What all have in common, however, is the need for early implementation. Although an operational national system is not a legal requirement until 2007, the complexity of the reporting and review mechanisms makes it imperative that countries allow time for 'learning by doing'. There will inevitably be problems to resolve before the start of the first commitment period.[27]

National registries

The other 'system' required under the Kyoto Protocol is a national registry to ensure the accurate accounting of the four types of units that will be used by countries to meet their emission reduction targets or traded under the flexible mechanisms.

Assigned Amount Units (AAUs) are derived from the 'assigned amount', or emissions allowance set for each party for the first commitment period. Emission Reduction Units (ERUs) and Certified Emission Reductions (CERs) are awarded in respect of projects operated under JI and the CDM. Removal Units (RMUs) are issued to parties undertaking sinks activities under articles 3.3 and 3.4 of the protocol. These are the only type of unit that cannot be carried over into the second commitment period. Otherwise, the units are fully fungible so that they can be traded freely among Annex I parties. All the units are equal to one tonne of carbon dioxide equivalent.

National registries will act like banks, with accounts for holding, retiring and cancelling AAUs, ERUs, RMUs and CERs. Companies that are authorised by a party to participate in the flexible mechanisms can also hold accounts in the national registry. An international transaction log (ITL), operated by the UNFCCC Secretariat, will track the transfer and acquisition of units between national registries, ensuring

that the operation adheres to the rules set out under the protocol. Information from the ITL will be used to check that parties are eligible to use the flexible mechanisms and that transactions do not violate the commitment period reserve (CPR)[28] or the sinks caps.

Where there is a discrepancy, the party initiating the transaction is obliged to terminate the operation. Where a transaction is not terminated, the initiating party has 30 days to resolve the discrepancy. However, the units involved remain invalid (that is, cannot be used to meet the emissions reduction target) until the discrepancy has been audited under the annual Article 8 review process. This means that invalid units can be floating in the registry system for up to 12 months before their status is resolved.[29] It will be important for the credibility of the flexible mechanisms that these invalid units do not get 'lost', thereby introducing illegitimate carbon reductions into the accounting and trading systems.

The Marrakech Accords stipulate that each national registry should take the form of a 'standardized electronic database'.[30] However, the technical standards to ensure the 'accurate, transparent and efficient exchange of data between national registries . . . and the independent transaction log'[31] will need to be elaborated before parties can implement their systems. These are expected to be finalised by 2003 in order to allow adequate time for the construction of the ITL and for parties to plan and build their registries prior to the first commitment period. It is clear that experience and expertise from the banking and financial sector will be useful in this process.

The Marrakech Accords are more specific about the tracking of units within the registry system. Each unit will have a unique serial number, which will include elements to identify its commitment period, country of origin, unit type and, where relevant, the 'sink' activity it has been generated from. This unique number will make it possible to trace every unit from issuance to retirement or cancellation, thus minimising the potential for fraud.

Reporting and review

Parties to the protocol are required to submit a number of different reports between entry into force and 2013 so that the fulfilment of their obligations over the first commitment period can be assessed. Each of these reports is subject to some kind of evaluation or review. The objectives, scope and timing for each of these processes are summarised in table 1.

Demonstrable progress

Under the protocol each party 'shall, by 2005, have made demonstrable progress in achieving its commitments'.[32] This important provision was included as both an 'early warning system' for countries not acting fast or radically enough to meet their commitments by 2012 and a means of sharing experience and information on 'best practice' between parties. In addition, 'demonstrable progress' reports could act as a confidence-building measure, reassuring all parties, even prior to the first commitment period, that the burdens of the protocol are being taken seriously and implemented fairly.

Since the original Kyoto text was adopted, the concept of demonstrable progress has been largely undermined by the Umbrella Group, which wanted it to be clearly decoupled from any form of compliance assessment. For this reason, the text of the Marrakech Accords only 'urges each party to submit a report by 1 January 2006, for the purpose of reviewing demonstrable progress'.[33] The non-mandatory nature of these submissions is likely to make them less meaningful. Furthermore, the parties decided that reports on demonstrable progress should be 'evaluated' by the COP in a similar way to the national communications submitted periodically by parties under the Framework Convention. The absence of any serious, expert analysis will mean that recommendations made by the COP may not carry the weight necessary to encourage failing countries to take serious remedial action.

The Marrakech Accords do state that the reports on demonstrable progress should include:

- descriptions of policies and measures implemented and any legal or institutional steps taken to meet emissions reduction targets;
- trends in and projections of GHG emissions;
- an evaluation of how implemented policies and measures will contribute to meeting emissions reduction commitments; and
- descriptions of activities and programmes to implement technology transfer and capacity building in developing countries.

Beyond this, however, there is little guidance on how the information should be presented, other than that it should be consistent with a party's last national communication. Given that much of the same information is required by both reports,

it would seem sensible to follow the format and guidelines for the preparation of national communications, which were recently revised and adopted at COP8, held in New Delhi, India from 23 October–1 November 2002. However, additional elements, specific to the protocol, will need to be reported on, including:

- the implementation of national systems for estimating GHG emissions and removals under Article 5.1;
- relevant legal and institutional activities;
- the enhancement of sinks activities; and
- activities relating to the financial mechanisms and the implementation of a national registry.

The compiling of the demonstrable progress report will demonstrate in practice the functionality of national systems, provided parties have made efforts to establish them early enough. The value of the reports will be further enhanced if countries begin collecting relevant data now. Without access to historical data when the reports are being prepared in 2005, their quality and usefulness will be seriously reduced, increasing the already speculative and uncertain nature of projections of the effects of policies and measures on emissions trends.

The pre-commitment period report

In preparation for the first commitment period, parties are required to submit a report by 31 December 2006, or one year after the Kyoto Protocol enters into force for them, whichever is later. This report will be used to fix each party's assigned amount and judge the suitability of its national system and registry.

The report will be in two parts. The first should contain complete national inventories for all years since 1990 until the most recent year.[34] In the second, each party is asked to calculate its assigned amount and CPR, and to provide full descriptions of its national system and registry. In addition, parties are asked to specify which sinks activities they intend to take advantage of during the first commitment period and how these will be accounted for.

Each party's pre-commitment period report will be reviewed by an expert review team (ERT) in accordance with the Article 8 guidelines adopted in the Marrakech Accords. The team is selected by the UNFCCC Secretariat from a roster of experts on the basis of equitable geographic representation and expertise. The review of

the pre-commitment period report will include either a 'desk'[35] or a 'centralised'[36] review and an in-country visit, which is thought necessary to enable the comprehensive assessment of institutional arrangements. During the review process, the ERT should interact with the party to resolve any apparent problems. Where this is not possible, the ERT will produce a review report highlighting any 'questions of implementation' for the attention of the Compliance Committee.[37] The reviewers are asked to 'refrain from making any political judgement',[38] their role being to analyse the technical information presented in the reports and that gathered during the in-country visit.

Once the review process has been concluded, the party's assigned amount is fixed and cannot be changed. The final review report also establishes parties' eligibility to use the flexible mechanisms, which is contingent on the review team having judged its GHG inventories, national system and registry to be satisfactory.

Reporting during the commitment period

The regular reporting process will begin voluntarily a year after parties submit their pre-commitment period report. It becomes mandatory for the first year of the commitment period, in 2008, and beyond. Parties are required to submit two types of report in order to demonstrate the implementation of their commitments under the protocol. The first is an annual report on the action they have taken to meet their emission reduction commitments. The second is supplementary information relating to their other commitments. For practicality, this information will be added to the national communication already submitted periodically under the Framework Convention.

The key component of the annual submission is the national GHG inventory report, the format of which is prescribed by the revised UNFCCC reporting guidelines.[39] These require each party to submit inventory tables for every year from the base year to the most recent year (which is two years behind) in a common reporting format (CRF) which is designed to ensure the transparency, consistency, comparability, completeness and accuracy of their inventories. In addition, each party is asked to prepare a supporting national inventory report (NIR), containing information relevant to understanding its inventory. These have been found to greatly facilitate the review of the inventories during a trial period running between 2000 and 2002.[40]

In the preparation of the inventory, parties are also required to comply with two sets of guidance developed by the IPCC. The first of these is the 1996 Revised IPCC Inventory Guidance,[41] which provides a set of default methodologies for calculating inventory estimates. However, countries are encouraged to improve on these methodologies, where possible, to take into account individual country circumstances. The second publication is the *IPCC Good Practice Guidance*.[42] This provides parties with methods for estimating the uncertainty associated with inventory values. This is important in order to ensure that source categories contributing significant percentages to the overall emissions of a country are prioritised and calculated with sufficient accuracy. Smaller sources are of lower priority.

In addition to its GHG inventory, each party's annual report should contain information relating to the accounting of the assigned amount and any changes to the national system and registry. Although parties have yet to specify what details they will need to report on in relation to their registry, it seems likely that they will include listings of the total numbers of AAUs, ERUs, RMUs and CERs issued, acquired, transferred, retired and cancelled during the year and, if transaction discrepancies have occurred, how they were resolved.

The annual report should be submitted by 15 April each year. After carrying out an 'initial check' of its format, completeness and timeliness, the UNFCCC Secretariat co-ordinates the review of the report by an ERT, which should complete its work and finalise its review report within a year of submission. The annual submissions will be assessed via a desk or centralised review. In addition, parties will be subject to one in-country visit during the first commitment period, carried out in conjunction with the review of their national communications submitted under the Framework Convention.

The quality and accuracy of the inventories will be the key concern of the ERT. As well as being essential for assessing parties' compliance at the end of the commitment period, the inventories are linked to parties' eligibility to use the flexible mechanisms. If the ERT finds that key source categories are missing or have not been calculated correctly or with sufficient accuracy, they may decide to make an adjustment. Parties have developed methodologies under Article 5.2 of the protocol for this purpose. Under these guidelines, adjustments should be 'conservative'[43] and only performed when a party is benefiting from an inaccurate or wrong

estimate. In practice, this means that adjustments are only applied where a party has overestimated in the base year and underestimated thereafter.

Apart from the base year inventory, which is fixed during the review of the pre-commitment period report, the significance of a review team applying an adjustment is limited. Parties are able to correct the adjusted value in later submissions of the inventory series, so that it does not have an impact on their final emissions tally at the end of the commitment period. However, adjustments can have immediate implications for a party's mechanisms eligibility. A party will be suspended when:

- the total value of adjusted emissions estimates exceeds the original estimates by 7 percent in any single year's inventory;
- the above value totals 20 percent at any time over the commitment period; and
- an adjustment needs to be applied to any source estimate equal to more than 2 percent of the overall emissions.

Concerned about being suspended for long periods from using the flexible mechanisms, Japan successfully championed the inclusion of an expedited review process for reinstating eligibility. The guidelines for this new process were agreed at COP8. The expedited process can be initiated at any time by the party and will take no longer than 21 weeks. The guidelines specify that a review should be expedited only by restricting it to the issue that caused the suspension, not by adopting a less rigorous approach to assessing the information.

Parties to the protocol will need to supply 'supplementary' information in their periodic national communications submitted under the Framework Convention. This information will focus on parties' non-mandatory obligations, including financial help provided to developing countries, technology transfer and scientific research on climate change. Parties are also asked to demonstrate how their use of the flexible mechanisms is supplemental to domestic action and to provide a full description of their national policies and measures to reduce domestic emissions.

The information relating to the protocol commitments will be reviewed in conjunction with the review of the national communication undertaken under the UNFCCC. This will begin with a desk or centralised review and will be followed by an in-country visit co-ordinated by the UNFCCC Secretariat. The final report will be provided to the Compliance Committee and the COP.

Report on expiration of the additional period for fulfilment of commitments

At the end of the commitment period, in 2012, it will not be possible to assess parties' compliance with their emission reduction commitments. Since the inventory preparation process lags behind real time by two years, the ERT will only have access to parties' inventories for the period 1990–2010. Inventories for 2012 will not be available until 2014. Compliance assessment for each party can therefore only take place in 2015 after its inventory has been reviewed under Article 8.

The COP, serving as the Meeting of the Parties (MOP) to the protocol, will set the completion date for the review process related to the first commitment period. After this date, parties will have an 'additional period' of 100 days to make their final registry transactions, settle their registry accounts and bring them into compliance. At the end of this period, parties will submit a report on the additional period for fulfilment of commitments containing the final registry information relating to the first commitment period, including the total number of AAUs, ERUs, CERs and RMUs in the retirement account. During the review of this information, undertaken in accordance with the Article 8 guidelines, the ERT will compare the total number of units in the retirement account with the party's emissions over the commitment period to assess whether it has met its emissions reduction target.

The expert review process

The mechanism for reviewing parties' annual reports and supplementary information is designed to provide the Compliance Committee with a 'technical assessment of the implementation of the Kyoto Protocol by Parties included in Annex I'.[44] In addition, the review should help to promote consistency and transparency in national reporting and assist parties in improving the quality of their reports. This dual role of facilitation and assessment is carried out by the ERT in accordance with the Article 8 guidelines adopted in the Marrakech Accords.

The UNFCCC Secretariat will assign each party's submission to a single ERT. The teams are selected and co-ordinated by the secretariat, which maintains a list of experts nominated by the parties or intergovernmental organisations. However, experts will serve in their personal capacity. The ERTs may vary in size and composition, taking into account the national circumstances of the party being reviewed and the expertise necessary to review its submission. When considering the composition of the review teams, the secretariat is required, where possible, to achieve

a mix of Annex I and non-Annex I country experts as well as an equitable geographical balance. However, this should not compromise the team's technical expertise.

Each ERT will be headed by two lead experts—one from an Annex I country, the other from a non-Annex I country. The lead reviewers will manage the work of the review team, assigning work to the other team members, monitoring progress and liaising with the secretariat and the party. They will also manage the writing of the review reports in accordance with the format and guidelines agreed in Marrakech.

Throughout the review of a submission, the ERT may put questions to or request additional or clarifying information from the party. Where the review team identifies a potential problem, the experts should offer advice to the party on how to correct it. The party is able to read the draft versions of the review report with a view to resolving any questions of implementation prior to the final version. This supports the facilitative aspect of the ERT's role, helping states parties to improve the standard of their reporting. In the event of a dispute between the party and the ERT, the party can submit comments along with the final review report to the Compliance Committee.

After completion of the Article 8 review, and following the resolution of any disputes, certain information is recorded in the accounting database maintained by the UNFCCC Secretariat. The database is designed to be a single repository and definitive source of information relating to parties' assigned amounts. Among other things, a party's aggregate emissions for each year will be recorded, as well as a running total for the commitment period. Each year the secretariat will publish a compilation and accounting report containing information from the database. At the end of the additional period for fulfilment of commitments, and following the Article 8 review for the last year of the commitment period, the UNFCCC Secretariat will publish a final compilation and accounting report for each party and submit it to the COP/MOP and the Compliance Committee for the purpose of assessing the party's compliance.

Compliance assessment

Each year during the commitment period, the Compliance Committee will assess each party's compliance with the terms of the protocol on the basis of the ERT's final review report. Whereas the ERT is expected to make a technical assessment of the national reports, highlighting 'questions of implementation', it is the task of

the Compliance Committee to judge whether such questions translate into non-compliance. At the end of the additional period for the fulfilment of commitments, the Compliance Committee will judge whether each party has met its emissions reduction target on the basis of a report from the ERT.

The committee will in fact comprise two separate panels called the Facilitative Branch and the Enforcement Branch. Each will consist of nine members: one member from each of the five UN regional groups,[45] two from Annex I countries and two from the non-Annex I group of states. In general, the Enforcement Branch is intended to make judgements on emissions target-related issues. This includes meeting the targets set by Article 3.1, issues relating to reporting under articles 5.1, 5.2, 7.1, 7.2 and 7.4, and questions of the flexibility mechanisms under articles 6, 12 and 17. In contrast, the Facilitative Branch will deal with the complementary objectives of the protocol, helping parties implement more effectively their obligations in respect of finance, technology transfer and sustainable development.

Each branch will take decisions by consensus in the first instance. Where that is not possible, a two-thirds majority is needed. Additionally, for the Enforcement Branch, a majority of members in both the Annex I group of countries and the non-Annex I group of countries is required to carry a decision.

In instances where the Enforcement Branch finds a party to be in non-compliance with its emissions reduction commitment, the party can appeal to the COP, serving as the MOP to the protocol. A majority of at least three-quarters of the conference is needed to overturn a decision of the Compliance Committee.

Conclusions

Compared to other multilateral environment agreements, the Kyoto Protocol provides for a rigorous verification regime. To some extent this reflects the parties' commitment to the protocol and to the goal of mitigating and adapting to climate change. The strength of the system is the integration of reporting into all the operational elements of the agreement and the fact that it develops prescriptive guidelines to set out in detail the information and standards necessary to allow a thorough and technical assessment of parties' implementation.

The guidelines represent experts' 'best guess' for facilitating the smooth running of the reporting and review process. However, the protocol is a novel and innovative

instrument and consists of many untested elements. It is therefore inevitable that, as they become operational, problems and gaps will become apparent, requiring parties to revise and adapt the regime.

The requirements may initially present problems. While many parties have established functioning systems for the preparation of national inventories, others only have a rudimentary one and some have none at all. If these systems are to be ready in time for the first commitment period, serious emphasis needs to be put on implementing the institutional, legislative and methodological developments required for national systems and registries. Parties should use the opportunity of the report on demonstrable progress to test these systems with a view to resolving problems before they affect their eligibility to use the flexible mechanisms.

Early implementation of the reporting requirements will also highlight the extent of the resources parties need to commit domestically and internationally, including to the UNFCCC Secretariat, for the verification regime to function successfully. Many countries, particularly those with economies in transition, will need financial and technical help to meet the standards set by the reporting guidelines. However, such assistance needs to be matched by institutional reorganisation and political commitment in these countries so that funding is effectively channelled. In parallel, the secretariat, which collects submissions, co-ordinates the review process and provides technical and administrative assistance to parties, needs to be adequately funded for these tasks. Parties need to demonstrate their continuing commitment to the process not only by meeting their obligations but by supporting others in theirs.

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Table 1 Reporting obligations for Annex I parties to the Kyoto Protocol (submission date, objective and review process)

Demonstrable progress report (Article 7)

1 January 2006

To provide basis for reviewing party's progress by 2005

The UNFCCC Secretariat will prepare a synthesis document, which will be evaluated by the Subsidiary Body for Implementation along with the 6th national communication. Recommendations will be forwarded to the COP

Pre-commitment period report (Article 7.4)

Earliest: one year after entry into force of the protocol for that party

Latest: 1 January 2007

To review party's base year inventory; to fix the party's assigned amount; to demonstrate capacity to account for assigned amount in accordance to Article 7 guidance; to establish the party's eligibility to use the flexible mechanisms

Review by expert review team in accordance with Article 8; desk or centralised review, followed by an in-country review; to be completed within one year of the submission date

Annual Report (Article 7.1)

Yearly on 15 April; voluntary from the year following the submission of the pre-commitment period report; mandatory from 2008

To provide the basis for assessing a party's compliance with their emission reduction commitments

Review by expert review team in accordance with Article 8; desk or centralised review. In addition, each party will be subject to one in-country visit during the first commitment period; to be completed within one year of the submission date

Supplementary Information (Article 7.2)

*Submitted with party's national communication, submitted periodically, as decided by the COP**

To provide the basis for assessing: changes to the national system and registry; a party's compliance with non-emission target-related commitments

Reviewed by expert review team in accordance with Article 8; desk or centralised review of supplementary information in conjunction with review of annual report.

Followed by an in-country visit conducted in conjunction with the review of national communication; to be completed, where possible, within two years of submission date

Report on expiration of the additional period for fulfilment of commitments (Article 7.4)

*2015***

To provide registry information not included in the annual reports, but that is relevant to the review of the last year of the commitment period

Reviewed by expert review team in accordance with Article 8; desk or centralised review; to be completed within 14 weeks of submission date.

Notes

* Under the Framework Convention, parties submit periodic reports called national communications at intervals decided by the COP. Parties are likely to adopt a decision that Annex I parties submit their sixth national communication by 1 January 2006, to coincide with the submission of the report on demonstrable progress, due under the Kyoto Protocol.

** The COP, meeting on behalf of the Meeting of the Parties (MOP) to the protocol, will decide the submission date for the report on expiration of the additional period for fulfilling commitments.

Endnotes

[1] The text of the United Nations Framework Convention on Climate Change (UNFCCC) can be found at http://unfccc.int/resource/docs/convkp/conveng.pdf.

[2] The text of the Kyoto Protocol can be found at http://unfccc.int/resource/docs/convkp/conveng.pdf.

[3] UNFCCC, Article 2.

[4] UNFCCC, Article 4, para. 2(b).

[5] For links to emissions data between 1990 and 2000, see www.climatenetwork.org.

[6] International Panel on Climate Change, *Second Assessment Report, 1995,* Cambridge University Press, Cambridge, 1995. Summaries can be found at www.ipcc.ch/pub/reports.htm.

[7] The Kyoto Protocol regulates the emission of six greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). The 'basket' approach sets one emissions reduction target for all six gases. The last five gases in the list can be converted into carbon dioxide equivalents using global warming potentials (GWPs), which reflect the capacity of each gas to increase the temperature of the atmosphere. Emissions are measured in metric tonnes of carbon dioxide equivalent ($MtCO_{2e}$).

[8] Annex I countries are the 35 industrialised countries (plus the European Community) that are signatories to the convention. These are Austria, Belgium, Bulgaria, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, the Netherlands, New Zealand, Norway, Poland, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, United Kingdom of Great Britain and Northern Ireland, and the United States. It should be noted that 38 countries have, in fact, taken emission reduction targets, as inscribed in Annex B of the Kyoto Protocol. Annex I countries Belarus and Turkey did not take targets, while Croatia, Liechtenstein, Monaco, Slovakia and Slovenia were added to Annex B, leaving them in a slightly ambiguous position.

[9] UNFCCC, Article 3, para. 1.

[10] Daniel Bodansky, 'The United Nations Framework Convention on Climate Change: a commentary', *Yale Journal of International Law,* vol. 18, 1993, p. 451.

[11] COP6 Final Document (Bonn Agreement), FCCC/CP/2001/L.7.

[12] COP7 Final Document (Marrakech Accords), FCCC/CP/2001/13/Add.1-4.

[13] For the latest ratification information, see http://unfccc.int/resource/kpthermo.html.

[14] Clare Tenner, 'Verification and compliance systems in the climate change regime', in Trevor Findlay (ed.), *Verification Yearbook 2000,* The Verification Research, Training and Information Centre (VERTIC), London, December 2000, pp. 151–166; and Molly Anderson, Trevor Findlay and Clare Tenner, 'The Kyoto Protocol: verification falls into place', in Trevor Findlay and Oliver Meier (eds), *Verification Yearbook 2001,* The Verification Research, Training and Information Centre (VERTIC), London, December 2001, pp. 119–133.

[15] If X=an Annex I party's emissions during 1990 and R=the reduction percentage it negotiated for the first commitment period (inscribed in Annex B of the protocol), its permitted emissions between 2008 and 2012 would be 5(X–RX).

[16] FCCC/CP/2001/L.7, p. 7, para. 5.

[17] The Umbrella Group is a loose alliance of non-EU members of the Organisation for Economic Co-operation and Development (OECD) which negotiate collectively on some issues. The Umbrella Group states are Australia, Canada, Japan, New Zealand, Norway, Russian Federation, Ukraine and the US.

[18] Under Article 3.4, parties can use forest management, cropland management, grazing land management and revegetation to meet their emissions reduction commitment. This is in addition to the provisions under Article 3.3, which include afforestation, reforestation and deforestation.

[19] Referred to as the Annex Z cap, this sets an overall limit on the emission reduction that can be claimed from the Article 3.4 activities listed above. The limits for Annex I countries can be found in FCCC/CP/2001/L.7.

[20] International Panel on Climate Change, *Third Assessment Report: Climate Change 2001,* Cambridge University Press, Cambridge, 2001. Summaries are available at www.ipcc.ch/pub/reports.htm.

[21] The Alliance of Small Island States (AOSIS) is a coalition of small island and low-lying coastal countries that share similar development challenges and concerns about the environment, especially their vulnerability to the adverse effects of global climate change. For more information see www.sidsnet.org/aosis.

[22] Forty-nine countries are currently designated by the United Nations as LDCs. The list is reviewed every three years by the UN Economic and Social Council (ECOSOC). For more information see www.unctad.org/en/subsites/ldcs/ldc11.htmList of LDC countries.

[23] FCCC/CP/2001/L.7, p. 4.

[24] See Michael Grubb, 'International emissions trading under the Kyoto Protocol: core issues in implementation', RECIEL (Review of European Community and International Environment Law), July/August 1998. See also Tom Tietenberg *et al.,* 'International rules for greenhouse gas emissions trading: defining principles, modalities, rules and guidelines for verification, reporting and accountability', United Nations Conference on Trade and Development, Geneva, 1998, available at www.cdmcentral.org/docs/emissions-trading/27.pdf.

[25] Kyoto Protocol, Article 5.1.

[26] Inventory estimates are calculated using a 'top–down' method. Using electricity production from coal as an example, the activity data could refer to levels of coal imports and production , while the emission factor would be the level of CO_2 generated from a tonne of coal when it is burnt in the power station. By combining this type of information, one can estimate emission in each source category. See www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm for a full description of how an inventory should be prepared.

[27] This was the subject of a VERTIC workshop held in London on 13 September 2002. Links to the presentation summaries can be found at www.vertic.org/workshops/work1.html.

[28] The CPR is the lowest number of units that can be held in a party's national registry at any one time. This provision is designed to prevent countries from flagrantly trading all their allowances without any intention of meeting their emission reduction obligations by the end of the commitment period. For each party, the CPR should not drop below 90 percent of its assigned amount, or 100 percent of five times the total emissions reported in its latest inventory if this is lower.

[29] The rules for reporting national registry information, including discrepancies, and the review of this information were agreed at COP8, held in New Delhi, India, 23 October–1 November 2002. This task was postponed to COP8 by COP7 due to lack of time, following the resolution of issues relating to the definition of the assigned amount during the last night of the negotiations.

[30] FCCC/CP/2001/13/Add.2, p. 61, para. 19.

[31] FCCC/CP/2001/13/Add.2, p. 55, para. 1.

[32] Kyoto Protocol, Article 3.2.

[33] FCCC/CP/2002/L.6/Add.1.

[34] The information in the inventories will be for the current year minus two. Thus, a party's 2002 inventory will list its emissions in 2000.

[35] During a desk review the expert reviewer works on a section of a party's inventory in his or her own country, communicating electronically or by telephone with the party, other members of the ERT and the UNFCCC Secretariat.

[36] During a centralised review all members of the ERT meet in a central location to review a party's submission.

[37] The Compliance Committee makes judgements about whether a party has complied with its obligations under the treaty.

[38] FCCC/CP/2001/13/Add.2, p. 42, para. 21.

[39] FCCC/SBSTA/2002/L.5/Add.1.

[40] See 'Report on experience of the technical review process', FCCC/SBSTA/2002/5.

[41] The full title is *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories,* available at www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm.

[42] The full title is *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories,* available at www.ipcc-nggip.iges.or.jp/public/gp/gpgaum.htm.

[43] Parties have yet to define the term 'conservative'. COP8 adopted a work plan, proposed by the secretariat, to trial the guidelines for applying inventory adjustments during expert review of parties' annual submissions under the Framework Convention. This process, to be concluded by COP9, will include an investigation into conservativeness. See FCCC/SBSTA/2002/INF.19 for more information about the work plan; and FCCC/2002/SBSTA/INF.5 for the draft guidelines under Article 5.2. Both are available at www. unfccc.int.

[44] FCCC/CP/2001/13/Add.3, p. 38, para. 2(d).

[45] The five UN regional groups are Europe and North America, Latin America and the Caribbean, West Asia, Asia and the Pacific, and Africa.

10

Monitoring environmental treaties using earth observation

Josef Aschbacher

Earth observation has become a common good since 1972, when the first Landsat satellite was launched. In the 1970s only a handful of satellites were in orbit. Today, more than 60 are continuously monitoring the state of the earth, including the atmosphere and land and ocean surfaces. Over the next 15 years, approximately 150 earth observation satellites with over 300 different instruments will be in orbit. While the first decades of remote sensing were characterised by scientific exploitation, the past decade has shown increased use of space-derived information for global environmental monitoring.

Rapid advances in satellite technology, an increase in the number of available sensors taking more frequent measurements and an increased awareness of the need for global environmental observation have progressively introduced space technology to the environment community. This is not without reason. Information derived from space has a number of distinct advantages over conventional, ground-based measurements:

- Satellite-derived information is *comparable.* The same instrument takes measurements of the whole globe, allowing data to be compared between different geographic areas and times of acquisition.
- Satellite measurements are taken *remotely.* Satellite operators do not need the consent of a country or a party to a treaty to monitor a particular area.
- Satellite measurements are *verifiable.* Raw satellite data can be reprocessed by independent parties from commonly accessible data archives.
- Satellite measurements are *continuous.* Their global nature and long-term operation help close measurement gaps in space and time, providing a more integrated picture of the state of the earth's environment.

These characteristics make satellite measurements an indispensable information source in many cases. However, to exploit their potential they are usually integrated with in situ measurements, climate models, socio-economic data and other relevant information. Geographic information systems and communication, navigation and other information technology are commonly used to add value to earth observation data and convert it into information of relevance to decision makers.

Taking satellite measurements

A great variety of satellite sensors exist today, designed to take measurements of different 'windows' of the electromagnetic radiation spectrum. Generally, there are two modes of operation for sensors: passive and active.

Passive sensors measure the energy of radiation arriving at the satellite sensor. This radiation may be emitted from the sun and reflected back to the satellite off the earth's atmosphere, land or ocean surface. Alternatively, the radiation may have been directly emitted from the earth environment: the latter is commonly referred to as thermal radiation and allows temperature to be measured. While the human eye is sensitive to only a very narrow part of the electromagnetic spectrum (wavelengths from 0.3 to 0.75 microns), satellite sensors measure across a far wider range, from ultraviolet (wavelengths<0.3 microns) to microwave (wavelengths of millimetres to metres), thus spanning several magnitudes of wavelengths.

Sunlight reflected off the earth environment allows the measurement of albedo—the ratio of reflected to incoming radiation, a parameter that can be related to the geophysical characteristics of the object observed. Healthy vegetation, for example, has a high albedo in the near-infrared part of the spectrum (i.e., at wavelengths of *c*. 1 micron) but a much lower value in the visible part of the spectrum. Within the visible part of the spectrum (0.3–0.75 micron), higher values of albedo are around 0.5 micron, which corresponds to green colour, thus giving healthy vegetation a green appearance. Most satellite sensors measure in many narrow windows of the electromagnetic spectrum to increase the number of information channels.

Active sensors are instruments that emit electromagnetic radiation and measure the amount scattered back to the satellite sensor. The most commonly used active sensors are radars working in the microwave region of the spectrum (for example, L, C, X bands) as these are able to penetrate clouds and even rain.

In the scientific literature, satellite sensors are also categorised according to the window of the electromagnetic spectrum in which they take measurements. So-called optical sensors measure in the visible (wavelengths=0.3–0.75 microns) and near- and mid-infrared (IR) (wavelengths=0.75–2 microns) part of the spectrum; thermal IR (wavelengths=~10–12 microns) sensors measure the temperature of objects; and microwave sensors (wavelengths=millimetres to metres) measure either emitted energy in a passive mode or backscattered energy if they work actively.

The resolution or geometric measurement quality of satellite sensors has improved hugely over the past 30 years. The first sensors had resolutions in the order of 100 x 100 square metres, while today's civilian satellites measure objects smaller than 1 x 1 metre. Military sensors have even better resolutions, although the data they gather are not publicly available. Generally, many of the environmental applications of interest to treaty verification deal with phenomena that are relatively large (such as forest and agricultural areas) and global in scale. For both reasons, resolutions only need to be in the order of several tens of metres up to hundreds of metres.

An important issue is the *accuracy* of the classification of land-cover type, which depends on the number of satellite images available, their quality, and the number and diversity of land-cover types being observed. Typically, the accuracy of a satellite-derived land-use map is in the order of 90 percent or higher, that is, at least 90 percent of the area is correctly mapped. This is considered adequate for most cases and compares well with other methods of observation, such as ground observations, which are normally less accurate.

Higher accuracies may be obtained from aerial photography. However, this method presents significant drawbacks because the image analysis process is more complex. Aerial photography is mostly limited to visual interpretation methods and is therefore subject to the interpreter's skills. Satellite data are mostly analysed using digital processing techniques. Recent developments, such as fuzzy logic, neural network and pattern-recognition techniques, as well as the use of multi-temporal images, have significantly improved the accuracy of satellite-derived land-use maps. This has made such products an everyday information source for many applications, for example, providing information on vegetation type and health, forest cover, vegetation fires, agricultural crops and built-up areas. It is also possible to identify geological parameters for three-dimensional terrain models and to measure tempera-

ture, salinity, wave heights of ocean surfaces, the extent of ice and snow cover, or the concentration of atmospheric trace gases, to name just a few types of information. Only some of these parameters are relevant to environmental treaties.

Obviously, earth observation also has its limitations. These fall mainly into two categories: the limitations of technology; and the availability of data. In addition, there are obstacles at the institutional and policy level; these are dealt with briefly at the end of this chapter.

Limitations in technology result mostly from the fact that satellite measurements are taken indirectly. For example, a forester may want to determine the biomass of a tree, while the satellite provides a measurement of the albedo of the tree, including its leaves and branches. Biophysical models, multiple measurements in different wavelength spectra and multi-temporal observations are needed in order to extract the parameter the forester wants.

Limitations in data availability are set by a satellite's orbit configuration and its sensor characteristics. Commonly used polar-orbiting satellites circle the earth approximately 14 times per day, taking measurements over a strip several tens to hundreds of kilometres wide. Typically, a spot on the earth's surface is revisited every two days or so by the same satellite. This may be sufficient for most environmental or climate studies, but may cause problems where measurements need to be available at a given time, as in the case of natural disasters.

Enormous progress has been made, and continues to be made, in satellite sensor technology. Integration of measurements from different sensors is helping to close the observation gap. Furthermore, the new concept of satellite constellations allows more frequent observations using a fleet of identical, or easily comparable, satellites.

For multilateral environmental treaties, the time-frame for observations is normally in the order of months, years or even decades. The frequency of measurements is therefore, in most cases, not a limiting factor.

Earth observation for multilateral environmental agreements

The first multilateral environmental agreement (MEA) dates back over a century,[1] although widespread public awareness of 'the environment' only dates back to the 1960s and 1970s. Since the UN Conference on the Human Environment, held in Stockholm, Sweden, in 1972, the number of MEAs has grown considerably—from

140 in 1970[2] to over 240 today.[3] Among these are the three Rio conventions—the 1992 United Nations Framework Convention on Climate Change (UNFCCC), the 1994 Convention to Combat Desertification and the 1992 Convention on Biological Diversity. Many governments established environment ministries and environment protection agencies in the 1970s and 1980s.

At the World Summit on Sustainable Development (WSSD), held in Johannesburg, South Africa, from 26 August to 4 September 2002, heads of state and government adopted the Johannesburg Declaration, which identifies environmental and development goals for the coming century. These will be particularly challenging because of the expected 50 percent increase in global population over the next 50 years. The Johannesburg Declaration's supporting Plan of Implementation[4] has identified satellite earth observation as a crucial information source for a number of disciplines relevant to sustainable development. Earth observation is specifically mentioned as a key decision-making tool for better management of water resources, natural disaster monitoring, conflict management, climate monitoring (including El Niño/La Niña forecasts) and desertification monitoring. The 54-page Plan of Implementation contains 12 specific paragraphs referring to the need for earth observation for sustainable development. Article 36 of the Plan of Implementation states that:

> The United Nations Framework Convention on Climate Change is the key instrument for addressing climate change, a global concern, and we reaffirm our commitment to achieving its ultimate objective of stabilisation of greenhouse gas concentrations in the atmosphere . . . Actions at all levels are required to: . . . (g) Promote the systematic observation of the earth's atmosphere, land and oceans by improving monitoring stations, increasing the use of satellites, and appropriate integration of these observations . . .

Table 1 lists the principal MEAs, as well as the Rio and Johannesburg conference final declaration goals, for which earth observation is playing or could potentially play a key role in monitoring and verification.

Most of these agreements require, directly or indirectly, continuous monitoring of a number of parameters of the land surface, the oceans and the atmosphere. An example is the UNFCCC and its 1997 Kyoto Protocol, whose parties will report on specific parameters to be used for assessing their compliance.

Table 1 Earth observation in MEA monitoring and verification

World Summit on Sustainable Development (WSSD), 2002
The Johannesburg Political Declaration and supporting Plan of Implementation commit all governments to ensuring sustainability. Main issues are eradication of poverty, access to clean water, sanitation, energy, health, trade and agriculture.
Parameters measurable from space for verification purposes: includes land use and land cover (desertification, drought, water resources, urban sprawl, environmental degradation); climate change (such as El Niño, atmospheric trace gases, global warming, ocean temperature and circulation, ice extent and melting); disaster (floods, forest fires, earthquake damage); food production.

Agenda 21 and UN Commission for Sustainable Development, 1992
Blueprint for sustainable development in the 21st century.
Parameters measurable from space for verification purposes: as for WSSD.

UN Framework Convention on Climate Change (UNFCCC), 1992
Provides for future action to regulate greenhouse gases (GHGs) in the atmosphere. 1997 Kyoto Protocol commits parties to legally binding targets to limit GHG emissions.
Parameters measurable from space for verification purposes: land use, land cover and forestry (LULUCF); afforestation, reforestation and deforestation (ARD); climate change (as for WSSD).

UN Convention to Combat Desertification (CCD), 1992
Aims to combat desertification and mitigate effects of drought through long-term integrated strategies.
Parameters measurable from space for verification purposes: desertification, drought; vegetation cover and stress.

United Nations Convention on Biological Diversity (CBD), 1992
Aims to conserve biological diversity, promote sustainable use of its components and encourage equitable sharing of benefits from utilising genetic resources.
Parameters measurable from space for verification purposes: vegetation; wetlands; land use and land cover.

Montreal Protocol and Vienna Convention on Protection of the Ozone Layer, 1987
The Protocol sets out legal obligations in the form of timetables for progressive reduction and/or elimination of production and consumption of certain ozone-depleting substances.
Parameters measurable from space for verification purposes: atmospheric ozone concentration; concentration of other atmospheric trace gases critical to ozone formation/destruction.

UN Convention on the Law of the Sea, 1982
Establishes a comprehensive legal regime for the sea and oceans with rules for environmental standards.
Parameters measurable from space for verification purposes: oil slicks; marine pollution and algae blooms.

Convention on Long-Range Transboundary Air Pollution (CLRTAP), 1979
Aims to limit, gradually reduce and prevent air pollution, including long-range transboundary pollution.
Parameters measurable from space for verification purposes: concentrations of atmospheric trace gases (such as CO_2, NO_x, CH_4, water vapour); impact of pollution on vegetation.

International Convention for the Prevention of Pollution from Ships (MARPOL), 1973
Aims to eliminate pollution of the sea by oil, chemical and other harmful discharges from ships.
Parameters measurable from space for verification purposes: oil slicks.

Access to earth observation data

The use of space-based earth observation systems is firmly anchored in international space law, as well as national law, customary law and the application of equity principles. The first, and most important, of these is the 1967 Outer Space Treaty,[5] which determines that there is freedom of scientific investigation in space for governmental, intergovernmental and non-governmental entities. All nations have the non-exclusive right to use space. Earth observation systems have been accepted as legal users of space since the early 1970s.

The Principles Relating to Remote Sensing of the Earth from Outer Space, adopted in UN General Assembly Resolution 41/65 in 1986,[6] define the general purpose of space-based earth observation and regulate the rights and duties of states conducting or being sensed by earth observation. According to the principles, the sensed state has access to primary and processed data acquired by any other state on a non-discriminatory basis and at reasonable cost. Although the UN resolution is not a treaty, the principles have achieved the status of customary international law and have been incorporated in the domestic law of some nations, as well as in many earth observation missions and agreements.

Earth observation data are generally available to everyone. The only exception is when the national security of a country may be at risk. Some governments choose to exercise the right to withhold access to such data with 'shutter control' agreements, which allow them to stop the acquisition or distribution of satellite data over certain areas. However, these instances are generally limited to war zones during time of war.

Each data provider has its own data policy, and there is no standard pricing policy for earth observation data. Generally, data for research or other non-commercial use are available at very low cost (perhaps just the cost of reproduction, or the cost of data storage, which may be in the order of only tens or hundreds of euros for a 10,000-square kilometre (km^2) image). In some cases data will be provided free, as in the case of many of the meteorological satellites, or for data exploitation research projects. However, for commercial or operational applications a fee is normally charged, which varies between providers. A commercially available, high-resolution optical image can cost in the order of €1 per km^2. However, even where data are purchased at commercial rates, their cost may still only be 10–15 percent

of an average earth observation project. Other costs are related to data analysis and its integration into other data sets and models to extract parameters of relevance to end-users. During the past 10 years the cost of satellite data has fallen substantially.

Monitoring the Kyoto Protocol

The Kyoto Protocol strengthens parties' obligations under the UNFCCC by imposing quantified, legally binding commitments to reduce atmospheric concentrations of a 'basket' of six greenhouse gases (GHGs).[7] These commitments can be met either by reducing emissions or by balancing them using biological carbon sinks. Although the protocol left many details unresolved, it set the course for subsequent negotiations in the conferences of the parties (COPs). COP7, held in Marrakech, Morocco, in October 2001, concluded enough detail to allow parties to ratify the protocol.[8]

A matter of great controversy during this process was the question of accounting for sinks, or land use, land-use change and forest (LULUCF) activities. COP7 also agreed that an afforestation, reforestation and deforestation (ARD) scheme was covered by Article 3.3 of the UNFCCC and that forestry projects are permitted under the Clean Development Mechanism (CDM).

Reporting and earth observation

Countries' information requirements related to their commitments under the UNFCCC, Kyoto Protocol and the various guidelines of the convention can be grouped into two major categories: national inventories and global climate observations.

The first category covers information needs related to the LULUCF sector—yearly national inventories of anthropogenic emissions by sources and removals by sinks of all GHGs;[9] the second covers the need for global climate change observation systems in order to improve climate forecasts and the impact of climate change.[10] The information needs in these two categories are different in scale, scope and content.

As regards global change observations, earth observation can provide a number of measurements, including concentrations of atmospheric trace gases, rises in sea level, the extent and evolution of sea ice cover and ice shelf melting, or the dynamics of the atmosphere and oceans. These are mostly issues of climate change research, which may feed into the evolution of the Kyoto Protocol but do not have a direct impact on parties' national reporting requirements. Hence, the present chapter

only deals with the national reporting requirements and the potential for earth observation data to be used for this purpose.

National inventories

The UNFCCC commits all parties to prepare 'national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies to be agreed upon by the Conference of the Parties'. Reporting guidelines were subsequently developed and revised to help Annex I countries meet their obligations.[11] These guidelines are to be complemented by the International Panel on Climate Change's (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories,* which is to be applied from 2003 onwards (parties with economies in transition must do so two years later).

In addition, the IPCC, following a request by the Subsidiary Body for Scientific and Technological Advice to the UNFCCC (SBSTA), prepared a Special Report on Land-Use, Land-Use Change and Forestry.[12] According to the report, the information-gathering process (under articles 3.3, 3.4 and 3.7) includes two main tasks:

- identification of land use and land cover in 1990 to serve as the baseline; and
- monitoring of ARD activities between 1990 and 2012.

The base year for GHG inventories is 1990 in most cases. Only Annex I countries with economies in transition may use an alternative base year.[13] For the base year, land and forest cover must be recorded and the forest biomass (above and below ground and including, litter, dead wood and soil organic carbon) must be expressed in carbon stocks. The IPCC notes that approximately three-quarters of the anthropogenic emissions of carbon dioxide (CO_2) into the atmosphere during the past 20 years was due to the burning of fossil fuels. The rest was predominantly due to land-use change, especially deforestation.

The IPCC special report states that: 'Scenarios that create ARD land on the basis of a wide range of activities, including harvest/regeneration cycles and natural disturbances followed by regeneration (as in land cover or FAO [Food and Agriculture Organization] scenarios), will result in a much larger area of ARD land. The data requirements for area determination under such scenarios may be met through approaches that are based on monitoring land-cover change, such as remote sensing'.[14]

Satellite sensors since 1990

The mapping of land-cover change during the 1990s and at the beginning of the new millennium has benefited from the proliferation of very high-resolution sensors (with resolutions in the order of 1 m or less), as well as more frequently available radar imagery (around 10 m resolution). Sensors with intermediate resolutions (a few hundred metres) but more frequent coverage complete the arsenal of useful satellite sensors. Table 2 lists the major earth observation missions, launched during the past 12 years, which can be used for the purposes of national reporting under the Kyoto Protocol.

The Kyoto Protocol sets specific resolution standards. Forest area must be determined using a spatial resolution no larger than 1 hectare, corresponding to a satellite sensor resolution of less than 100 metres. This limits data collection from earth observation sensors to two main types, available in 1990. These are the sensors on board the Landsat (US) and Spot (France) satellite series. Both operate in the visible and IR region of the electromagnetic spectrum and measure reflected sunlight.

Since 1990, a number of new sensors have become available for monitoring ARD activities in the period up to 2012. These are also listed in table 2. They include radar imaging sensors on the ERS (European Remote Sensing Satellite) series (ESA, European Space Agency, 1991 onwards), the JERS-1 (Japan, 1992–1998) and the Radarsat (Canada, 1995 onwards) satellites, and the recently launched dual-polarisation radar imager on board Envisat (ESA, 2002 onwards). Envisat is the most advanced and complex space-based earth observation mission ever.

In addition to these radar missions, the Indian IRS series offers an optical/IR imaging sensor similar to the ones on the Landsat and Spot satellites. Some recently-launched very-high-resolution sensors, with resolutions of 1 metre or less, show some interesting characteristics, which may give a better distinction between forest and tree types. However, the relatively small imaging size, of the order of 10 x 10 km, presents a major technical limitation in constructing countrywide land-use maps.

Earth observation measurements of interest to the Kyoto Protocol

Forestry is one of the key activities allowed under the Kyoto Protocol's LULUCF and ARD provisions. Earth observation can provide information about forest area, forest type, density, species and the health of a forested area. Deciduous, coniferous, broadleaf and mixed forests can be distinguished from each other. Very-high-

Table 2 Sensors on satellites launched since 1990 for baseline mapping and national reporting

Satellite	Agency (country)	Sensor	Resolution (metres)	Operational life
Landsat-4	NASA/NOAA (US)	Multispectral scanner (MSS)	60	July 1982–Aug. 1993
Landsat-5		Thematic mapper (TM)	30/120	Mar. 1984–
Spot-1	CNES (France)	High resolution visible (HRV)	10 (pan)	Feb. 1986–Feb. 2002
Spot-2			20 (VIR)	Jan. 1990–
ERS-1	ESA (Europe)	Synthetic aperture radar (SAR)	30	July 1991–1999
JERS-1	NASDA (Japan)	SAR	18	Feb. 1992–Oct. 1998
SPOT-3	CNES (France)	HRV	10 (pan) 20 (VIR)	Sep. 1993–Nov. 1996
ERS-2	ESA (Europe)	SAR	30	Apr. 1994–
RADARSAT-1	CSA (Canada)	SAR	28	Sep. 1995–
IRS-1C	ISRO (India)	Linear imaging self-scanning	23.5 (VIR)	Dec. 1995–
IRS-1D		system (LISS-III)	70 (IR) 5.8 (pan)	Sep. 1997–
SPOT-4	CNES (France)	High-resolution visible and infrared radiometer (HRVIR)	20 (VIR) 10 (pan)	Mar. 1998–
IKONOS-2	Space Imaging (US)	Optical sensor assembly (OSA)	4 (VIR) 1 (pan)	Sep. 1999–
LANDSAT-7	NASA/NOAA (US)	Enhanced thematic mapper plus (ETM+)	30 (VIR) 15 (pan) 60 (TIR)	Apr. 1999–
QUICKBIRD-2	Earth Watch Inc. (US)	Ball global imaging system (BGIS)	2.8 (VIR) 0.7 (pan)	Oct. 2001–
ENVISAT	ESA (Europe)	Advanced synthetic aperture radar (ASAR)	< 30	Mar. 2002–
SPOT-5	CNES (France)	High resolution geometry (HRG)	10/20 (VIR)	May 2002–
		High-resolution stereoscopic (HRS)	2.5/5 (pan)	

NOTES NASA=National Aeronautics and Space Administration; NOAA=National Oceanic and Atmospheric Administration; CNES=Centre National d'Études Spatiales; ESA=European Space Agency; NASDA=National Space Development Agency of Japan; CSA=Canadian Space Agency; ISRO=Indian Space Research Organization; pan=panchromatic (one channel only); VIR=visible/IR channels (more than one channel); TIR=thermal IR.

SOURCE Committee on Earth Observation Satellites, *CEOS Handbook 2002,* European Space Agency, Paris, 2002, available at www.eohandbook.com; Herbert J. Kramer, *Observation of the Earth and its Environment: Survey of Missions and Sensors*, 4th edn, Springer Verlag, Heidelberg, 2002; http://earth.esa.int/ers/instruments/index.html; www.csc.noaa.gov/products/maine/html/rs_mang.pdf; http://ceos.cnes.fr:8100/cdrom-98/ceos1; www.esa.int/atsrconf/; http://envisat.esa.int/instruments/asar/data-app/app/land.html; http://apex.neonet.nl/browse/www.neonet.nl/Document/FZUVFOVVFWTGRWHMPHWYEXWGS.html; and www.spotimage.fr/home/system/introsat/payload/welcome.htm.

resolution sensors (1 metre or less) can be used to identify individual trees for forest type classification. Sensors in the visible, IR and radar range of the electromagnetic spectrum are suitable for monitoring changes in ARD. The state of a forested area—whether healthy or stressed—can be determined and monitored. This affects the carbon storage of the forested area.

Satellite sensors can also be used to monitor agricultural activities. Important parameters include type of crop (such as wheat, maize, rice, barley, soya beans, potatoes or sunflowers) and the state and productivity of crops. Taking several images during the growth cycle makes it possible to draw conclusions about field management practices, such as crop rotations, irrigation cycles and harvesting times. If remote sensing data are combined with agro-meteorological models and plant physiology information, yield estimates can be retrieved to obtain countrywide agricultural statistics. The European Commission, for example, has established an operational agricultural monitoring system which monitors and predicts yields for the 10 most common crops across the European Union using field-sampling methods. Information on rice fields, for example, is important, since they contribute up to one-quarter of global methane emissions.

Vegetation fires are a significant element in global carbon stock changes because the burning process releases CO_2 and the vegetation cover which absorbs carbon from the atmosphere is reduced. Changes in vegetation cover need to be accounted for in the national inventories submitted under the Kyoto Protocol. Vegetation fires are monitored daily and globally by a number of satellite sensors at medium resolution. If more detailed area analyses are required, high-resolution satellites are commonly used.

The application of earth observation in practice

Earth observation is undoubtedly a very appropriate, and in many cases the only, viable tool to provide the land-use, land-cover and forest information required by the Kyoto Protocol. However, there remains a challenge in converting this information into the equivalent carbon stock figures required under the reporting guidelines. Although progress has been made since the Kyoto Protocol was negotiated, further standardisation of methods is needed. It should be possible to have globally applicable methods for deriving carbon stock figures from satellite-retrieved land-use maps. Default methodologies would greatly facilitate the reporting process.

Remote sensing from space is most likely to be used by:

- countries which lack regular inventories;
- countries which do not have information on the baseline year;
- large countries where remote sensing from space is inexpensive compared to ground-based or airborne methods (if available for 1990); and
- countries with well-developed inventories which want to introduce comprehensive national full-carbon-accounting projects.

The National Carbon Accounting System of Australia is a good example of the latter.[15] Another is the research programme of the International Institute for Applied Systems Analysis (IIASA) for setting up a full-carbon-accounting approach in Russia and other countries, which is supposed to contribute to the work of the IPCC. According to IIASA, 'current findings stipulate a heavy use of remote sensing in order to implement the Kyoto Protocol'.[16]

Looking ahead

Earth observation is a viable tool for monitoring the implementation of the Kyoto Protocol. In particular, LULUCF and ARD activities can be monitored using space technologies and data can be used to meet the reporting provisions under the treaty. Satellite data offer several key advantages over other methods—independence, repeatability and comparability of the information retrieved.

There is a need to further develop internationally accepted and standardised methodologies for using satellite information. This is a major challenge which remains to be tackled.

At the institutional level, there are several possible ways in which earth observation may be used to meet national reporting requirements under the Kyoto Protocol (in addition to advancing research on climate change in order to improve UNFCCC guidelines more generally). First, national governments can use earth observation as a way of collecting national activity information, in accordance with the rules of the Kyoto Protocol. Second, an independent body can use earth observation to verify estimates of carbon stocks submitted in national inventories. Third, some parties may decide to establish a joint, independent (space-based) reporting mechanism in order to reduce their individual reporting burdens.

The second option might meet resistance from some signatories, which may feel that their national interests would be compromised by an external verification mechanism. That leaves earth observation as a largely voluntary choice for governments. It is therefore the task of space agencies to convince the international community that earth observation is a valuable and practical information source. Some signatories have already started major projects to incorporate satellite data into their inventory preparation. The results are expected in time for 2007, when national reporting for the first commitment period will begin.

The use of earth observation to verify MEAs other than the Kyoto Protocol follows the same principal. For most of the agreements dealing with issues relating to land surface (biodiversity, wetlands and desertification), earth observation has proved in hundreds of individual cases how it can be used to map and continuously monitor the type and state of health of vegetation, changes in land use and other environment-related parameters. Similarly, space techniques allow the measurement of concentrations of trace gases in the troposphere and stratosphere. Several efforts are under way, using remote sensing, to support the 1973 International Convention for the Prevention of Pollution from Ships (the MARPOL Convention) or the UN conventions to combat desertification and on biodiversity. While the advantages of using space techniques for these agreements are clear, the challenges remain the same as those for the Kyoto Protocol, namely, to convert space-derived data into the required parameters and to introduce the tool as an internationally accepted method of verifying treaties. Here, the challenges of science end and the challenges of politics begin.

Institutional and political obstacles are certainly among the more difficult ones to overcome. While the merit of using space technology is in many cases acknowledged, the main difficulty is the introduction of a new observation technology into an existing, often decades- or centuries-old, political and institutional structure. Changes may require the abolition or modification of current techniques, such as ground-based observation, the reorientation of budget and staff resources in government organisations, or the creation of a new legislative framework.

To help overcome these obstacles, several governments have initiated programmes to move space technology from a predominantly research-oriented tool to a more user-driven one. Among the most prominent is the European Global Monitoring

of Environment and Security (GMES) initiative, which aims to develop a global monitoring capability in support of European environment and security policies, including implementation of the Kyoto Protocol.[17] Another example is the recent initiative of the Committee on Earth Observation Satellites (CEOS)[18] in actively participating in the negotiations at the 2002 Johannesburg summit. The CEOS achieved the inclusion of a large number of specific references to space in the final Johannesburg Political Declaration and its supporting Plan of Implementation. Established in 1984 under the auspices of the Group of Seven (G7—today's G8), the CEOS co-ordinates earth observation programmes at the international level. Its membership comprises all government agencies which are developing or operating earth observation satellites or which are major users of earth observation data.

In moving towards an internationally agreed mechanism to use earth observation for MEA verification, committees such as the CEOS might act as catalysts by being politically unbiased and having a technologically optimised approach. However, it would be helpful if the preparedness of the space community were matched by a proactive approach by the negotiators and implementers of MEAs in foreseeing, and even encouraging, the use of earth observation for treaty monitoring and implementation.

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Endnotes

[1] For a historical listing of environmental agreements, see SEDAC website at http://sedac.ciesin.org/rs-treaties/rs-treaties_bckgnd.pdf. SEDAC is the Socioeconomic Data and Applications Center at Columbia University, New York.

[2] See http://sedac.ciesin.org/rs-treaties/adesherbinin_riopaper.pdf.

[3] See http://sedac.ciesin.org/rs-treaties/rs_treaties.pdf; and www.un.org/esa/sustdev/agreed.htm.

[4] See www.johannesburgsummit.org.

[5] The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies entered into force 10 October 1967, available on the website of the UN Office for Outer Space Affairs at www.oosa.unvienna.org/SpaceLaw/outerspt.html.

[6] Available at www.oosa.unvienna.org/SpaceLaw/rs.html.

[7] Annex A to the Kyoto Protocol. The text of the protocol is available at http://unfccc.int/resource/docs/convkp/conveng.pdf. See also chapter 9 in this volume.

[8] An instructive summary of the Marrakech accords (COP7) is provided on the website of the Pew Center on Global Climate Change, Arlington, VA, US, at www.pewclimate.org/cop7/update_110901.cfm.

[9] United Nations Framework Convention on Climate Change, Articles 4.1(a) and 12.1(a). The text of the convention is available at http://unfccc.int/resource/docs/convkp/conveng.pdf.

[10] United Nations Framework Convention on Climate Change, Articles 4.1(g) and (h), 5 and 12.1 (c); and Kyoto Protocol, Article 10(d).

[11] Annex 1 countries are the 35 industrialised countries that are signatories to the convention, plus the European Community. See website of the International Panel on Climate Change at www.ipcc-nggip.iges.or.jp/public/gl/invs4.htm.

[12] See United Nations Environment Programme (UNEP) GRID-Arendal website at http://www.grida.no/climate/ipcc/land_use/index.htm.

[13] Kyoto Protocol, Article 3.5.

[14] See www.grida.no/climate/ipcc/land_use/139.htm.

[15] See www.greenhouse.gov.au/ncas/files/abstracts/tech09.html.

[16] See www.iiasa.ac.at/Research/FOR/carbon.html?sb=3.

[17] See http://europa.eu.int/comm/space/gmes_en.html.

[18] See www.ceos.org.

election observation





II

International election observation

Bill Gray and Therese Laanela

During the decade of the 1940s, only 78 democratic elections were held worldwide. In the 1970s that number leapt to 237 and in the last decade of the 20th century 603 elections were held. The change in the Commonwealth of Independent States (CIS) and Central and East European countries is even more impressive: only one democratic election was held there in the 1980s, but 113 in the 1990s.[1]

The exponential increase in the number of elections towards the end of the century reflected a number of factors. The end of apartheid in South Africa and associated changes in Southern Africa, the transformation of military dictatorships into democratic regimes in Latin America and the disintegration of the Soviet Union all gave rise to an environment in which the conduct of democratic elections was not only an essential element of democratisation and legitimate governance but often a precondition for the receipt of international aid and membership of international organisations.

With so much at stake—notably domestic legitimacy and international recognition—in the 'stamp of approval' that successful elections provide, a minor industry has developed in tandem with the proliferation of elections: election observation and monitoring. If the most favoured media image from high-profile elections, such as those in Kosovo, Cambodia, Peru, Indonesia and Zimbabwe, is the classic ballot box and the determined first-time voter, then the most favoured 'sound bite', competing with the actual results of the election, is their declaration as 'free and fair' or otherwise by high-profile personalities representing international observation groups.

The practice of election observation is not new—the first recorded international observation being that of the general election in Moldavia in 1857—but it has

undergone considerable development and change, particularly over the past two decades.[2] The UN gave rise to new expectations in the conduct of election observation with its organisation and conduct of elections in Namibia, Nicaragua, Cambodia and South Africa (although the scale and cost of those exercises make them the exception and would be beyond the capacity of the organisations that normally sponsor election observer missions).

The questions arise, however, what the purpose of such observation is, how it is conducted and what benefits, if any, flow from it. It is timely to question the utility of such activity and whether election observation is a valid and reliable means of verifying that an election is legitimate and has been conducted with integrity.

For the purposes of this discussion, a democratic election is an event (comprising a number of complex processes, including voter registration, logistics, party registration and much more) designed to ensure the free and fair expression of the will of citizens in choosing a representative parliament, legislature or a head of state. Election observation is about being able objectively and independently to assess and report on the integrity or otherwise of the various elements of an electoral process.

Election observation assessments may form the basis for validating or challenging the legitimacy of the government elected. Such findings may also have an impact on donors' commitments to a country or on its relationship with an international organisation, such as the Council of Europe or the Commonwealth.

At its best, the presence of international observers can reassure voters as to the secrecy and integrity of the voting process, provide the opportunity to evaluate the political, social and legal environment in which the election is being conducted, and enhance the possibilities for reform and improvement of the democratic process.

At its worst, an international election observation presence gives undue legitimacy to an improper electoral process. Observation missions also run the risk of contradicting each other as a result of different interpretations of the notion of 'free and fair'. They have, at times, been criticised as biased, arbitrary, an intrusion into national sovereignty or costly 'electoral tourism'.

An emerging set of standards, both on how elections should be conducted and on how they should be observed, and an increased professionalism in observation are two factors that partly address concerns about election observation. The next

two sections of this chapter consider these in turn. This is followed by a case study of the 2002 presidential elections in Zimbabwe. A final section draws some conclusions.

Emerging global standards on elections

If we accept that election observation is a form of verification, and that what is being verified is the integrity of the electoral process, then against what treaties, norms or generally understood principles are the elections being measured or verified? Based on the experience and practices of electoral events of the past two decades, principles and standards are being developed, acknowledged and utilised by the international community to provide guidance in determining the integrity and legitimacy of elections.

The most important source documents are the 1948 Universal Declaration of Human Rights and the 1966 International Covenant on Civil and Political Rights, which enshrine the overarching rights of citizens to the expression of their will through periodic elections, universal and equal suffrage, and free voting procedures.[3]

The notion of 'free and fair' is central to the work of election observers, both international and domestic. It is the case, however, that the concept of 'free and fair' is both vague and multidimensional and that there is no one definition, methodology or handbook which is universally regarded as enabling an incontestable judgement to be made as to whether an election has been free or fair.

Apart from these two documents, very little guidance in the form of benchmarks or checklists existed for election observation until the late 1980s. Up to that point, in established democracies, elections were conducted as a national public administration endeavour under national rules and procedures. Just how they were conducted and by whom was largely seen as a domestic, often routine, concern. In each jurisdiction local solutions were found, leading to myriad permutations—in electoral systems, in voter registration practices, in boundary delimitation criteria and in the structure and functioning of election management bodies. While there was commonality of task, there was no 'one size fits all' for electoral practice.

Several organisations were set up between the late 1980s and the mid-1990s to support good practice in elections, either 'on the ground' or through documentation. This work has contributed to raising elections from a national to an international

concern.[4] It resulted in the adoption in Paris in 1994, by 120 countries, of a Declaration on Criteria for Free and Fair Elections.[5]

Identifying and codifying good practice in a field that has developed in such a diversified manner has not been without its challenges, for example, in determining the degree of 'prescriptiveness' and specificity that is possible or desirable. On the one hand, organisations such as the Organization for Security and Co-operation in Europe (OSCE) were anxious for 'tough' and relatively specific guidelines to be set by the international community in order to pre-empt and deal with threats to fragile new democracies from corruption or sabotage of the electoral process by tenacious incumbent regimes or other anti-democratic forces.[6] Paradoxically, these 'tougher' guidelines, developed with newer democracies in mind, have become problematic for many long-established democracies, particularly in Western Europe and North America, where traditional practices do not necessarily match the new standards—for instance, the expectation that an independent agency rather than a government department should run elections.[7] It is likely that a document that aimed to incorporate common prescriptions for all electoral practices would have to adopt a 'lowest common denominator' approach, which would render it of little use when international or domestic monitors want to expose malpractice and need internationally agreed documents to refer to.

Consequently, guidelines and codes that are intended to be globally applicable tend to focus on principle rather than practice. For example, the Code of Conduct for the Ethical and Professional Administration of Elections developed by the Stockholm-based International Institute for Democracy and Electoral Assistance (IDEA) specifies non-partisanship, professionalism and service-mindedness, respect for law, transparency and accuracy as essential principles that must not be compromised, but avoids advocating any particular practice or system.[8] International IDEA's Administration and Cost of Elections (ACE) project, a widely used web-based resource on election administration,[9] is structured in such a way as to recognise the existence of 'options' in practice, but also emphasises 'guiding principles' that should steer each aspect of the conduct of an election. For example, recognising that there is diversity of practice in the counting of votes, it suggests that 'counting at polling stations' and 'counting at counting stations' are options, while 'accuracy' is a guiding principle and must not be compromised.

According to Professor Jörgen Elklit of the University of Århus, Denmark, freedom of speech, assembly and association, along with the absence of intimidation of voters, the right and opportunity to participate in the election, and equal and universal suffrage are all pertinent to a valid assessment of whether an electoral process can be considered free. With regard to 'fair', Elklit suggests that the more widely recognised criteria would include transparency in the electoral process, the absence of special privileges for any political party or social group, the impartial treatment of political parties and candidates by the police, the army, the courts of law and other government institutions, and the existence of an independent election commission or other electoral body.[10]

As regards sovereignty, sometimes the 'right' to international observation for elections can be derived from membership requirements in international organisations (the OSCE or the Council of Europe, for example), peace agreements (such as the 1991 Agreement on a Comprehensive Political Settlement of the Cambodia Conflict), or a provision in domestic law that election observers must be present. More commonly, however, an invitation by a country or its election authority is the mechanism by which international observation is made possible. The incentive for issuing invitations can range from pressure from the international community to a pursuit of legitimacy on the part of the hosting country.[11]

Even with an invitation, there are times when it is not appropriate to mount an observation. The prerequisites for an observation mission listed in International IDEA's Guidelines for Determining Involvement in International Observation are:

- a basic agreement with the host country, which would include not only an official invitation but also general support from other parties and other groups;
- an initial assessment of the likely character of the election, taking into consideration the existence of basic laws and freedoms, the legal framework for the elections and the credibility of the election authorities; and
- a realistic assessment of whether the observers will be free and able to do their job.[12]

Practical considerations such as lead time, availability of expertise and resources, the safety of observers and the 'fit' with other observer groups are also important considerations.

The final set of prerequisites relates to the credibility of the observer group. The 'good name' of an organisation mounting an observation will be undermined if its observers are ill-prepared, ill-informed or under-resourced.

Professionalism in observation

Observation, in the electoral context, requires the gathering of information on and the witnessing of activities that are part of the electoral process. It also requires an analysis of those activities and the making of a judgement about the validity and integrity of the electoral process as a whole. Here the political, cultural and historical dimensions will play a significant part in judgements about whether an election has been free and fair.

Observers make direct contact with as many of the stakeholders and participants as possible, including candidates, party officials, election administrators, security officials, media representatives, non-governmental organisations (NGOs) and voters. They examine the legislative framework within which the election is being held and observe directly as many of the various phases of the election as resources and time allow. The observers report their findings and come to a view as to whether the election has been conducted in a way that is consistent with international standards and whether it has been 'free and fair'.

How precise is election observation? What tools does an election observer have to match general and imprecise (in many cases uncodified) principles against the reality that confronts him or her?

The increasingly professional attitude towards verifying the integrity of the elections is the result of a number of factors:

- clear and transparent mandates;
- consistent and examinable criteria;
- a wider range of issues and structures being observed;
- increased sophistication and specialisation of the tasks; and
- the development of and adherence to ethical codes for the observers themselves.

First, election observation is more than simply an election presence. The mandate must be clear and define the role and intentions of the observer group: for example, observers from the OSCE's Office for Democratic Institutions and Human Rights

(ODIHR) base their commentary on: adherence to the OSCE Commitments (defined at Copenhagen in 1990)[13]; and the electoral law of the given country. Mandates are different for supervising, monitoring and observing elections. The International IDEA Code of Conduct for the Ethical and Professional Observation of Elections suggests that supervising is the process of certifying the validity of all or some of the steps in an election process. 'Peace process' elections (such as those held in Bosnia and Herzegovina after the 1995 Dayton Agreement) are the most common examples of a supervisory role being introduced. Monitoring involves the authority to observe an election process and to intervene in that process if relevant laws or standard procedures are being violated or ignored. (The Atlanta-based Carter Center tends to favour a monitoring role.[14]) Observing is limited to gathering information and making informed judgements on that basis.

Second, the validity of elections was, up until the last decade or so, judged against very limited criteria relating to the mechanics of casting and counting votes. Today, the criteria against which an election is judged to be free and fair are much broader and include an assessment of the basic rights and freedoms available to the voters, candidates and other stakeholders in the election. Other criteria, such as the political and security environment, equitable access to national resources for the competing parties, the integrity of the electoral register, the role of the media and the application of the rule of law, are now widely acknowledged as fundamental in assessing the integrity of elections.

Third, while early observation efforts were largely focused on and around the polling event, serious observation efforts now include assessments of:

- the full electoral cycle (voter registration, nominations procedures, vote-counting and so on);
- the full set of relevant structures (the electoral administrative structure, and judicial and dispute resolution mechanisms);
- the environment (the pre-election environment, party campaign activities and media coverage); and
- documentation (electoral law and procedures).

Observation efforts today are likely to combine long-term (deeper and longer) and short-term efforts (the insertion of large numbers of personnel on and around

polling day); the involvement of eminent persons (for political 'clout' and media coverage) and election or country specialists; and the use of national (domestic) observers in conjunction with, or instead of, international observers. There is growing recognition that different techniques and skills are required to assess different aspects of the process. 'Look and listen' polling station observers in significant numbers are being complemented by specialists, for example, database experts who can conduct 'post-mortems' on disputed registration databases or vote-counting computer programmes.

A fourth reflection of increased professionalism in verification is a 'methodical' approach to processing both qualitative and quantitative data in analysis and reporting. Increasingly sophisticated methods are being introduced in order to do this. Quick counts and parallel tabulation (where the observer group estimates the election results) are increasingly sophisticated and reliable.[15] These techniques are based on well-designed questionnaires, the employment of observers who are well trained in the methodology and follow the same procedures wherever they are, appropriate geographical spread, statistical relevance and the careful processing of questionnaires. Comprehensive debriefing of individual observers is also an important element.

An important aspect of improving standards of election observation is the 'human dimension'—the conduct and ability of the observers themselves. Observers bring to their tasks a range of experiences, skills, preconceptions and biases, all of which result in differing weights being applied to the criteria for free and fair elections. Election observation involves more than mere technical analysis of a process. A 'softer' judgement is often required that checklists cannot always help with: a 'good' observation effort will be able to assess the elements of the electoral process with the highest potential for faults and concentrate the verification effort on those areas. A 'good' observer will be able not only to identify deviation from the rules or procedures, but also determine whether the deviation is acceptable or understandable or whether it compromises basic principles that are critical to the overall process.

To be able to exercise sound judgement, observers need to be familiar with electoral laws, regulations and procedures, election materials (the ballot box and ballot papers), forms, counting procedures, the process for distribution of seats and processes for resolving challenges and other disputes.[16]

Finally, international organisations such as the UN, the European Union (EU), the Organization of American States (OAS), the OSCE, the Centro de Asistencia y Promoción Electoral (Centre for Electoral Promotion and Assistance, CAPEL), the Commonwealth Secretariat and International IDEA have all promulgated formal guidelines and codes of conduct which are increasingly used by international observers. Host nations expect international observers to adhere to the principles embodied in such guidelines and protocols as a condition of invitation and accreditation.

As with many other human endeavours, election observation faces the challenge of closing the gap between ideal and practice. Even with the advent of comprehensive guidelines and protocols, election observation is subject to many vagaries which can have a significant impact on its effectiveness. While techniques have been improved as a consequence of repeated observation efforts, it is still the case that political interference, limited resources or, most commonly, shortness of time prohibit the best practices in election observation from being achieved. Too much reliance on the presence of eminent persons (such as former heads of state, senior parliamentarians and senior diplomats called in to lead an observer group) and not enough on the professionalism and technical competence of the observers can result in findings that are less than objective or factually flawed.

Election observation has developed significantly since the days when, so long as the vote was conducted in a reasonably fair and equitable fashion, the secrecy of the ballot was maintained and the counting was transparent, the election was likely to be assessed as 'free and fair'. Professional methods and techniques are evolving, but they also bring greater complexity.

The two great challenges ahead are: the inclusion of the 'socio-political environment' in a consistent, quantitative and qualitative way as a factor to be taken into account in the observation assessment; and the issue of the consequences resulting from an observation report. The emphasis on these two elements made Zimbabwe a turning point for election observation.

Zimbabwe: a recent case study

The Zimbabwean presidential elections of 9–11 March 2002 were held in the face of widespread national and international concern as to the integrity of the electoral process. A constitutional referendum held in February 2000 and parliamentary

elections held on 24–26 June 2000 had been similarly controversial. In particular, serious concern was voiced by observer groups about intimidation and violence experienced by candidates and voters during the political campaign leading up to the parliamentary elections. These concerns were partly responsible for the deterioration of relations between the government of President Robert Mugabe and donor nations such as the UK and the US, and some international organisations, including the EU and the Commonwealth.

The Zimbabwean government invited a number of international organisations and countries to send observers, including the Commonwealth, the EU, the Organization of African Unity (OAU), the Southern African Development Community (SADC), the African National Congress (ANC), Namibia, Nigeria, Norway, South Africa and Tanzania. However, it announced that it would not permit any British citizens to be accredited as observers. The EU arranged to deploy a large team of observers, but a last-minute dispute with the Zimbabwean government over the composition of the team resulted in the EU advance team being withdrawn and the EU's deciding to take no further part in the observation of the election. This decision resulted in significantly fewer observers being available for deployment across the country and was to have an important impact on the weight given by the international community to the report of the Commonwealth Observer Group (COG).

The COG was led by General Abdusalami Abubakar, former head of state of Nigeria, and comprised 53 observers, all from member nations of the Commonwealth. Most had previous experience as election observers. Teams were deployed to all 10 provinces of the country and all travelled extensively during the three weeks leading up to the poll. The observers met political party representatives, members of parliament, electoral administrators, and representatives of the media, the police and civil society, including the Zimbabwe Election Support Network, churches, war veterans, commercial farmers and ordinary voters in urban, regional and remote areas of the country. Although English is widely spoken throughout Zimbabwe, each team was accompanied by a driver/interpreter to facilitate communication between observers and the community, particularly those in rural areas.

The COG findings

On their return to the capital, Harare, after the election, the observers reported their experiences and findings, and identified major concerns. These included the

paucity of voter education, the violence and intimidation during the campaign period, infringements on freedom of speech, movement and association, the lack of adherence to the rule of law, the disenfranchisement of thousands of voters as a consequence of voter registration procedures, the reduction of numbers of polling stations in urban areas, media bias and the inappropriate use of government resources by the incumbent candidate, Robert Mugabe.

Of particular interest to the COG was the campaign period leading up to polling day. As mentioned above, election observation has, until recently, focused to a high degree on the mechanisms and procedures associated with polling day and the counting of ballot papers. On this occasion, however, the COG determined that the political and security environment in which the elections were being held constituted a crucial consideration in judging the integrity of the electoral process. It recognised that violence, or the threat of violence, can impede the ability of an elector to exercise his or her right to participate freely and can be used to deter electors from voting or influence their choice.

Whereas the so-called war veterans were held responsible for the greater part of the violence and intimidation during the campaign leading up to the 2000 parliamentary election, it was a newly formed paramilitary youth group trained by the government under a 'National Youth Training Programme' that led the attacks on opposition party supporters and ordinary citizens in the lead-up to the 2002 presidential elections. While the violence perpetrated by these youths, often supervised by war veterans, was not dissimilar to that observed during elections in other countries, their operations were distinguished by the seamless alliance that existed between the youth groups, the police and the military. The deployment of youths in camps across all parts of the country, particularly in the rural areas, required the logistical support of the military. The illegal activities of the youth groups, ranging from killings, kidnapping, arson, rape and assault to the establishment of roadblocks, relied on the often conspicuous support and protection of the police. There was an obvious reluctance on the part of the police to intervene to stop attacks by members of the youth militia on opposition supporters. The actions (or inaction) of the police raised serious questions about the rule of law in Zimbabwe.

Other issues—such as the recently enacted legislative constraints on freedom of speech, movement and association; the arbitrary removal of voters from the

electoral register; the disenfranchisement of thousands of voters in Harare and Chitungwiza resulting from the reduction of the number of polling stations in urban areas; the inequitable use of government resources by supporters of the incumbent candidate; the polarisation of the media; and the inability of domestic observers to gain access to the great majority of polling stations—were all important factors in the overall assessment made by the COG. It was, however, the weight given to the political and security environment, characterised by violence, fear and intimidation, that distinguished the COG's findings (as well as those of the SADC) from those of other (mainly African) observers who assessed the election as being free and fair.

Reporting

The timing of the public announcement of an observer mission's findings is always a matter of judgement either by the head of mission or by the sponsoring body, having regard to the political situation.

Before the Commonwealth mission had made its findings known, the OAU team announced that 'in general the elections were transparent, credible, free and fair'. This view was endorsed by the head of the Namibian observer mission, Tuliameni Kalomoh, who told the BBC: 'I have not seen any objective individual who was ever to say with a straight face that "I have observed irregularities, I have observed rigging of the election, I have observed intimidation of the voters"—that they've been prevented to go and cast their votes. I have not seen that'.[17] Similarly, the South African parliamentary observer team also declared the election to have been free and fair.

These findings were greeted with cynicism and disbelief by opposition party supporters and other members of the international community, especially the UK, the US and the EU. But two important groups had yet to make public their findings—SADC and the Commonwealth. SADC was an important player in that its members were Southern African countries, including South Africa, Zambia, Botswana, Namibia and Mozambique, all of which have close links with Zimbabwe. Its Parliamentary Forum, of which Zimbabwe is a member, had collectively developed Norms and Standards for Elections in the region which were formally approved by SADC in March 2001. The objective of the norms and standards is 'to ensure the conduct of peaceful, free and fair elections in the region'.[18]

The SADC Parliamentary Forum observer mission made known its findings on 13 March, the day after the counting of votes. Unlike its parliamentary colleagues from South Africa and Namibia, it expressed serious concern at the extent of intimidation and violence during the campaign period and questioned the limitations that had been placed on freedom of speech, movement and association during the election period. It concluded that: 'The climate of insecurity obtaining in Zimbabwe since the 2000 parliamentary elections was such that the electoral process could not be said to adequately comply with the Norms and Standards for Elections in the SADC region'.[19]

For its part, the COG issued an interim statement on 14 March in which General Abubakar announced that, on the basis of the observations of the group and having regard to the serious concerns that had been expressed about many aspects of the electoral process, the COG had concluded that 'the conditions in Zimbabwe did not adequately allow for the free expression of will by the electors'.[20]

The COG report was immediately taken up by the President of South Africa, Thabo Mbeki, the President of Nigeria, Olusegun Obasanjo, and the Prime Minister of Australia, John Howard, who had been mandated by the Commonwealth heads of government earlier in the year to examine the report and to determine whether, on the basis of its findings, Zimbabwe should be suspended from the Commonwealth. On 19 March, the three leaders announced that, on the basis of the group's findings and report, it was their unanimous view that Zimbabwe should be suspended from the Commonwealth for 12 months.

Conclusion

Election observation is an inexact but evolving art. Nevertheless, its importance as a tool or process by which the integrity and legitimacy of elections can be objectively and independently assessed is widely acknowledged. It is now seen as an integral part of the electoral process in the majority of democratic countries worldwide.

The past decade has seen the development of standards and norms that provide a more consistent and professional approach by observers, both international and domestic. International organisations continue to review their operations after each electoral event and the lessons learnt form the basis of improved guidelines and practices for future practitioners.

Nevertheless, election observation is also open to legitimate criticism in that the findings of observer missions can be affected by the skills (or lack thereof), biases and preconceptions of individual observers and of the governments and organisations that sponsor them. There will never be enough observers to achieve adequate geographical coverage and there will always be difficulties of communication and language. Differences in culture, tradition and value systems will also give rise to questions about the efficacy and legitimacy of international observation. The case of Zimbabwe has shown that different observers can come to very different conclusions about the same event.

If the integrity of elections, rather than their observation, is the ultimate goal, the question arises whether the resources spent on observation could be better spent on longer-term efforts to enhance the integrity of elections 'from within' by supporting the professional development of election management bodies.

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Endnotes

[1] Data from International IDEA's Voter Turnout project: see www.idea.int/vt/analysis.

[2] For an overview of the development of international observation, see Horatio Boneo, 'Observation of elections' in Richard Rose (ed.), *International Encyclopedia of Elections,* Palgrave Macmillan and Congressional Quarterly Press, Basingstoke and Washington, DC, 2002.

[3] UN General Assembly Resolution 217A (III), 10 December 1948; and UN General Assembly Resolution 2200A (XXI), UN document A/6316, 16 December 1966, entered into force 23 March 1976.

[4] These organisations include International IDEA (Institute for Democracy and Electoral Assistance), Stockholm, from 1995; the Centro de Asistencia y Promoción Electoral (Center for Electoral Promotion and Assistance, CAPEL), a sub-organisation of the Inter-American Institute for Human Rights, Costa Rica, founded in 1983; the IFES (International Foundation for Election Systems), Washington, DC, established in 1987; the Organization for Security and Co-operation in Europe (OSCE) Office for Democratic Institutions and Human Rights (ODIHR), Warsaw, established in 1992 (formerly the Office for Free Elections, established in 1990); the United Nations Electoral Assistance Division, set up in 1994 (formerly the Electoral Assistance Unit); and the Electoral Institute of Southern Africa (EISA), Johannesburg, founded in 1996. Organisations with a much wider mandate have also contributed significantly to the field: the Commonwealth and the Inter-Parliamentary Union (IPU) are two of the most important. Documents include the IPU's *Free and Fair Elections: International Law and Practice,* by Guy Goodwin-Gill, Inter-Parliamentary Union, Johannesburg, 1994; International IDEA's codes of conduct on electoral administration and election observation, available at www.idea.int/publications/pub_electoral_main.htm; EISA's *Handbook for Election Observation Missions* by Gerhard Tötemeyer and Denis Kadima, Johannesburg, 2000; and the Venice Commission's 'Guidelines on elections', Venice Commission, Strasbourg, 5–6 July 2002, available at www.venice.coe.int/site/interface/english.htm.

[5] Declaration on Criteria for Free and Fair Elections, adopted by the Inter-Parliamentary Council, Paris, 1994, available at www.ipu.org/english/strcture/cnldocs/154%2Dfree.htm. The Inter-Parliamentary Council is the Council of the IPU.

[6] The OSCE/ODIHR document 'Guidelines for reviewing a legal framework for elections' (Warsaw, 2001) is one example, codifying what should or should not be in an electoral law.

[7] The Inter-Parliamentary Council's Declaration on Criteria for Free and Fair Elections calls for a 'neutral, impartial or balanced mechanism for the management of elections'. Some older democracies, such as the UK and Sweden, have been 'catching up' within the past two to three years by introducing independent election agencies, recognising that newer democracies, such as South Africa, are paving the way with rigour and innovation in election structures and procedure.

[8] See note 4.

[9] See www.aceproject.org, a comprehensive multilingual website developed by International IDEA, the IFES and the UN Department of Economic and Social Affairs, in co-operation with Elections Canada and the Federal Electoral Institute of Mexico.

[10] The work of Jörgen Elklit and his colleague Palle Svensson can be found in the *Journal of Democracy*, *the International Encyclopedia of Elections* (note 2) and an annex to International IDEA's *Conference Report on the Future of Election Observation,* Copenhagen, 1998.

[11] Provision in the law permitting election observation is an another example where the practice expected from new democracies diverges from that of the established democracies: emerging standards expect this, while many older democracies, while not necessarily explicitly averse, do not have these provisions.

[12] International IDEA, 'Guidelines for determining involvement in electoral observation', Stockholm, 2000, www.idea.int/publications/pub_electoral_main.htm, specifies certain rights for observers which should be guaranteed in advance. The following is a slightly abridged list:

- the general right to pursue observation unhindered;
- the right to receive formal accreditation;
- the right to import necessary equipment and materials;
- the right to determine the scale on which the mission will undertake observation;
- the right to travel and move throughout the country;
- the right to attend political meetings and rallies;
- the right to visit polling stations and counting centres;
- the right to contact persons and organizations with an interest in the conduct of the election, and guarantees that those persons will not be subject to reprisals;
- the right of access to documentation relating to the electoral process;
- the right to information regarding complaints about the elections; and
- the right to make public the findings of the observer mission.

[13] International Standards of elections: document of the Copenhagen meeting of the Conference on the human dimension of the CSCE, Copenhagen, 29 June 1990, available at www.osce.org/odihr/elections/standards/view.php3?document=1. The Conference on Security and Co-operation (CSCE) became the OSCE in January 1995.

[14] The Carter Center in Atlanta, GA, is a US-based NGO set up by former American President Jimmy Carter. See www.cartercenter.org.

[15] This is largely thanks to the work of the National Democratic Institute (NDI), based in Washington, DC.

[16] Above all, the observers, as independent assessors of the integrity of the elections, should be familiar with the basic principles on which democratic elections are based. Ideally, this requires that observers have: 'proven knowledge of electoral procedures and systems; proven ability to exercise sound judgement and the highest level of personal discretion in a politically sensitive environment; eminence in the areas of law, government or specialised aspects of the electoral process such as public education; a knowledge of the language of the host country; a knowledge of the host country and/or the region in which it is located; and appropriate standards of health, fitness and resilience'. International IDEA, 'Guidelines for determining involvement in election observation', p. 25.

[17] Interview reported on BBC News Online, 14 March 2002.

[18] The Zimbabwean presidential election was the seventh election the Parliamentary Forum has observed in Southern Africa since 1999.

[19] Statement by the SADC Parliamentary Forum Election Observation Mission, 13 March 2002.

[20] Preliminary Report of the Commonwealth Observer Group, 14 March 2002.

iv technologies and modalities





12

Infrasound as a tool for CTBT verification

Hein Haak and Läslo Evers

During the 1994–1996 negotiations on the Comprehensive Nuclear Test Ban Treaty (CTBT), it was decided that infrasound was one of four techniques that would be used to verify it. Infrasound is very low-frequency sound that is inaudible to humans. The term 'infrasound' is analogous to 'infrared', the part of the visible light electromagnetic spectrum with lower frequencies than the red part. Infrasound monitoring is directed towards the atmosphere where the sounds of nuclear explosions propagate. The other technologies used are seismology for the verification of nuclear explosions in the earth; hydroacoustics for ocean basins; and the measurement of airborne radionuclides to detect atmospheric fallout.

Three media and four techniques might at first sight seem to be overkill. However, for the atmosphere there is no single earth-based technique that is able to locate and identify nuclear explosions. Satellite technology was considered at the time of the CTBT negotiations, but was judged to be too expensive. The measurement of radionuclides can provide the 'smoking gun' that identifies a nuclear explosion but is not well suited to locating the event. Infrasound complements the radionuclide measurements because it enables analysts to locate the events faster in time and space.

This chapter considers various aspects of infrasound as a tool for CTBT verification. As a young and relatively unknown technique compared with the other technologies, it needs some technical explanation if we are to understand its role and contribution to the verification system. While the infrasound technique could be considered to be the equivalent of seismology for the atmosphere, in fact, the atmosphere has a complicated dynamic structure that is unlike the solid earth. This adds to the complexity of the technique.

The CTBT system is the first worldwide network of infrasound stations that has been built. Even experience with regional infrasound networks is very limited. This is a challenge for scientists and might lead to unexpected contributions by infrasound to the verification system, especially when integrated with the other techniques. It could also lead to new applications of infrasound for civil use.

A brief history of the infrasound technique

The infrasound technique did not simply emerge during negotiations on the CTBT. Efforts had been undertaken since 1920 to measure pressure variations from large explosions, such as those from exploding meteors. Two well-known American seismologists at the California Institute of Technology at Pasadena, Hugo Benioff and Beno Gutenberg, in 1939 developed both instrumentation and applications for the detection of infrasound.[1] The primitive instrumentation consisted of a wooden box with a low-frequency loudspeaker mounted on top. Being seismologists, they connected their instrumentation to earthquake recording equipment. Even today this primitive detector is very effective, having low mechanical and electronic noise and a response which naturally adapts to existing wind noise.

The problem Benioff and Gutenberg needed to solve is still a problem—to study the temperature structure of the atmosphere to heights over 50 kilometres (km).[2] One of their objectives was to study the detonation of 5000 kilograms (kg) of buried ammunition near Berlin, Germany, in 1939. Surprisingly, they found that the explosion was heard in a relatively small area, less than 100 km in diameter. The sound of the explosion was not observed immediately outside this region, which they called the 'zone of silence'. At larger distances, the sounds were noticed again in an asymmetric ring at distances averaging 160 km, as well as in other rings at 400 and 600 km. A zone of silence separated each ring from the next. The asymmetry of the rings was caused by the influence of the wind. Finally, they concluded that sound waves had their highest point of reflection in the stratosphere at a height of 50 km. Today all of this is underpinned with solid theory.

For over 20 years after World War II, infrasound was mainly developed and used to monitor nuclear explosions. During that period the concept of wind noise reducers was developed; it is still used today. One development was initiated by Fred Daniels, who patented a directional microphone. It was recognised that

these directional microphones, scaled up to accommodate longer wavelengths, were very effective in suppressing the pressure variations caused by wind from all directions.[3] Tapered tubes were designed, which could easily reach 100 metres or more, fitted with over 30 capillary inlets, to reduce the noise by a factor larger than 10. At high frequencies, however, they showed the features for which they were originally designed—a high degree of directionality, which is not desired in a system that should have the same response in all directions. These types of problem, especially under high wind conditions, still play an important role in infrasound research. Later, porous hoses were applied which are the same as those used to water the garden. These were very effective but were vulnerable under various environmental conditions—for instance, to pores clogging with moisture or dust—and to small animals. Today complicated tree-like structures are used to make many individual inlets.

The early period of development came slowly to an end when the Limited (Partial) Test Ban Treaty (LTBT or PTBT) was signed in 1963 by the Soviet Union, the United States and the United Kingdom, confining nuclear test explosions to underground. To mark the development, a series of articles on infrasound was published in the *Geophysical Journal of the Royal Astronomical Society* in 1971.[4] This series was taken as a point of departure when in 1995–96 the CTBT was negotiated and when it became gradually clear that infrasound monitoring should become one of the four techniques used by the treaty's verification system. Between 1971 and 1995 much of the existing knowledge had been lost, and only a handful of researchers were working on infrasound. Australia, Sweden, the US, the Netherlands and France were among the countries that had some activity in the field.

In recent years, since the signing of the CTBT, infrasound research has been expanding again. The almost yearly informal infrasound conferences play an important role in keeping the research community up-to-date. Although this is a positive development, the conferences are only attended by a group of around 50–70 scientists who represent almost 90 percent of the world's knowledge in the field.

How does the infrasound technique work?

The infrasound technique in the context of the CTBT is based on a global network of 60 stations. Each station is an infrasound array, which consists of between four

and eight infrasound detectors. The detectors are highly sensitive barometers, also called microbarometers, and have separations between 1 and 3 km. The operating principle of an array is as follows: when a signal crosses the array, small differences in the arrival times of the signal at the individual array elements are used to calculate the velocity and direction of the signal.[5]

The accuracy of the velocity and direction determinations increases with the diameter of the array. On the other hand, the diameter of the array cannot be made larger than 3 km since the shape of the signal must not significantly change from one array element to the other; the signal should be coherent. This coherence limits the size of the array, called the 'aperture'. The shape of the signal slowly changes, while travelling over the array, due to changes in velocity structure of the atmosphere. The coherence of the noise must also be taken into account. Coherent noise will make the array less effective. Fortunately, most of the noise is exceptionally incoherent in infrasound, in contrast to seismology. Although in practice the apertures of infrasound arrays are limited to diameters of 3 km, it is still an open question what the optimum diameter of an infrasound array is under given circumstances. However, in a large number of cases, local circumstances such as the availability of land and existing infrastructure strongly influence the array layout.

The array technology is not the only factor that determines the quality of an array station. The method of reducing wind noise, which is a hindrance at every station, is perhaps most important.[6] For that purpose, every array element is equipped with a noise reducer. This is a structure of pressure inlets designed to average out the atmospheric pressure fluctuations over a considerable area in order to reduce pressure fluctuation due to wind. The signals are not affected by the noise reducer since their wavelength is larger than the diameter of the wind-reducing structure. The noise reducer is in almost all cases located just above the earth's surface, where the wind velocity is lowest. As an extension of these noise-reducing structures one might even think of using natural conditions, such as a wooded area, to reduce the noise. In fact, one of the CTBT system's infrasound stations, in French Guiana, is built in the rainforest and is one of the quietest stations in the network because of the natural noise-reducing qualities of its surroundings.

The products from the 60 arrays in the CTBT network are the waveform of the signals, which is the acoustic fingerprint, the direction of the coherent signals and

their apparent velocity. The apparent velocity is dependent on the angle of incidence of the signal. The angle is usually close to the horizontal plane due to the structure of the atmosphere. The small differences in apparent velocity can help to identify the height at which the wave is reflected back to the earth's surface. The other product is the time of arrival of the signal. In seismology this is one of the main products, but the nature of infrasound arrivals is such that the onset of the signals is hard to identify. Equally hard to identify are the secondary arrivals, which are caused by different atmospheric trajectories of the signals, for example, a higher reflection. More study could lead to improvements in this respect. Usually the low velocity of sound will compensate for this shortcoming in the technique.

With respect to analysis of the waveforms, the situation in infrasound is even more complicated than that in seismology. In seismology a trained analyst can, on the basis of the fingerprint of the waveform, identify a large number of signals. In infrasound this is not yet possible and it is not clear if the influence of the medium is such that it will ever be possible. There are research challenges.

The signals from the CTBT network of infrasound stations will be transmitted continuously to the International Data Centre (IDC) in Vienna for processing. The detection parameters will be extracted from all stations. The result is essentially a list of arrival times and directions of detected signals for each station. In the subsequent process, that of association, the list of arrival times is converted to a list of events that are detected by two or more stations. The location of the event is determined by the point where the directions cross and that is consistent with the arrival times.

The mathematics of detection is highly sophisticated. Signals can be detected with much lower amplitude than the ambient noise. The quality of the arrays will be greatly improved when the number of elements is raised from four, as in the original specifications, to eight. All of this will lead to a large number of infrasound detections and increase the detectability of small events. On the other hand, the large number of detections makes the association of individual arrivals more difficult. The propagation velocity of sound is only 300 metres per second (m/s), unlike in seismology where 2000–5000 m/s is reached, and the long travel time of infrasound has a negative affect on the identification of associated arrivals at different stations. It takes an infrasound wave almost two hours to travel 2000 km

from the source to the station. If in that period a substantial number of events has occurred in the region of interest, different events can be assumed from the association of various combinations of data detected. To sort out this kind of puzzle and separate real from erroneous events is one of the challenges for the IDC.

Pressure

What are the pressure changes relevant to the detection of infrasound events? To answer this question, reference should be made to the ambient pressure at sea level measured in pressure units of one bar or one atmosphere. This pressure originates from the mass of air pressing down and corresponds approximately to a column of water 10 metres high. The unit of pressure accepted in science and technology today is not the atmosphere, but a unit 100,000 times smaller, the pascal (Pa) named in honour of French mathematician and physicist Blaise Pascal (1623–62).

To get a feeling for this unit of one pascal, imagine that the pressure measuring instrument is lifted up slowly from the surface. The absolute pressure that the instrument shows will slowly become smaller, since the column of air pressing down on the instrument is also diminishing. When the instrument has been lifted only 10 centimetres (cm) it corresponds to 1 Pa. Although the atmosphere is approximately 100 km thick, the air gets thinner and thinner as the height increases. Therefore, most of the atmospheric pressure at sea level is due to the first 10 km of air. A signal with a pressure change of 1 Pa already constitutes a large infrasonic signal. More likely is a regular signal that is one-hundredth of 1 Pa. This pressure change corresponds to lifting the measuring instrument by 1 millimetre (mm). The precision of the pressure measurements corresponds to changes in height equivalent to the thickness of a sheet of paper.

The atmosphere: the medium of transport

The medium of transport for infrasonic signals is the atmosphere. The atmosphere is complex in many ways, both in space and in time. Temperature, wind and pressure conditions influence the propagation of infrasound.

The pressure in the atmosphere, as has already been noted, decreases exponentially with height. At 30 km the pressure is reduced by a factor of 100 relative to that at the earth's surface, and at 100 km the pressure is one-millionth—almost a vacuum.

We all are familiar with outdoor audible sound propagation and know that an aeroplane flying overhead at a cruising altitude of 10 km is barely audible. How can it be that large explosions in the atmosphere are detected over a distance of 2000 km, the typical distance between stations in the 60-station worldwide network?

The explanation consists of two elements. First, the energy dissipation of infrasound is very low compared to that of audible frequencies, so the transformation of the elastic energy to heat is not very efficient. Moist air has even lower attenuation than dry air. As a rule of thumb, for the same attenuation, a 10-hertz (Hz) signal can travel 100 times further than a 100-Hz signal, and a 1-Hz signal can travel 10,000 times further. The other factor of importance is the way signals are bent back to the earth's surface by the atmosphere. This is mainly caused by the vertical temperature profile of the atmosphere.

The absorption of solar radiation shapes the temperature profile of the atmosphere. Most of the transfer from radiation to heat takes place at the earth's surface, so the atmosphere is heated from below. Therefore the temperature of the atmosphere decreases with height in the lower atmosphere. This affects the propagation of sound by bending the sound path away from the surface. This explains why it is relatively quiet at the earth's surface where audible sounds are concerned. Occasionally this situation changes. For instance, over cool water surfaces the temperature near the surface can be lower than the temperature higher up in the atmosphere, in which case exceptionally good sound transmission may occur. This is called a temperature inversion.

At higher altitudes—between 20 and 50 km—there is a warmer zone because of the absorption of ultraviolet radiation by oxygen and ozone. In fact this warm zone is the main reflector of infrasound back to the surface. At approximately 100 km the situation changes again, as here the direct ultraviolet radiation of the sun heats the atmosphere to the highest values. This high-temperature region may also reflect infrasound rays. As a result of this complicated temperature structure, signals may travel long distances by being bounced up and down in several 'hops' between the surface and one of the two reflectors.

The effects of wind also have to be taken into account when the propagation of sound through the atmosphere is considered. Especially important is the wind shear. In general the winds increase with altitude. Therefore, in a situation where

the signal travels in the direction of the wind and the wind is stronger at a higher altitude, the signal is bent back to the earth. In contrast, when the signal travels against the wind the signal leaves the surface. We all know that it is harder to hear audible sound upwind than downwind. Winds in the atmosphere are highly variable: the surface wind may be westerly and at a height of 50 km the winds may be easterly, turning to westerly again at 100 km. At high altitudes high wind speeds of over 50 m/s are common.

Infrasound propagation in the atmosphere is a complex matter, but by studying infrasound much may be learned from this medium. This may be one contribution to civil society of the CTBT infrasound network.

Noise is a complication

As with the other CTBT monitoring techniques, infrasound monitoring is not without its complications. Ambient wind and other atmospheric noise are a severe problem for the detection of infrasound. A considerable number of infrasound stations are on small oceanic islands due to the relative large amount of ocean surface compared to land mass. Here, the weather conditions with strong winds are far from ideal for infrasound detection.

The atmosphere is in a constant state of turbulence, in contrast to the solid earth. The turbulence is present at every level and on every length scale, and the noise in the frequency regime is therefore spread over a wide frequency range. As a rule of thumb, the amplitude of the noise will increase by a factor of 10 when the frequency is lowered by the same factor. This type of noise is called 1/f noise and is notoriously difficult to suppress.

Better noise reduction is achieved with more array elements, as is necessary on oceanic island sites. On the most optimistic estimates, the ratio of the signal detected to the apparent noise amplitude will be proportional to the square root of the number of elements. One needs nine times more instruments in order to gain a factor of 3 in detection level under the same noise conditions.

As a verification technique, infrasound detection has to deal with the dynamics of the atmosphere; this is apparent in the estimation of the noise as well as in the propagation of the signal. Air has two distinct properties: it can flow in often irregular patterns, like the movements of smoke from a cigarette or a chimney, or it can behave elastically, as is apparent from a rubber balloon or a soap bubble.

The noise associated with the wind follows from the flow property of air. This noise is apparent over a broad frequency range, over the whole band of interest, from periods of 50 seconds to a fraction of a second. In general the amplitude of the noise will be roughly proportional to the period. Therefore, the noise is lower at high frequencies and high at low frequencies. This is a sign of the complex nature of the noise. The noise is of the order of a few pascals at the highest frequencies of interest for infrasound. Fluctuations on a daily scale are of the order of 10,000 Pa, as we know from the weather service.

To counteract the wind noise, special noise reducers are designed in a variety of shapes and forms. The basic principle is that the fluctuations of the air pressure are summed over a large area, perhaps 100 square metres or more, to average out the incoherent wind-induced pressure changes. These systems are difficult to design in such a way as to produce a satisfactory response at higher frequencies.

The optimum solution to the noise reducer problem is currently being researched. Much more research is needed on the improvement of noise reduction systems, where every small gain in signal-to-noise ratio is a significant contribution to the infrasound network of the verification system.

Signals and false alarms

The infrasound network is set up to detect atmospheric nuclear explosions in the context of the CTBT. These explosions may originate thousands of kilometres away and the signals may be small. The basic problem, as with so many problems in science and technology, is that of detecting signals in a background of ever-present noise. Most of us will interpret the term 'noise' as the continuous sound coming from a radio that is tuned in between two radio stations. This kind of continuous noise is taken care of in infrasound detection with the wind-noise reducers in front of every instrument.

However, in connection with the detection of specific explosions, one may think of another kind of noise—unwanted signals. These may lead to false alarms in the detection process. In the seismology part of the International Monitoring System (IMS) network, these unwanted signals are the natural earthquakes which can hinder the detection of explosions. So what are the unwanted signals in infrasound, how often do they occur and do they also prevent the detection of nuclear explosions?

At the moment we do not exactly know, and this is therefore a subject of research. However, we do know that a larger number of unwanted signals are detected than the treaty negotiators expected, even with the rudimentary network operating today. Moreover, certain classes of these signals may lead to false alarms, such as signals generated by the explosion of meteorites high in the atmosphere. Fortunately, these false alarms may not be of long duration. The other technique that focuses on the atmosphere, the detection of traces of radionuclides attached to small particles in the atmosphere, will give the final answer, generally within a week, as to whether there has been a nuclear explosion or not. It is clearly beneficial to have synergy among various techniques.

All sources of infrasound involve the movement of large masses of air. Infrasound sources can be divided into two groups—impulsive, which create a pulse, and those with a more continuous character. The former consists of a variety of explosions—chemical, nuclear, volcanic and meteors. The continuous signal group includes phenomena such as the infrasound produced by the interaction of air and interfering ocean waves in an atmospheric depression. These waves are called microbaroms and are present in almost all recordings in low-noise sites. Other more continuous sources are helicopters, aeroplanes (both supersonic and subsonic), rocket launches or even aurora, the majestic lights in the north and south polar regions caused by the interaction of energetic particles from the sun and the atmosphere in the presence of a magnetic field. Much experience will be gained in the coming years from analysing this suite of signals.

During the days of atmospheric nuclear testing, many recordings were made of infrasonic waves from nuclear explosions, and these will serve as study material in the years to come. The largest of these explosions, in the megaton range, produced waves of very low frequencies, with periods of minutes. The atmosphere as a whole started slowly to vibrate. The wavelength of these waves can be 50 km or more, of the same order of magnitude as the thickness of the atmosphere as a whole. Similar explosions can have a natural cause, such as the explosion of Mount St Helens in Washington state, US, in May 1980 or the impact of the Tunguska meteorite in Siberia in June 1908. The waves of such explosions travel around the globe several times. There is only a small chance that these large events will be mistaken for nuclear explosions.

On the other hand, smaller events—in the kiloton range—are more difficult to deal with. The number of detections at individual array stations will be smaller, while the events are far more numerous. It is estimated that at least 10 meteor events per year occur in the kiloton range. Most of these will take place over the large ocean basins, leaving no traces but infrasound waves and a flash of light that may be detected by satellite surveillance as a part of national technical means (NTM).

Finally, there is a class of signals of yet unknown origin. Some of these signals are impulsive, while others are more or less continuous and can last many hours.

Contribution of the infrasound network to CTBT verifiability

The question how much the infrasound technique will contribute to the verifiability of the CTBT can be answered briefly: when we demand a 90 percent probability that an event will be detected by at least two infrasound stations, the detection threshold is 0.5 kiloton (kt) for most of the globe; the threshold is 0.1 kt at its lowest, and 0.3 kt in large parts of all the continents except Antarctica. These are the results of model calculations made by the Center for Monitoring Research (CMR) in Arlington, Virginia, US. Because of wind patterns the thresholds can be different for a substantial part of the year; moreover, the numbers are based on model calculations, so the reality may be slightly different once the complete network is in place. At this point it is too early to tell, but the limited current experience shows promising results.

Detection is the easy part. Identification and attribution are generally more difficult. In atmospheric monitoring we have the luxury (which we do not have with the other media—the solid earth and the ocean basins) of two techniques. Infrasound is used to detect and locate the explosion. If we rely on the radionuclide network to identify the explosion, then the question is not whether it is identified as a nuclear explosion but when a positive identification can be made.

Wave propagation in infrasound and the transport of particles in the radionuclide detection are two distinct aspects of the atmosphere, with a large difference in signal propagation speed. For a 1-kt explosion there is a chance of detection of 50 percent within five days by one of the planned stations in the 80-station radionuclide network of the IMS over most of the continents. This will increase to 90 percent within 10 days. Over the southern oceans it is somewhat less. The possibility

of tracking the signal back to its origin accurately is far smaller when longer periods are considered. The detection probability therefore increases with time, whereas the location capability diminishes with time for the radionuclide technique.

In detecting and identifying nuclear explosions, the performance of the combination of the two techniques directed to the atmosphere is probably comparable to the performance of the techniques for the other two media. In a few years experience will tell. The infrasound technique is therefore an essential element of the global verification system, and its detection and localisation capabilities are somewhat better than the detection and identification capabilities of the radionuclide technique in short time frames. This rule applies also to the techniques used for the other media; detection thresholds are usually lower than identification thresholds.

A separate problem is that of the capability to locate an event. In the solid earth component (seismology) of the verification system, the situation is clear. The location precision should correspond to the area that is felt to be realistic for an on-site inspection—1000 km^2. This corresponds to an area with a diameter of 35 km. For both the atmosphere and the ocean basins the situation with respect to location accuracy is less clear. When a nuclear explosion has occurred in one of the large ocean basins the central question is not that of localisation but one of attribution—which nation has detonated the explosion. The ship or aeroplane from which the explosion is triggered has probably disappeared, and the evidence could be destroyed in the explosion. What might be retrieved is some radioactive debris from the explosion that could give some insight into the technical sophistication of the device used in the explosion.

For an atmospheric explosion over land, at least, the exact geographical location may be an important factor. The question that remains is: is there enough reason to launch an on-site inspection to collect whatever evidence still remains, for instance, in border regions of several states, or are the data collected by the radionuclide technique already conclusive?

Suppose that the location accuracy needed is comparable to that of seismology. This means that the accuracy of location of the infrasound network should be of the order of 50 km. The detection of a series of volcanic explosions in July 2001 at Mount Etna in Sicily, Italy, has shown that such accuracies are possible for distances of 1800 km between source and receiver. In order to obtain such

results the direction of the signals was corrected for wind along the entire path through the atmosphere.

The performance of the infrasound network, judging from preliminary results, seems to be in line with the estimates that formed the basis of the network design by the small Infrasound Expert Group. This group reported as early as December 1995 to the Conference on Disarmament's Ad Hoc Committee on a Nuclear Test Ban, which was negotiating the treaty.[7] Although they were right in their estimation of performance of the network, they were wrong in their estimates of its cost and the time needed to build it. The current cost estimates are higher by at least a factor of two, while the original estimate that the infrasound system could be built in three years was out by a factor of three.

Civil and scientific uses of infrasound

The infrasound technology as used in the context of the CTBT is a small niche where outdoor sound propagation, atmospheric sciences and a number of other disciplines come together. Up-to-date instrumentation is now largely preceding the research, although some research was carried out in recent times and prior to 1971. Wide application of the infrasound technology to cover the entire globe will become possible in the near future. As a result the discovery of many new phenomena should be expected. Especially in the field of meteorology and its many applications in our society, progress could be expected.

Two examples where society as a whole can benefit directly from the CTBT infrasound network are the detection of volcanic explosions, which can assist in the rerouting of aviation to avoid volcanic ash in jet engines, and the detection and characterisation of major disastrous chemical explosions, such as those at Enschede in the Netherlands on 13 May 2000 and Toulouse in France on 21 September 2001.

Focusing on the scientific use of infrasound technology, it should be noted that infrasound sources long escaped detection. Many sources, both impulsive and continuous, man-made and natural, are known today—chemical and nuclear explosions, helicopters and aeroplanes, rockets, city hum, meteors, volcanoes, earthquakes, microbaroms, severe storm systems, auroras, sprites, the sounds associated with mountains and even elephants. Infrasound can be used to study the characteristics of these events. After a number of years the archive of the IDC in Vienna

will contain a reliable high-quality worldwide database of infrasound data. This can be of special value when long data sets or data on specific events are needed for a variety of studies of yet unknown phenomena.

Conclusion

In conclusion, the infrasound technique has many unique features and cannot be seen as a simple extrapolation of what are called waveform technologies, such as seismology and hydroacoustics. Our current knowledge of the fundamentals is good enough to enable the infrasound monitoring system envisioned in the treaty to be built. At the same time it is clear that much work still has to be done in order for the technique to reach the same mature status as the other waveform technologies. Examples are the need to identify nuclear explosions and distinguish them from an abundance of other sources, and the need to quantify the dynamic atmosphere with respect to wind and temperature profiles and noise generation. When the network comes to life in the coming two to three years it will offer an unprecedented amount of high-quality data, which will help scientists worldwide in their future research. Since many of the applications of this research are connected to natural disasters and meteorology, civil society as a whole could eventually benefit.

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The Open Skies Treaty

Ernst Britting and Hartwig Spitzer

When the Treaty on Open Skies was signed in March 1992 it was seen as one of the most far-reaching and intrusive confidence-building measures ever agreed.[1] The treaty opens the full territory of its member states, 'from Vancouver to Vladivostok', to co-operative aerial observation overflights. After decades of bloc-to-bloc confrontation and secrecy in military matters it embodied the determination of its states parties to overcome the East–West military stalemate by enhancing transparency and openness.

Ten years later, the treaty faces an unexpected and somewhat uncertain future. After a lengthy ratification period it finally entered into force on 1 January 2002. Russia, which delayed its ratification until 2001, is now a keen supporter of the treaty. On the other hand, the recent détente between Russia and the United States and other developments have made confidence building through observation overflights a much lower priority for the former adversaries than it was 10 years ago. In addition, the availability of high-resolution commercial satellite imagery calls for a re-evaluation of the relative value of Open Skies images.

It is therefore time to address the role and potential of the treaty. Given sufficient political will the treaty's implementation can be adapted to the changed security situation and security needs of its members in its vast application area, which covers the territory of 26 member states of the Organization for Security and Co-operation in Europe (OSCE).[2] The area of application includes Siberia and North America, which are not covered by the 1990 Treaty on Conventional Armed Forces in Europe (the CFE Treaty) or the Vienna documents. The attractiveness of the treaty has been demonstrated by recent applications for admission by seven additional OSCE member states.[3]

The treaty provisions

The fascinating story of the treaty negotiations and their outcome has been told by Peter Jones in three VERTIC *Verification Yearbooks* and by other authors.[4] It is worthwhile recollecting the intentions and purpose of the treaty, as stated in the Preamble: 'employing such a regime to improve openness and transparency, to facilitate the monitoring of compliance with existing or future arms control agreements and to strengthen the capacity for conflict prevention and crisis management in the framework of the Conference on Security and Co-operation in Europe and in other relevant international institutions'. In this context, the states parties also see the possible contribution which an aerial observation regime of this kind could make to security and stability in other areas (outside the OSCE), as well as its extension to other fields such as the protection of the environment.

The core of the treaty is the right to observe any point on the territory of the observed state party, including areas designated as hazardous air space. The legitimate interests of the observed state party are taken into account by ensuring that the maximum ground resolution of the sensors to be used allows for the reliable identification of major weapon systems, although not for detailed analysis.

What is characteristic of the Open Skies Treaty is that it contains numerous and sophisticated provisions for balancing the two fundamental rights and interests of the parties (see the box). In contrast to many other treaties, it offers almost unlimited flexibility in permitting states parties to make different or modified arrangements if they wish.

Beyond that, the treaty incorporates several innovations. It establishes unprecedented openness of territorial access. It also has a strong co-operative element, since flight preparation, execution and follow-up as well as aircraft certification are carried out by bilateral or multilateral teams. It puts all states parties on an equal footing. It thus prevents a monopoly on information and ensures reciprocity of observation, in stark contrast to monitoring by reconnaissance satellites owned and operated by individual states.

Ratification and entry into force

Before entry into force the treaty had 27 signatories. By 1995 most member states had completed their ratification processes and deposited their instruments of

Provisions of the Open Skies Treaty

- Co-operative observation flights are carried out by unarmed fixed-wing aircraft which are equipped with imaging sensors.
- The agreed sensor set comprises:
  - optical panoramic and framing cameras with a ground resolution of 30 cm;
  - video cameras with real-time display and a ground resolution of 30 cm;
  - thermal infrared imaging sensors with a ground resolution of 50 cm at a temperature differential of 3°C; and
  - imaging radar (Synthetic Aperture Radar, SAR) with ground resolution of 300 cm.[A]

Infrared sensors can only be used in a second phase (starting on 1 January 2006). The full sensor set thus ensures an all-weather, day-and-night observation capability.

- Sensors and aircraft have to pass a certification procedure in order to make sure that the agreed resolution is not exceeded.[B]
- A system of flight quotas has been negotiated. For example, in the first year of application the UK can carry out four observation flights per year (active quota) and has to accept three overflights (passive quota), whereas Russia (with Belarus) has an initial active quota of 26 flights and a passive quota of 28 flights.[C]
- At the insistence of Russia, each state to be overflown has the choice of either: receiving the aircraft of the observing state; or providing an aircraft with full sensor equipment of its own for the observing state (the 'taxi option').
- The flight time line allows for a certain element of surprise. The time span between announcement of the planned flight route and the beginning of the flight is typically 24–30 hours.
- Treaty implementation matters are decided by an Open Skies Consultative Commission (OSCC) in Vienna, Austria. Such matters include the reallocation of the active quotas on an annual basis, the admission of new members, the upgrading of existing sensors and the scheduling of extraordinary flights in times of tension. The Commission consists of representatives of all states parties and is empowered to take such decisions between conferences of the states parties.
- Image data are shared between the observing and the observed state. Other states parties can acquire copies of the imagery at nominal cost.

NOTES

A The resolution definition of the treaty as specified in Decision 3 of the OSCC deviates from the standard photogrammetric definition by a factor of 2 (a resolution of 30 cm under Open Skies corresponds to a ground resolved distance of 60 cm).

B At a certification event the aircraft is examined by representatives of all member states in order to check compliance with treaty regulations. In addition, the flight altitude at treaty resolution of the sensors is determined by a series of precisely defined procedures and parameters (treaty Appendix D, Decisions 2, 3, 7, 12–16 to the Treaty; and OSCC Sensor Guidance Document).

C Annex A of the treaty; and Peter Jones, 'Open Skies: events in 1992', in Verification Technology Information Centre (VERTIC), *Verification 1993*, Brassey's, London and New York, 1993, p. 152.

ratification: these were Belgium, Bulgaria, Canada, the Czech Republic, Denmark, France, Germany, Greece, Hungary, Iceland, Italy, Luxembourg, Norway, Poland, Portugal, Romania, Slovakia, Spain, the Netherlands, Turkey, the United Kingdom and the United States. Georgia followed in 1998. Kyrgyzstan has signed the treaty but has not started its ratification process.

Belarus, Russia and Ukraine did not ratify until 2000–2001. This threatened to endanger the whole process, since ratification by these states was mandatory for entry into force. The delay in Russian ratification was the result of several factors. Initially the treaty met resistance and suspicion in the political and the military class, in particular in the Duma, which was at odds with President Boris Yeltsin. It took between eight and nine years before Russia and Ukraine recognised the objectives and advantages of the treaty and no longer perceived it as a tool of reconnaissance and espionage. This example demonstrates that epoch-making changes may take many years to achieve acceptance. In addition, seen from the perspective of the US, ratification of the first (1991) Strategic Arms Reduction Treaty (START I) was a much higher political priority than Open Skies.

A change in the Russian position was signalled by its increased participation in annual trial flights, from 2 in 1995 to some 14–18 annually in the years 1997–2001. Several factors contributed to the final move to ratification by the Duma in early 2001: continuous quiet diplomacy by some states parties, in particular Germany and the US; the election of President Vladimir Putin and his growing influence on the Duma; the participation of Duma representatives in joint trial flights in the US as well as over the Benelux countries (Belgium, the Netherlands and Luxembourg), the UK and Germany; and the faltering performance and decline in numbers of the Russian reconnaissance satellite fleet.[5]

On 2 November 2001, the final steps towards entry into force of the treaty were taken when Russia and Belarus deposited their instruments of ratification with the depositary states, Canada and Hungary. Ukraine had ratified the treaty on 2 March 2000 and deposited its instruments of ratification on 20 April 2000. Thus, according to the treaty provisions, it could enter into force in 60 days, on 1 January 2002. Encouraged by these events, the Open Skies Consultative Commission (OSCC) increased its activity in order to make the necessary preparations for entry into force.

Preparing Open Skies aircraft

Immediately after the treaty's signature and parallel to the ratification process, most states parties started to establish an operational unit in charge of technical preparations, trial implementation and actual observation flights (after entry into force). Several states decided to use existing medium-range observation aircraft (Bulgaria, the Czech Republic, Hungary, Romania, Russia, Ukraine and the UK) or to retrofit existing long-range aircraft for Open Skies use (Germany and the US). The 'Pod Group' (Belgium, Canada, France, Greece, Italy, Luxembourg, the Netherlands, Norway, Portugal and Spain) use Lockheed C-130 Hercules transport aircraft, which can carry a sensor container (the 'pod') under one of their wings. Turkey is planning to acquire one or two CASA Airtech CN 235 aircraft for Open Skies purposes. Table 1 shows a list of existing and planned Open Skies aircraft and their initial sensors.

The aircraft are adequate choices in terms of range and seating capacity. In particular, the Boeing, Lockheed and Tupolev types have ample space for escorts and observers but relatively high operational costs. The German aircraft was lost in an accident in 1997 and was not replaced. The Benelux states operate jointly and act as a single state party (as provided for in Article XIV of the treaty). Several states parties decided not to equip an Open Skies aircraft of their own, notably Denmark, Georgia, Iceland, Poland and Slovakia. Each of these countries can participate in Open Skies missions by leasing an aircraft from another state party or by making arrangements with the state party to be overflown.

Russia originally intended to insist on the taxi option. Overflights over Russia would have to be carried out with Russian observation aircraft operated by Russia for the observing states parties. However, this position is softening. As it stated on 22 July 2002 in the OSCC, Russia will not in principle provide its own observation aircraft for flights from the Open Skies airfields related to the point of entry of Ulan-Ude (near Lake Baikal in Siberia). States parties will be able to conduct such observation flights either with their own aircraft or that of a third party.

Trial implementation

In 1992 the states parties began their first trial observation flights within the framework of the preliminary application of the treaty. By the end of 2000, more than 400 trial observation flights had taken place. All states parties conducted them in

Table 1 Open Skies aircraft

State	Type	Range[A]		Sensor operation altitude		Ground swath		Seats[B]
		1000 m	6000 m	Panorama camera	Vertical camera	Vertical camera	Panorama camera	
Bulgaria	1 Antonov 30	1500 km	2650 km	2724 m 3149 m	1174 m	4.1 km 4.7 km	6.5 km	24
Czech Rep.	1 Antonov 30	1500 km	2650 km	1803 m 2047 m	–	4.6 km 5.2 km	–	24
Hungary	1 Antonov 26	1500 km	2650 km	1972 m 2993 m	–	3.0 km 4.5 km	–	30
Pod Group	Hercules C 130	2500 km	5000 km	1354 m 1965 m	3999 m 5290 m	2.0 km 3.0 km	22.0 km 29.1 km	20
Romania	1 Antonov 30	1500 km	2650 km	1972 m 2993 m	–	3.0 km 4.5 km	–	24
Russia	3 Antonov 30	1500 km	2650 km	1210 m 3103 m	–	2.8 km 5.6 km	–	24
	3 Tu 154[C]	2500 km	5000 km	tbd[D]	tbd	tbd	tbd	30[E]
Turkey	2 CN 235[C]	2000 km	4000 km	tbd	tbd	tbd	tbd	25[E]
Ukraine	1 Antonov 30	1500 km	2650 km	1073 m 2308 m	–	2.5 km 2.1 km	–	24
UK	1 Andover MK1	1300 km	–	–	750 m	–	10.7 km	16
US	2 OC 135	3000 km	6000 km	1440 m 2172 m	4834 m 10841 m	2.2 km 3.3 km	10.2 km 22.8 km	39
Sweden	1 Saab 340	1500 km	2500 km	tbd	–	–	–	25

NOTES A Range at different flight altitudes; B Including crew; C Planned; D To be determined; E Approximation. The data on Bulgaria, Hungary, the Pod Group, Russia, Ukraine, UK and US correspond to their certification in 2002. Some of the parties have more than two sensor configurations and related operation altitudes. The table gives the minimum and maximum altitude. The values are subject to change. Pod Group Panorama Camera with reduction filter 786 m (ground swath 4.3 km). The data for Romania are expected to be the same as for Hungary (the camera and film are the same). SOURCE German Verification Center, Geilenkirchen.

reasonably close accordance with the treaty with respect to both its objectives and its complicated rules and regulations. In addition, two multinational trial certifications were conducted at Fürstenfeldbruck airbase in Bavaria, Germany, in 2000 and 2001. These events provided a good opportunity to clarify all important organisational and technical issues and to agree on common standards for the certification of aircraft. Some of the test flights involved non-member states, in particular Estonia, Finland, Latvia, Lithuania, Slovenia and Sweden. These states obtained practical experience with a view to future accession to the treaty.

In summary, the trial implementation and trial certifications of the treaty can be considered a success. The activities:

- involved virtually all states parties (except Iceland);
- proved the functionality of the equipment and the treaty provisions;
- demonstrated that the treaty's objectives could be met through co-operative observation flights; and
- showed that even small states with modest resources can play a distinctive role (as an example, Bulgaria now has, due to prudent investment, some of the most advanced camera equipment of all Open Skies states).[6]

The trial implementation also underlined one special characteristic of Open Skies inspections compared to the inspection regimes of other arms control and disarmament agreements. The inspections are mainly shaped by the professional spirit of aviators, especially since most Open Skies experts are recruited from air forces or naval aviation. Only a joint team of the observed and observing state can act successfully on board an Open Skies aircraft. Therefore, it is crucial that the verification teams make joint flight preparations and co-operate closely. Once the mission plan has been agreed, it is important for everyone aboard to obtain optimum results from the use of sensors. The very practice of inspection thus has a strong co-operative and confidence-building element and trains military personnel in a culture of international co-operation.

Certification

One main goal of the OSCC in 2001 and early 2002 was to enable states parties to begin observation flights quickly and comprehensively after entry into force. To

do this, the OSCC began by clarifying the intention of states parties with respect to the certification of their observation aircraft in 2002, the desirable time and place of such certification, and their willingness to conduct joint certification. To this end, the German delegation declared its government's readiness to conduct a joint certification on its territory.

The first results were apparent within one month, when the OSCC, at its plenary meeting of 17 December 2001, adopted a decision regarding the provisions for the initial certification period and a Chairperson's Statement on issues related to the certification of observation aircraft and sensors. The initial certification period was designated to last from 1 January to 31 July 2002. During this period, observation flights were to be conducted on an agreed bilateral basis only, and in accordance with the treaty's provisions. The utilisation of states parties' active quotas for the first year of application (Annex A of the treaty) will take place during the period 1 August 2002–31 December 2003. The decision also established the initial certification schedule.

Subsequently a group of states parties comprising Belarus, Hungary, Russia and Ukraine proceeded with joint certification at Nordholz Naval Air Station (NAS) in northern Germany from 15 to 29 April 2002. The American aircraft was certified from 8 to 15 May 2002 at the Wright-Patterson Air Force Base (AFB) in the US. The pod users' unique certification event took place from 19 to 26 June 2002 at Orléans Brecy AFB in France. According to an agreement in the OSCC, the certification results for one C-130H Hercules aircraft and its pod system will be valid for all states parties of the Pod Group. In order to facilitate this, the pod users were obliged to take additional steps while both collecting their data prior to certification and providing information on their aircraft. The United Kingdom and Bulgaria conducted a joint certification event from 8 to 16 July 2002 at RAF Brize Norton in the UK .[7]

By August 2002 all these certifications had been concluded successfully. Thus, Bulgaria, Hungary, Russia (with Belarus), Ukraine, the UK, the US and the Pod Group have certified aircraft and sensors ready for resuming observation flights under treaty rules. Table 1 shows the certified sensor operation altitudes at treaty resolution. Certification of the Czech, Romanian and a newly equipped Swedish observation aircraft is expected in 2003.

The information potential of Open Skies imagery

Open Skies images may be used for monitoring all kinds of military installations and activities, but also for assessing transport infrastructure and industries. Crisis monitoring applications will include the detection of illegal traffic in border zones, refugee camps, terrorist training camps, freshly laid minefields and post-conflict damage assessment.

Photographic black-and-white images at treaty-approved resolution will allow for the detection and general identification of land vehicles, rockets and artillery, as well as detection and precise identification of troop units, aircraft, airfield facilities, missile sites, surface ships and infrastructure such as roads and headquarters. In addition, test missions have demonstrated an excellent capacity for monitoring the effects of environmental disasters such as floods and hurricanes.

In the context of Open Skies, thermal infrared (IR) imaging (not to be used until 2006) will be particularly useful for monitoring military manoeuvres and production plants at day and night. Thermal IR image detectors are sensitive to the thermal radiation which each body emits. The operational status of vehicles and equipment can be deduced from their heat profile. The fuel status of aircraft and storage tanks can be determined, as well as thermal differences in effluent and cooling ponds.

Synthetic Aperture Radar (SAR) images can be taken through cloud cover and in darkness. The 3-metre (m) resolution under Open Skies, however, is quite crude: it will permit only the detection and general identification of large structures such as buildings, airports and ships.

Open Skies flights can be scheduled at short notice with a flexible choice of flight routes. However, they do not provide continuous coverage. They rather give spot checks which can be exploited best in combination with other sources of information. Open Skies missions will be extremely useful for the preparation of ground inspections or ground missions by providing 'indicators of suspicious activity' and imagery which can be used as a map in foreign terrain.

Open Skies images have already been successfully used to support the verification of several arms control agreements or arrangements. Once the full sensor set is operative, its potential for such a contribution will be significantly enhanced. Three treaties are illustrative:

- **The 1990 Conventional Armed Forces in Europe (CFE) Treaty.** During the negotiations on this treaty it was anticipated that this would be accompanied by an aerial verification regime, but negotiations were not concluded in time. The Open Skies Treaty will assume the role of monitoring Siberia and North America, which are not accessible to CFE inspections. For example, in 1995 a German–Russian trial flight over Siberia monitored huge amounts of weapon systems which had been brought over the Ural Mountains from the European part of Russia shortly before the conclusion of the CFE Treaty. Open Skies flights have a much wider area coverage than on-site inspections under the CFE Treaty. A single Open Skies flight can cover more sites than the total annual passive CFE inspection quota of Germany (39, including those for stationed forces) or even Russia (50). Flights and inspections are complementary. Flights can be used for monitoring facilities and equipment parked in the open, whereas CFE inspections can focus on weapon systems under cover.
- **The 1993 Chemical Weapons Convention (CWC).** This treaty does not foresee aerial inspections. However, images of chemical weapon sites from Open Skies trial flights have been very informative. Delegates at the Organisation for the Prohibition of Chemical Weapons (OPCW) in The Hague, Netherlands, have used the information successfully in bilateral exchanges. The general disclosure of such imagery to all CWC states parties will require the consent of the observed state. This should be supported by diplomatic efforts. The value of Open Skies imagery will be much enhanced once thermal IR sensors allow the monitoring of the operational status of suspect chemical weapon plants.
- **The Global Exchange of Military Information.** An additional data exchange agreed by the CSCE in Budapest on 28 November 1994,[8] it covers all kinds of weapon systems, including naval vessels and aircraft of all OSCE members, regardless of their deployment site, worldwide. The exchange is not being verified by on-site-inspections. Open Skies flights can be used to verify notifications of forces.

Open Skies in comparison to commercial satellite monitoring

How does Open Skies imagery fare in comparison with commercial satellite images, which are now available to every member state irrespective of their access to information derived from American, Russian or French military reconnaissance satellites?

First, the resolution of the photographic cameras used in Open Skies is unmatched by any existing or proposed commercial imaging satellite. Space Imaging Inc. in the US is licensed to launch a 50-centimetre (cm) resolution sensor, but this is still above the 30-cm resolution under Open Skies. Moreover, Open Skies images are routinely taken in stereo, which provides much enhanced power for object identification through height determination. Second, it would be extremely difficult to match from space the 50-cm resolution of Open Skies thermal IR images. It would require mirrors of 5 m in diameter or more. No commercial satellite provides thermal images even at 10-m resolution, nor does any military satellite provide thermal images at a resolution comparable to those of Open Skies.

In contrast, the 3-m radar image resolution under Open Skies will soon be overtaken by a commercial radar satellite of 1-m ground resolution developed by the German Aerospace Establishment (Deutsches Luft- und Raumfahrtzentrum, DLR), which is due for deployment in 2005.

The Open Skies community has the technical potential and opportunity to provide first-class imagery of crisis areas either for its own benefit or at the request of an international organisation such as the OSCE or the UN, which do not have routine access to the highly classified images of American, French or Russian reconnaissance satellites. The treaty's sensor suite of high-resolution stereo imaging and thermal imaging day and night, and the ability to fly under dense cloud cover, make Open Skies information-gathering technically superior to the satellite data accessible to most treaty members.

Perspectives and outlook

Entry into force has meant that the opportunity is now open for other states to accede to the treaty. In general, the regime is open to any state which in the opinion of the existing states parties is able and ready to make its contribution to the objectives of the treaty.

In January 2002 Finland and Sweden applied for accession. Both had been actively involved in the trial implementation. In their applications Finland and Sweden also asked for passive quotas to be allocated of five and seven observation flights, respectively. The OSCC accepted the applications on 4 February. On 28 June 2002, Sweden deposited its instrument of ratification, meaning that it became a state

party 60 days thereafter, on 27 August 2002. The ratification of Finland was still in progress at the time of writing.

By 20 July five additional states had applied for accession: Bosnia and Herzegovina, Croatia, Cyprus, Latvia and Lithuania. All were accepted by the OSCC on 22 July, except for Cyprus, because of a veto by Turkey. The handling of the veto is a challenge for OSCE diplomacy. Turkey had already strongly opposed Cyprus becoming a state party in 1991–1992 and was even more opposed to Cyprus having a quota (it was at Turkish insistence that there is a rule that countries with a territory of less than 10,000 square kilometres (km) have no active quota).[9]

These applications have particular political relevance to and underline the future potential of the treaty in areas of tension. Many new states parties have unresolved issues with one or more neighbours. The relationship between the Baltic states and Russia could, for instance, be eased by Open Skies flights—especially after the former were invited to join the North Atlantic Treaty Organization (NATO) in 2002. Croatia wishes to integrate itself into the network of European institutions. It was involved in two wars between 1991 and 1995, and is a main player in the future peaceful development of the Balkans. Bosnia and Herzegovina is still struggling with the wounds of war and ethnic conflict. It hosted six multilateral aerial observation demonstration flights between 1997 and 2000. It is thus fully aware of the potential of Open Skies. The applications of Bosnia and Herzegovina and Croatia to join are also a reaction to the failure to establish a separate aerial monitoring regime under Article V of Annex 1b to the 1995 Dayton Accord.[10]

The future of the Open Skies Treaty

The future of the Open Skies Treaty will depend on the states parties' security policies. However, this is true for all arms control treaties and agreements. It is an open question how much importance will be attached to the future security balance within the OSCE area. The existing confidence-building instruments may not continue to be appreciated and developed as an insurance policy for more turbulent times. There are also questions as to whether Open Skies practice can help address current threats such as the proliferation of weapons of mass destruction, internal conflicts and terrorism. These issues will have to be addressed and clarified at the first review conference for the treaty in 2005.

The trial observation missions conducted in the current area of application to date have already shown the potential for confidence building and enhancement of transparency. Moreover, four areas can be identified in the OSCE region which will continue to require special political attention—the Balkans, the Caucasus, Central Asia and to some degree the Baltic states, especially following their accession to NATO and the European Union (EU).[11]

There has been little discussion in the open literature on the future adaptation of the Open Skies Treaty. James Marquardt has rightly pointed out that its original intention, of contributing to détente between the former NATO and Warsaw Pact adversaries, has been largely accomplished by other means since 1992.[12] Klaus Arnhold has suggested the negotiation of a memorandum of understanding which would focus future implementation on crisis prevention and post-crisis management, the prevention of the proliferation of weapons of mass destruction and the fight against international terrorism.[13] Arnhold also proposes the establishment of an international pool of Open Skies aircraft which could be used by all member states. The EU could and should play an active role by providing one or several such aircraft.

The present authors by and large support these proposals. In addition they emphasise the following objectives for optimally exploiting the treaty's potential:

- the admission of as many OSCE member states as possible, in particular through diplomatic efforts to persuade the Central Asian republics to join;
- efforts to give Open Skies monitoring a more explicit role in support of the 1968 Nuclear Nonproliferation Treaty (NPT) and the CWC;
- the use of Open Skies flights to monitor illegal trafficking in weapons, drugs and people across borders; and
- appreciation of the Open Skies Treaty as an insurance policy for more turbulent times. It is essential to be prepared for the unexpected. In this respect it might even be beneficial to anticipate, as proposed by Arnhold, reciprocal overflights by NATO states.

Outside the OSCE region, equipment and procedures developed for the Open Skies Treaty could be applied to many regions in crisis, for example, under a UN mandate. The treaty could also be a model for separate Open Skies agreements in other

regions. For example, two former air marshals from India and Pakistan have drafted a detailed aerial monitoring concept for the India–Pakistan border area, which incorporates many elements of the multilateral Open Skies Treaty (as well as initial technical assistance from its member states).[14]

For the time being, the US opposes the admission of non-OSCE member states to the existing Open Skies Treaty. On the other hand, between 1997 and 2000 it was active in advocating the Open Skies idea for other regions, for instance, by displaying its Open Skies aircraft in Japan and Latin America.

Apart from these political questions, a number of technical and procedural questions will soon arise for the Open Skies states parties.

- **Quota distribution.** The meetings of the OSCC in Vienna in 2003 promise to be intense as the quotas for 2004 are negotiated, including those for new members like Finland and Sweden.
- **Joint aircraft.** Most of the existing Open Skies aircraft are more than 20 years old and will have to be replaced in the next decade. In addition major sensor upgrades are due in 2006 when the full sensor set becomes mandatory (especially if states choose to apply the taxi option). This offers the opportunity to consider joint aircraft equipped and operated by several states or by a larger group of states such as the EU.
- **Additional types of sensor.** Technological developments and potential applications in environmental monitoring dictate that at least three types of additional sensors and film be considered: IR-sensitive film (false colour IR film) which is essential for the monitoring and evaluation of vegetation; digital cameras which are becoming the state of the art in civilian aerial photography; and SAR at 1 m resolution (or better) in order to compete with commercial radar satellites.
- **Environmental disasters.** Most states parties have adequate means for regular environmental monitoring. It would be useful, however, to allow short-notice Open Skies flights in the event of cross-border environmental disasters. Germany and the US have demonstrated that such flights can be arranged easily without much additional cost using the mandatory quota of national training flights.

In summary, it is now particularly crucial for the Open Skies states parties to move the spirit and the implementation of the treaty into the new century. Otherwise

it will become a relic of the last. If this risk is seen as likely, states parties should have the courage now to discuss the issue openly. The first review conference in 2005 will provide a good opportunity for such a fundamental stocktaking. The necessary preparations should start in the OSCC in good time, preferably in 2003, and be conducted expeditiously.

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Endnotes

[1] Peter Jones, 'Open Skies: events in 1992', in Verification Technology Information Centre (VERTIC), *Verification 1993,* Brassey's, London and New York, 1993, pp. 146–161.

[2] The treaty was originally signed by members of NATO and the former Warsaw Treaty Organization. It has been ratified by Belarus, Belgium, Bulgaria, Canada, Czech Republic, Denmark, France, Georgia, Germany, Greece, Hungary, Iceland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovakia, Spain, Turkey, the UK, Ukraine and the US. Kyrgyzstan has signed but not ratified.

[3] Bosnia and Herzegovina, Croatia, Cyprus, Finland, Latvia, Lithuania and Sweden. See below in this chapter.

[4] Peter Jones, 'Open Skies: a review of events at Ottawa and Budapest', in VERTIC, *Verification Report 1991,* The Apex Press, New York, 1991, pp. 73–82; Peter L. Jones and Marton Krasznai, 'Open Skies: achievements and prospects', in VERTIC, *Verification Report 1992*, London, 1992, pp. 47–56; Peter Jones, 'Open Skies: events in 1992', in VERTIC, *Verification 1993*, Brassey's, London and New York, 1993, pp. 146–161; Sergey Koulik and Richard Kokoski, SIPRI, *Conventional Arms Control*, Oxford University Press, Oxford, 1994, pp. 156–90 and appendix C (full text of the treaty); and Rüdiger Hartmann and Wolfgang Heydrich, *Der Vertrag über den offenen Himmel* [The Open Skies Treaty], Nomos, Baden-Baden, 2000. This last book was written by two of the negotiators at Vienna. It comprises the text of the treaty, background comments and the decisions of the OSCC (in German), as well as the Sensor Guidance Document of the OSCC (in English).

[5] See, e.g., Sergei Ladygin, 'Russia and Open Skies', *Military Parade November, 2001: Armed Forces, MIC and Politics* (Internet magazine), www.milparade.com.

[6] The cameras are also frequently used for civil cartographic and monitoring missions.

[7] The fact that several separate certifications were held was to some extent an expression of national priorities. It also eased the workload and complexity of particular events.

[8] Conference on Security and Co-operation in Europe, Forum for Security Co-operation, 'Global exchange of military information', Budapest, Nov. 1994. The Conference on Security and Co-operation in Europe (CSCE) became the OSCE on 1 January 1995.

[9] Pal Dunay, Geneva Center for Security Policy, Geneva, Switzerland, private communication.

[10] See Dieter Rothbacher, 'Verification of the Dayton arms control agreements', in Trevor Findlay and Oliver Meier (eds), *Verification Yearbook 2001,* The Verification Research, Training and Information Centre (VERTIC), London, December 2001, pp. 182–183.

[11] In particular, Open Skies flights, because of their symbolic and co-operative nature, can contribute to confidence building between or even within the successor states of the former Yugoslavia. Open Skies flights could usefully complement ground monitoring of the OSCE in the Caucasus, for example, in Georgia (Ossetia and Abkhazia), Azerbaijan or Armenia (if an international peacekeeping operation is ever deployed as part of a solution to the Nagorny-Karabakh conflict). In Central Asia, Open Skies flights could also become a highly effective tool for early warning and confidence building along the borders between the Central Asian states and between them and Afghanistan.

[12] James Marquardt, 'Open Skies: not a moment too soon', *Bulletin of the Atomic Scientists,* January/February 2002, pp. 18–20; and July/August 2002, pp. 5 and 68.

[13] Klaus Arnhold, *Der Vertrag über den Offenen Himmel* [The Open Skies Treaty], SWP-Studie S-21, Stiftung für Wissenschaft und Politik, Berlin, June 2002 (in German).

[14] Mohammed Arshad Chandry and K.C. Cariappa, 'How cooperative aerial monitoring can contribute to reducing tensions between India and Pakistan', Sandia National Laboratories Report SAND 98-0505/22, December 2000, www.cmc.sandia/gov/Links/about-mainframe.htm.

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Verification and advanced co-operative security

Nancy Gallagher

The security circumstances confronting the world today are fundamentally different from those which shaped the theory and practice of Cold War arms control. Then, the central problem was to deter a massive nuclear or conventional attack while using arms control to stabilise deterrence and prevent proliferation. Now, the United States and its allies have little reason to fear a deliberate large-scale attack. Instead, the most troublesome security problems involve smaller-scale, more diffuse dangers driven by key trends associated with globalisation.[1] Various developments, including the information revolution, the emergence of global markets and transnational networks, widespread access to dual-use materials and sophisticated technologies, and growing economic inequalities, have magnified the threats posed by angry individuals, disaffected groups and weak states. They have also multiplied the destruction that could occur from natural causes, accident, inadvertence or other unintended consequences of 'business as usual' in a tightly connected high-technology world.

The Advanced Methods of Cooperative Security Program at the University of Maryland is exploring conceptual issues and operational techniques for co-operative responses to new global security problems.[2] The goal is to promote interdisciplinary research and discussion about applications that exemplify emerging security problems and embody elements of potential solutions. The current focus is on research with dangerous pathogens, space activities and fissile material controls. This chapter presents the basic concept of advanced co-operative security and explores the role for verification in advanced co-operative security systems. It also provides a brief illustration of advanced co-operative security in practice, using the example of biotechnology.

These concepts are at an early stage of development and far removed from current practice. This essay seeks to spark further research and discussion in order to broaden the array of options available for serious consideration.

The challenges of global security

The central problem for global security today is not balancing competing alliance systems but building inclusive arrangements which let co-operative states and non-state actors pursue diverse interests without causing major unintended problems and which organise the vast majority of willing co-operators to deal more effectively with a relatively small number of hostile players. This involves a reduced emphasis on deterrence and contingency response, and an increased emphasis on reassurance and systematic prevention. In the nuclear arena, for example, numbers now matter less than operational practices. Any country's residual need for deterrence can be satisfied with a much smaller stockpile of weapons. The most worrying scenarios all involve some type of irresponsible behaviour, such as lax security at storage sites, or loose talk about 'usable' nuclear weapons that promotes proliferation and weakens the nuclear taboo. Reducing such nuclear dangers requires agreement on operational practices that minimise the potential for misperception, mistakes, uncontrollable escalation or opportunistic action by hostile third parties.

The incentives for a reorientation of security policy from deterrence and secrecy towards reassurance and transparency were evident by the mid-1980s, when the 35 members of the Conference on Security and Co-operation in Europe (CSCE) sought to reduce risk of conventional war by changing European security concepts and operational practices. The 1986 Stockholm Accord provided for modest information exchanges, on-site inspections and constraints on major military activities. The 1990 Conventional Armed Forces in Europe (CFE) Treaty and the associated agreement on personnel (the 1992 CFE-1A Agreement), as well as the series of Vienna Documents (1990, 1992, 1994 and 1999) that followed the Stockholm Accord and the 1992 Open Skies Treaty, have included tighter behavioural constraints, detailed data-reporting requirements, extensive verification mechanisms and institutional arrangements which are integral to a more co-operative European security system.[3]

Initial attempts to elaborate the concept of co-operative security reflected this dramatic shift in East–West security relations. The original approach focused on

setting agreed standards for the size, concentration, configuration and operations of national militaries. The goal was to permit defence of the homeland but preclude large-scale external attacks, and to facilitate effective and legitimate multilateral military responses to external aggression or civil conflict. Compliance was to be verified through extensive transparency around weapons and operations, including increased sharing of national intelligence and international technical monitoring. Some inspection of key defence programmes was also considered necessary. Proponents argued that co-operative security systems should be inclusive and equitable, and should rely when possible on positive inducements and other forms of co-operative compliance management. They recognised, however, that a comprehensive co-operative security system would need tougher enforcement mechanisms, including economic sanctions and multilateral military responses.[4]

The example that comes closest to co-operative security from outside the European conventional force context is probably the nuclear threat reduction programmes in the former Soviet Union. In the mid-1990s, changed security circumstances and altered threat perceptions convinced the American and Russian leaders that they had a mutual interest in ensuring the safe and secure handling of nuclear weapons and material from the former Soviet arsenal. A variety of American-funded projects have helped Russia eliminate nuclear launchers under the Strategic Arms Reduction Treaty (START I); removed nuclear weapons from other former Soviet states; and reduced the likelihood that nuclear weapons, material or know-how would proliferate to hostile states or terrorist groups.

These programmes have improved Russian security standards and practices. New monitoring technologies are being developed to demonstrate that co-operative obligations have been met, without revealing other sensitive information. By developing industrial partnerships with Russian entities, American government agencies and firms have learned about Russian nuclear operations and gained experience working on nuclear problems with their Russian counterparts. However, despite these practical benefits, deeper co-operation has been impeded by suspicions and resistance on both sides. American access to sensitive Russian sites is restricted; Russia does not gain reciprocal access and auditing rights that come as a condition of American funding; and individual co-operative projects have not been embedded in a larger strategic framework of mutual accommodation and restraint. In short,

ad hoc threat reduction co-operation may be a step in the right direction, but it falls far short of comprehensive co-operative security.[5]

Meanwhile global trends are generating new types of security problem that cannot be addressed effectively through unilateral action, traditional arms control or ad hoc co-operation. For example, biotechnology has the potential to cure life-threatening illnesses or to create more virulent pathogens which could cause devastation that would rival the results of nuclear attack and against which defence would be equally difficult. Research involving especially dangerous pathogens, such as smallpox and Ebola, cannot be banned without foreclosing opportunities for protection and forgoing other public health benefits. Export controls, access controls and the classification of weapons-related information cannot provide reliable protection because everything needed to make deadly diseases is available in nature, in worldwide scientific laboratories and pharmaceutical firms, from mail-order companies, or on the Internet. Since large amounts of bio-agents could be grown quickly from a small sample of a virulent organism, quantitative limits are not an effective way to differentiate between legitimate and illegitimate activities. In short, the national security and arms control tools that have helped to prevent nuclear proliferation are not well suited for preventing the misuse of biology without impeding beneficial research.

Addressing such security challenges requires the development of more advanced co-operative security concepts and practices. They would have much in common with their predecessors, including the basic premise that most states and non-state actors do not want to threaten others' security and would benefit from shared standards of behaviour and mechanisms of reassurance; but the concept of advanced co-operative security differs from its predecessors in ways that reflect key trends in global security. Potential threats no longer arise primarily from dangerous configurations of military capabilities, but increasingly from the misapplication of dual-use technologies that are dispersed throughout society. Thus, advanced co-operative security arrangements cannot be mainly between national military establishments but must include scientists, commercial interests and non-governmental organisations.

If massive aggression is now less likely than asymmetrical attacks or dispersed interactions that coalesce into catastrophe, then the dividing line between legitimate

and illegitimate activities can no longer turn on quantitative thresholds or qualitative distinctions, such as rules about how large a purely defensive military can be and what types of weaponry it should or should not have. Instead, striking the right balance between promoting the beneficial uses of potentially dangerous technology while preventing misapplications will require expert judgements based on detailed information about who is doing what, why and how. This means that compliance cannot be verified primarily through exchanges of national intelligence, remote sensing, passive on-site monitoring or adversarial inspections. It will require unprecedented sharing of sensitive information, sophisticated systems for handling large volumes of data, and extensive protection against the misuse of information that was disclosed for protective purposes.

The role for verification in advanced co-operative security

Verification—one of the most controversial and time-consuming aspects of Cold War arms control—has been attacked from both the political left and the political right as largely unnecessary and often counterproductive in the new, more co-operative security environment. The administration of President George W. Bush in the US appropriated a stance that had long been popular with the disarmament movement by declaring that a strategic arms agreement could be reached quickly, without lengthy negotiation of detailed verification provisions, because verification would only institutionalise mistrust. As for agreements that include not only rivals-turned-friends but also countries of concern, some people are using the changed nature of the threat as evidence that verification could diminish national security and prosperity. For example, the Bush administration withdrew US support for the negotiation of a verification protocol to the 1972 Biological and Toxin Weapons Convention (BWC) on the grounds that the types of multilateral transparency measure that were under consideration could not reliably detect clandestine work with small amounts of deadly pathogens, yet would reveal information about US national security and commercial activities that could aid potential attackers or business competitors.

These attempts to dismiss verification as an outmoded relic of the Cold War are based on a narrow, often politically motivated, conception of verification as an adversarial process that should provide nearly complete confidence that every militarily significant violation by a devious enemy will be detected, identified and

attributed in time for a response before national security is harmed.[6] This conception neither reflects the full range of past verification approaches and accomplishments nor illuminates the role that verification should play in advanced co-operative security systems.

Verification, broadly defined, refers to any process that is used to assess compliance with co-operative obligations. It can be implicit and purely unilateral, as was the case with the 1963 Limited Test Ban Treaty (also known as the Partial Test Ban Treaty, the PTBT) which does not mention verification because the superpowers' own monitoring systems would provide evidence of a nuclear test in a prohibited environment. It can be part of an adversarial 'game' with monitoring rules and inspection rights in which opponents try to uncover information about the other side's treaty compliance and 'collateral issues' while protecting their own sensitive information, as was largely the case with superpower nuclear arms control. It can also take more co-operative forms, as with the European conventional security agreements mentioned above or the safeguard agreements used to confirm that non-nuclear weapon state parties to the 1968 Nuclear Non-Proliferation Treaty (NPT) are not diverting nuclear energy from peaceful uses into weapon programmes. The reasons for pursuing verification can also be diverse. States can press for intrusive and exacting verification arrangements in order to gain high confidence in compliance or to stymie negotiations. Likewise, they can favour only modest measures, such as voluntary data exchanges, because they care more about reaching an agreement than they do about compliance; because they want to protect their own secrets more than they care to know what others are doing; or because they have no real interest in agreements that constrain their own military options.

The trends shaping global security have reduced the importance of some of the factors that made verification important and controversial during the Cold War. At the same time, they have intensified other factors that make the exchange and analysis of compliance information likely to be even more essential and contentious than it was before, regardless of whether the process is called verification or something else. Despite recurrent American attempts to depict verification as a technical adjunct to the substantive limits placed on the superpowers' military capabilities, both sides in the Cold War recognised that information revealed, obtained or concealed during the verification process had intrinsic national security value.

Cold War concerns about verification could be somewhat muted, however, because the co-operative constraints left each side with such large residual capabilities that low-level cheating or collateral information collection was unlikely to have a significant effect on the bilateral strategic balance.

Addressing the most pressing global security problems will require more comprehensive and reliable obligations and verification arrangements among a diverse group of states and non-state actors. The stakes will be as high as they were during the Cold War, but it will be harder to tolerate sloppiness in any part of a security system. No amount of residual military capability can compensate for problems such as major intelligence failures, lax safety practices in work with dangerous pathogens, imprecise accounting standards that lose track of fissile material, or enforcement systems that can only handle egregious violations.

Given the ease with which dangers can cross national borders, homeland security will require not only tougher domestic regulatory arrangements but also high standards and rates of compliance among global neighbours. The complexity of the issues, the diversity of interests, the high stakes and low tolerance for mistakes mean that formal legal agreements with clear obligations, accountability measures and methods of protection will be necessary at both the national and the international levels. Everyone will want to know that the overall system is working as intended, but in the information age the adage that 'knowledge is power' is truer than ever. Thus, it is crucial to think carefully about what compliance information is really necessary, how it should be gathered, who should have access to raw data and analysis, and how assessments of compliance should be made.

The shift in emphasis of co-operative security from deterrence and contingency response to reassurance and systematic prevention calls for a corresponding reorientation in the ends and means of verification. If in a co-operative security regime one is less concerned about deliberate aggression by any of the main players and more concerned either that they might engage in inadvertently dangerous behaviour or that a minor player (small state or terrorist group) might misbehave, then more emphasis can be placed on reassurance than was true of traditional American approaches to verification. The deterrence and detection functions do not disappear, but the normal mode of verification can assume that most participants will try to comply because they share the underlying goals and understand the reasons behind

the rules, not because they fear punishment. Verification is no longer seen as a zero-sum game between hiders and finders. Instead, the presumption is that most participants will be willing to exchange detailed information in the interests of mutual reassurance and protection so long as they have confidence that the information will be handled carefully and used appropriately. With reassurance as the primary objective, it makes no sense to differentiate between 'substantive' obligations and verification mechanisms because disclosure is an integral and intrinsically valuable part of an advanced co-operative security system.

Reconceptualising verification to emphasise the co-operative exchange of information for mutual benefit can increase international support for a robust cooperative security system. During the Cold War, representatives of the non-aligned countries often dismissed the superpowers' use of mutually incompatible, but equally adversarial, approaches to verification as evidence that neither side was really serious about co-operation. In more recent multilateral negotiations, verification has sometimes been seen as a Western construct to which developing countries might acquiesce in return for other forms of technical, scientific or financial assistance, not as something that directly increases the security of all participants.[7] But if verification information is used not just to catch the 'bad guys' but also to help the 'good guys' benefit safely from dual-use technologies, then verification is less likely to be seen as a Western obsession that offers little but trouble for the rest of the world.

Broadening the objectives of verification to include positive purposes beyond reassurance can be controversial. When information from a verification system is also used to accomplish some unrelated, but unquestionably benign, objective, as occurs with earthquake data from the seismic sensors for the 1996 Comprehensive Nuclear Test Ban Treaty (CTBT), the only real concern is that the secondary purpose might detract attention and resources from the primary mission. The situation is more problematic when the same information could be used for co-operative or competitive purposes: for instance, technical assistance to increase the reliability of commercial satellite launches could also help ballistic missile development. Globalisation makes the national security strategy of restricting access to dual-use information increasingly difficult to sustain because there are so many incentives and opportunities to share powerful information with foreign business associates,

academic colleagues, fellow activists or partners in crime. It is wiser to work with, rather than against, this trend by making the exchange of dual-use information conditional on the acceptance of appropriate arrangements to document that it is being used for agreed purposes.[8]

The design of verification arrangements will differ depending on issue area, both in order to focus the most scrutiny on the most serious security concerns and in order to leverage maximum verification benefit from information being gathered or exchanged in that field for other purposes. In general, each advanced co-operative security system would include:

- reporting and other disclosure requirements whereby participants would document their own compliance with co-operative obligations;
- routine cross-checks whereby authorities would collect information to confirm or question the accuracy and completeness of disclosed information; and
- increasingly intrusive investigative powers allowing authorities to request additional information, conduct inspections, and take other steps to clarify suspicious situations and, if necessary, provide the evidence of non-compliance needed for an effective response.

Relevant concepts, practices and technologies can be found not only in previous arms control agreements but also in other types of international agreement, in various national regulatory regimes, in voluntary transparency and review arrangements, and even in surprising places, such as inventory tracking systems for global business. One review of global governance across a wide range of issues identified a diverse array of verification tools and some important general lessons, such as the need for verification to determine not only whether a violation has occurred but why it has happened, so that informed choices can be made to promote compliance.[9] The novel aspect of verification for advanced co-operative security lies not in any individual component. Rather, it rests in the creative synthesis of diverse sources of information, many of which exist now but are underutilised, for the purpose of providing participants with a clearer picture of activity in realms of behaviour that were previously shielded from outside scrutiny.

As other authors have noted, globalisation and the information revolution are creating new incentives and opportunities for small states, the private sector and

civil society to be active in the verification process.[10] Recent writing shows that global civil society shares the interest of advanced co-operative security in setting behavioural norms and promoting transparency. The decentralised nature of many global security problems makes non-coercive 'regulation by revelation' attractive, especially as governments, businesses and private-sector groups should be both regulators and regulated—that is, be more transparent about their own operations and use public information to pressure others to behave appropriately.[11]

Contrary to some writing about transparency, however, the advanced methods of co-operative security approach does not assume that all compliance information could come from open sources or that it should be made public. Once a clear picture has been obtained of the types of information needed to verify compliance with a particular set of co-operative obligations, one should first determine how much of that information is already in the public domain or in other accessible data sets. Then one needs to determine how much of the other necessary information should be encouraged or required to be made public, and how much is truly sensitive for national security or commercial reasons and thus needs to be kept within the system under special access and use rules. The computer technology exists to mine vast quantities of open-source data and to integrate compliance information from diverse sources into very powerful controlled-access databases. The more difficult challenge is deciding what needs to be known, who should know it and how that knowledge should be used to enhance co-operation.

Participants in a co-operative security regime will be more forthcoming with information about their activities if they are not worried about confusing regulations, unachievable standards, false accusations or criminal penalties for unintentional errors. If compliance concerns arise during the verification process, they should be handled, at least initially, through co-operative mechanisms. These would include procedures to clarify ambiguous rules and resolve disputes about the rules' applicability to specific cases. They could incorporate technical, financial and legal assistance to increase capacity for compliance. They could involve a range of positive incentives to encourage compliance. They would also include strategies to change how participants think about co-operation, such as providing more complete and accurate information to influence cost–benefit calculations or promoting norms to alter underlying values.[12] These mechanisms would be a relatively constructive, low-

cost way to resolve compliance problems that arise from ignorance, incapacity or inadvertence. If, however, the verification process yields evidence of deliberate and egregious violations, then there would be a need to have more adversarial investigation and enforcement tools available, either within the co-operative security system itself or through another national or international body.

Advanced co-operative security in practice

The 2002 anthrax attacks in the United States raised a host of questions about access to dangerous pathogens and revealed a remarkable lack of information and oversight of research involving virulent disease agents in academia, in industry, among defence contractors and in government national security laboratories. Much of the ensuing debate has focused on finding the right balance between science and security—trying to leave the 'good guys' alone as much as possible while preventing the 'bad guys' from gaining access to dangerous pathogens or learning from the open literature how to make deadly diseases.

Advanced co-operative security offers an alternative approach to promoting beneficial uses of biotechnology while preventing its misapplication—one in which systematic disclosure and independent peer review are used to make science and security mutually supportive. This section previews the basic elements of the prototype Biological Research Security System (BRSS) that is being developed as part of the Advanced Methods of Cooperative Security Program.[13]

A comprehensive research oversight system that covers both legitimate scientists and potential miscreants is needed for several reasons. To begin with, the most objective and effective way to draw proactive distinctions between the 'good guys' and the 'bad guys' is to define disclosure and review requirements for everybody doing legitimate work with dangerous pathogens, so that anyone who refuses stands out. Furthermore, the system needs to address not only the deliberate misuse of biotechnology but also various ways in which legitimate science could cause inadvertent destruction. Lax safety and security standards could prove disastrous even in a laboratory devoted solely to bio-defence or vaccine development.[14] Cutting-edge research could produce unexpectedly dangerous results.[15] Knowledge generated by benign research could be used by someone else for hostile purposes.[16] Finally, a diffuse problem such as that presented by dangerous pathogens requires a decen-

tralised solution that is primarily designed and implemented by a worldwide network of legitimate scientists.

Many international agreements and domestic regulations cover some aspect of work with dangerous pathogens, but few address basic research.[17] The BWC prohibits states parties from developing, producing, stockpiling, or otherwise acquiring or retaining biological agents or toxins 'of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes' but does not list research among its prohibitions. Neither the BWC nor subsequent review conferences have provided much guidance for differentiating between peaceful and hostile purposes, and some people argue that almost any activity could be justified in the name of 'threat assessment'.[18] During work on the BWC verification protocol a partial, indirect attempt was made to define activities that should be the focus of additional verification efforts by generating lists of dangerous agents, criteria for relevant facilities and requirements for declaring particular kinds of work. The logic behind constructive proposals was to concentrate on types and quantities of agents and equipment that seemed most likely to be used by a state in an offensive military programme. The politics of the protocol negotiations, however, combined conflicting preferences for secrecy and security into a compromise draft text in which the thresholds and exemptions of the transparency arrangements were so important that the net effect of going only that far might well have been to increase suspicions rather than to reduce them.[19]

Much attention is currently concentrated on strengthening national systems for controlling dangerous pathogens as an alternative or a supplement to future international efforts. In the US a patchwork of regulations and recommendations have some relevance for basic research with dangerous pathogens but focus primarily on the later stages of testing, producing and packaging biotechnology products. The three most relevant areas are probably new legislation mandating reports on the possession of designated pathogens; bio-safety recommendations to promote the safe handling of pathogens that pose varying degrees of risk; and review procedures for recombinant DNA (rDNA) research at institutions that receive funding for that purpose from the National Institutes of Health (NIH). The new federal legislation does not require any information about the research being done with the designated pathogens. Bio-safety reviews and most rDNA reviews are done at

the local (institutional) level with varying degrees of rigour. Much research with dangerous pathogens could be done with no external reporting or review whatsoever, especially if it does not involve a listed pathogen or is conducted at an institution that does not receive NIH funding. Concerns about what might be going on behind closed laboratory doors are likely to grow as funding for bio-defence work expands, more work is done on a classified basis, and pressures increase for the publication of potentially dangerous research results to be restricted.

An advanced co-operative security approach to balancing the benefits and risks of biotechnology research seeks to make science and security work together through the twin mechanisms of systematic disclosure and independent peer review. One can envisage the establishment of a BRSS with objectives, standards and operational procedures that are shared globally yet implemented largely on the local and national levels. The fundamental objective would be to provide reassurance that legitimate research involving dangerous pathogens was being done in such a way that its benefits for global society outweighed the risks of deliberate misuse or inadvertent danger. The system would be based on agreed standards for assessing the level of danger posed by different lines of research and for assigning appropriate operational standards for work at each danger level.

The BRSS should be based on a definition of dangerous research that is understandable for both scientists and lay people and is flexible enough to match rapid advances in biotechnology. The three features of a pathogen that are most relevant are its transmissibility, its infectivity and its pathogenicity. In other words, to assess the risk posed by research with a particular pathogen, one needs to know three things about the organism that the researcher will start or end up with. Could it spread easily from person to person or be widely disseminated in some other way? How many of the people that it encounters will become sick? And how many sick people will die? (Natural pathogens reflect evolutionary trade-offs along these dimensions. For example, pathogens that kill their hosts too quickly have less opportunity to spread.) Smallpox is considered to be among the most dangerous pathogens because it is moderately contagious, low-level exposure can lead to infection, and 30 per cent or more of infected individuals will die unless vaccinated before symptoms appear.[20] Smallpox that was genetically engineered to be more contagious or vaccine-resistant would be much worse.

One could define extremely dangerous research (EDR) loosely to cover work with pathogens whose combined danger factors are comparable to or worse than those associated with smallpox, the pathogen for which research is currently most tightly controlled.[21] Moderately dangerous research (MDR) would include work with pathogens such as anthrax that could pose very serious public health problems but do not have the same mass destruction potential as would be seen in a self-sustaining epidemic of smallpox or highly virulent influenza. Potentially dangerous research (PDR) would cover experiments that start with relatively benign pathogens and involve techniques that might produce a more dangerous pathogen or provide knowledge that could be applied to another, more dangerous pathogen with potentially devastating results. One of the first tasks in creating the BRSS would be to decide whether these conceptual categories should be operationalised narrowly, to minimise the amount of research subject to each level of oversight, or broadly, to reduce the likelihood of dangerous research receiving inadequate supervision.

Each level of danger would have corresponding disclosure and review requirements. Since EDR, if mishandled, might have dire global consequences, the very small amount of research that might be done in this realm should be subject to strict international control. For example, scientists would need a special license to conduct EDR; they would be required to submit regular activity reports and to secure approval from an international body of experts for each proposed EDR experiment, all of which would be conducted only at approved facilities under international supervision; and the results of all experiments would be handled according to special dissemination procedures. In terms of moderately dangerous research, internationally agreed standards and procedures for licensing, routine reporting, research proposal review and dissemination would be applied by national authorities with oversight from the international agency. Most biological research would either be low-risk, and thus could continue without new oversight requirements, or fall into the PDR category, which would be subject to more systematic local oversight and independent review with national oversight using world-class standards.

The BRSS would include two different types of verification. Much of the reassurance in the system would be a natural by-product of following the appropriate licensing, reporting, review and publication procedures, all of which would be designed with a presumption in favour of transparency or, if necessary, systematic disclosure of

sensitive information under agreed access and use conditions. There would need to be additional means to ensure that information provided to the system was detailed, accurate and complete enough to enable reliable judgements about the research activities in question. Some of this could be done by relatively neutral, technical methods, such as auditing annual reports for internal consistency, cross-checking information provided by one laboratory with submissions from others with which it interacted, or comparing research proposal review records with findings published in academic journals and patent applications for biomedical products.

Some tough political choices will be unavoidable, though, especially for moderately dangerous research involving information that is sensitive for reasons of national security, proprietary interests or other intellectual property rights. The preferred approach would be to require thorough reporting and review at the national level, with the most sensitive details being kept confidential but made available on request to the appropriate international authorities under agreed access and use rules. The less willing laboratories and national authorities are to disclose sensitive information through co-operative procedures, the more necessary it would be to resort to challenge inspections and other adversarial forms of verification.

The underlying purpose of the BRSS is to buttress the negative norm against the destructive use of life science embodied not only by the 1925 Geneva Protocol and the BWC, but also by the Hippocratic Oath and universal ideas of human decency. However, the fact that the proposed system builds on specific positive, process-oriented obligations has important implications for verification. To begin with, it is easier to confirm a positive than to prove a negative. Moreover, the appropriate standard for this verification system is not whether it can detect every significant clandestine biological weapons-related activity; that standard is both too broad for a research-focused system and impossible for any prevention-oriented approach to meet. A more appropriate standard would ask whether the BRSS verification arrangements (a) do more good than harm—whether the benefits of increased confidence that the power of biological research is not being misused outweigh whatever inconvenience and intrusion occurs at each level of research; and (b) make a net contribution to global security when combined with other national and international tools for detecting, deterring and redressing deliberately destructive misuses of biotechnology.

Conclusion

The pathogens application illustrates some of the ways in which security co-operation and verification need to change to reflect the altered circumstances of global security. In contrast to the Cold War, when threatening military capabilities and arenas for security co-operation existed apart from most citizens' normal existence, many new threats and the opportunities for co-operation are now spread throughout routine scientific, economic and social interactions. Biotechnology research is a diffuse, knowledge-driven, collaborative activity of increasing importance to the health and economic welfare of every country in the world. Any security strategy that ignores these fundamental facts is bound to fail. Any approach that recognises new types of threats but responds using traditional national security and law enforcement tools will impose unnecessarily high costs—including increased suspicion, threat assessment activities that erode constraints on the destructive uses of biotechnology, draconian prohibitions on experimentation or publication that impede scientific advance, and infringements on civil liberties—all for little or no net gain to world security.

Working out the details of a Biological Research Security System, or any other advanced co-operative security solution for comparable problems in other fields, will require a tremendous amount of creative thinking by scientists, arms control experts, information technology specialists, lawyers and industry representatives from around the world. This is a long-term vision; no one expects a full-blown version of this system to be in place at any time soon. But as the problem becomes more urgent the number of people working on incremental improvements to existing national and international arrangements will grow exponentially. Thinking now about where we might want to be headed can make the difference between counterproductive confusion and slow, steady progress in the right direction.

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Endnotes

[1] For a fuller analysis, see John Steinbruner, *Principles of Global Security,* Brookings Institution Press, Washington, DC, 2000.

[2] See the website of the Center for International and Security Studies at Maryland (CISSM) at www.puaf.umd.edu/CISSM/Projects/AMCS/AMCS.htm for more information about the Advanced Methods of Cooperative Security Program.

[3] On the role of arms control in managing the end of the Cold War and creating more co-operative norms of behaviour in Europe, see Stuart Croft, *Strategies of Arms Control,* Manchester University Press, Manchester, 1996.

[4] One of the earliest discussions of the concept of co-operative security was Ashton B. Carter, William J. Perry and John D. Steinbruner, *A New Concept of Cooperative Security,* Brookings Occasional Papers, Brookings Institution, Washington, DC, 1992. The fullest treatment of the earlier approach is Janne Nolan (ed.), *Global Engagement: Cooperation and Security in the 21st Century,* Brookings Institution, Washington, DC, 1994.

[5] Rose Gottemoeller, 'Arms control in a new era', *Washington Quarterly,* vol. 25, no. 2, spring 2002, pp. 45–58.

[6] For an analysis of competing approaches to verification and their effects on decisions about co-operation, see Nancy W. Gallagher, *The Politics of Verification*, Johns Hopkins University Press, Baltimore, MD, 1999.

[7] Trevor Findlay, 'Introduction: the salience and future of verification', in Trevor Findlay (ed.), *Verification Yearbook 2000*, The Verification Research, Training and Information Centre (VERTIC), London, December 2000, p. 17.

[8] This parallels the Cold War experience: the development of satellites, seismic monitoring and other remote sensing technology made it increasingly difficult for the Soviet Union to maintain tight secrecy about its nuclear weapons development. This increased its incentives to negotiate with the West about how such technology could be used to verify compliance with arms control agreements.

[9] P.J. Simmons and Chantal de Jonge Oudraat, *Managing Global Issues*, Carnegie Endowment for International Peace, Washington, DC, 2001, esp. pp. 693–698. This study found four techniques to be especially important in assessing compliance with co-operative agreements, all of which fit well with the advanced co-operative security approach: the use of independent experts and data; transparency and open review; mechanisms to protect sensitive information; and uniform standards of evaluation and trusted analysis.

[10] See, for example, Andrew Rathmell, 'The information revolution and verification', in *Verification Yearbook 2000,* pp. 215–228.

[11] Ann Florini, 'The end of secrecy', *Foreign Policy,* no. 111, summer 1998, pp. 61–62. See also Ann Florini (ed.), *The Third Force: The Rise of Transnational Civil Society,* Japan Center for International Exchange and Carnegie Endowment for International Peace, Tokyo and Washington, DC, 2000.

[12] On co-operative versus coercive compliance strategies, see Ronald B. Mitchell, 'International control of nuclear proliferation: beyond carrots and sticks', *Nonproliferation Review,* fall 1997, pp. 40–52; and Abram Chayes and Antonia Handler Chayes, *The New Sovereignty: Compliance with International Regulatory Agreements,* Harvard University Press, Cambridge, Mass., 1995.

[13] Since this is a work in progress, readers are encouraged to visit www.puaf.umd.edu/CISSM/Projects/AMCS/Pathogens.htm for more information about the Controlling Dangerous Pathogens Project and a fuller description of the proposed system.

[14] For example, a review by the US Department of Energy's Inspector General found that experiments with botulism, plague, anthrax and other lethal pathogens were being conducted at national laboratories without appropriate oversight—both violating requirements and carrying out activities which should have required oversight but did not—and without rigorous safety procedures. The Inspector General at the US Department of Agriculture found that unauthorised individuals could easily gain access to laboratories where deadly

biological agents were stored without adequate security. US Department of Energy, Office of the Inspector General, Office of Inspections, 'Inspection of Department of Energy activities involving biological select agents', February 2001, available at www.ig.doe.gov; and Reuters, 'Report finds easy lab access to deadly pathogens', 7 May 2002.

[15] The mousepox experiment in Australia has become a classic example of this problem. Other worrying examples include an experiment at Imperial College in London where researchers hoping to develop a vaccine for hepatitis C and eliminate the need for animal testing planned to combine hepatitis C with dengue fever, which could have created a lethal hybrid virus for which there is neither vaccine nor treatment. The experiment was stopped by the UK's Health and Safety Executive because serious safety violations at the laboratory had been reported in the past and it was attempting to proceed without a follow-up inspection. Ronald J. Jackson *et al.,* 'Expression of mouse interleukin-4 by a recombinant ectromelia virus suppresses cytolytic lymphocyte responses and overcomes genetic resistance to mousepox', *Journal of Virology*, February 2001, pp. 1205–1210; and Charles Arthur, 'Scientists made virus "more lethal than HIV"', *The Independent,* 24 July 2001.

[16] Recent examples of publications that contain dangerous information include a report on the synthesis of the polio virus using publicly available genetic information and short segments of mail-order DNA, and another paper identifying camelpox as smallpox's closest cousin. Jeronimo Cello *et al.*, 'Chemical synthesis of poliovirus CDNA: generation of infectious virus in the absence of natural template', *Science*, vol. 297, no. 5583, 9 August 2002, pp. 1016–1018; and 'The sequence of camelpox virus shows it is most closely related to variola virus, the cause of smallpox', *Journal of General Virology,* no. 83, 2002, pp. 855–872.

[17] For details of international agreements and domestic regulations, see Elisa D. Harris, 'International and domestic efforts to prevent dangerous uses of biological pathogens: a preliminary assessment', CISSM working paper, forthcoming; and Stacy Gunther, 'Federal regulation of scientific research', CISSM working paper, December 2001, available at www.puaf.umd.edu/CISSM/Publications/AMCS/AMCS.htm.

[18] The Third BWC Review Conference in 1991 did note that experiments involving the open-air release of dangerous pathogens had no justification for peaceful purposes, but no other similarly concrete distinctions have been elaborated between legitimate and illegitimate experiments. On attempts to differentiate between offensive and defensive research related to biological weapons, see Milton Leitenberg,'Distinguishing Offensive from Defensive Biological Research',*Critical Reviews in Microbiology,* (forthcoming 2003).

[19] John Steinbruner, Nancy Gallagher and Stacy Gunther, 'A tough call', *Arms Control Today,* vol. 31, no. 4, May 2001, pp. 23–24.

[20] Donald A. Henderson *et al.*, 'Smallpox as a biological weapon', *Journal of the American Medical Association,* vol. 281, no. 22, 9 June 1999, pp. 2127–2137.

[21] Stacy Gunther, 'Smallpox: oversight of a dangerous pathogen', CISSM working paper, forthcoming at www.puaf.umd.edu/CISSM/Publications/AMCS/AMCS.htm.