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EDITOR'S NOTE

There are many treaties in force, entering into force or currently under negotiation that have provisions for different types of on-site inspections, investigations and visits. It is timely to look at these in the round. A common factor in many disarmament and arms control regimes, recent events have perhaps eroded the image of OSIs. Much can be learned from comparing different OSI programmes. Reflecting on common denominators can help us take advantage of synergy across treaties. This issue of Disarmament Forum will examine OSIs from a number of different regimes, comparing and contrasting different approaches in the hope of promoting best practices and informing ongoing negotiations.

This issue makes a contribution to UNIDIR's research programme on the implementation of treaties. Often once a treaty has been negotiated and is in force, international focus is removed. Yet in some ways the implementation phase of treaties is far more difficult and more important than the negotiation phase.

The implementation of the Convention on the Prohibition of the Use, Stockpiling, Production, and Transfer of Anti-Personnel Mines and on Their Destruction (also known as the Ottawa Convention) has now begun. The first meeting of states parties was held in Maputo, Mozambique, from 3–7 May 1999. It meant a great deal to many of the delegates to be in a mine-affected country, the most appropriate venue for the first meeting. In addition to the positive meeting, the week included several highlights:

- The International Campaign to Ban Landmines launched the first edition of the Landmine Monitor. This extensive verification exercise includes information on every country in respect to landmines. To obtain a copy of the report or to find out how to participate in the research for the next edition of the Landmine Monitor, see page 101.
- The International Committee of the Red Cross launched its new educational video, "The Ottawa Treaty: Towards a world free of anti-personnel mines". Concise and informative, running just over 13 minutes, the video reviews the obligations instituted by the treaty: the destruction of existing stocks, the clearance of mine-infested areas and the setting up of prevention and assistance programmes. The video is available from the ICRC free of charge, in English, French, Portuguese, Spanish and Chinese (Russian and Arabic to be available soon). Please contact: ICRC, Centre for Public Information, 19 avenue de la Paix, 1202 Geneva for further information.

Issue 4, 1999 of Disarmament Forum will be "A Framework for a Mine-Free World". We will be examining the essential elements of the Ottawa Convention, including the importance of NGOs, the role of intersessional work, ongoing monitoring, victim assistance and verification.

Note: In the article by Frank von Hippel in issue 2 of Disarmament Forum, a year was misidentified. In Table 1, page 37, entries for “Separated civilian plutonium” for the United Kingdom and France are for the end of 1997, not 1996. We apologize for any inconvenience.

Kerstin Hoffman

SPECIAL COMMENT

I am pleased to act as commentator for this issue of Disarmament Forum in which experts offer a rich perspective on the provisions of on-site inspection (OSI) regimes, the methods they employ and the experience they have gained in verifying compliance with arms control and non-proliferation agreements. This issue provides a means to view the systems that have evolved, to reflect on common denominators and points of difference, to examine experience in implementation and to set new reference points for future consideration.

OSI has been a component of International Atomic Energy Agency (IAEA) safeguards since the Agency was established in 1957. Initially, inspections were limited to materials, equipment or facilities that came under safeguards as a result of bilateral transactions. With the Treaty on the Non-Proliferation of Nuclear Weapons the concept of OSI was accepted internationally.

Since the mid-1980s, when "glasnost" in the former Soviet Union led to a greater acceptance of OSI, such inspections have acquired a more prominent role in bilateral and multilateral arms control and non-proliferation agreements. A watershed was the Intermediate-Range Nuclear Forces Treaty of 1987. Success in implementing its OSI provisions made the benefits of OSI clear to a wider world. Major arms control and non-proliferation agreements concluded since then have featured OSI as a main component of verification.

OSI is integral to the verification of compliance with treaties to combat proliferation of weapons of mass destruction. The major multilateral non-proliferation agreements concluded in the 1990s, the Chemical Weapons Convention (CWC) and the Comprehensive Nuclear-Test-Ban Treaty (CTBT), each embody OSI provisions. The CTBT provides for OSI as a corollary to seismic monitoring. The verification systems of the organizations established to implement the CWC and CTBT draw, inter alia, on IAEA experience and structures. I am pleased to head an organization which pioneered and provided a template for other global non-proliferation organizations.

OSI-relevant features common to non-proliferation agreements build on earlier models and precedents. A key characteristic is that the rights and obligations of the inspection authority and of the inspected party are carefully defined and codified. Parties, for example, are obliged to provide data pertaining to the numbers or quantities, specific characteristics and locations of the items or materials covered by the treaty. They also need to provide additional site-specific information to facilitate the inspection process. Agreements specify particular categories of inspection for specific purposes and prescribe, in some detail, the scope of activities to be permitted in each category. The inspectorate is limited to specifically designated personnel and the inspected party has a role in the designation process. Time frames are defined within which specific inspection activities are to be carried out; the functional privileges and immunities of the inspector are established on a clear, legal footing; there are rules to govern inspector conduct; and provisions for protecting the confidentiality

of information obtained. Opportunities are given for resolving any ambiguities and procedures set down for the resolution of disputes. All these features have been incorporated into the IAEA Safeguards System since its inception. They not only prescribe but circumscribe the boundaries of OSI: no verification system can be more stringent than the legal instrument(s) on which it is based.

There are a number of ways in which OSI as a feature of the verification systems represented in this issue can be compared or contrasted. One could focus on respective objectives and methodologies or on the relationship of OSI to other elements of each verification system. One could focus on experience with specific types of inspection — whether "base line" to confirm initial declarations of the items or materials to be verified; routine inspections (some at short notice) to establish continuing compliance with material obligations at sites; and inspections aimed at verifying declared changes from base-line or subsequent data and specific types of inspection, whether "special" or "challenge", designed to investigate suspect sites. Another approach, which I have chosen here, is to view the OSI regimes in terms of the relationship between the inspector and inspected.

Viewed from that perspective, one category of OSI covered in this issue stems from the kind of bilateral agreement which has served as a means of retreating from the extensive military build-ups of the Cold War years. Inspections under these bilateral arrangements have entailed a high degree of cooperation, with each party being both the inspector and inspected party. They derive from a common wish to accomplish a given objective. Historically, this has been either the elimination of an entire class of weapons or deep cuts in other categories. The underlying presumption is that each party enters into the relevant commitments in good faith, but that specific OSI activities — whose intrusiveness and other special characteristics depend on the object or objects to be verified — are essential to check that the commitments made are actually being kept.

Another category of OSI — and one which features predominantly in this issue — is a characteristic of independent, multilateral verification by an international organization on behalf of the international community. This broad category reflects an underlying situation in which states recognize and commit themselves to a common, societal objective; bind themselves to accept certain material obligations in pursuit of that objective; and as part of that process, grant an impartial, professional and technically competent inspectorate access to their territory to verify compliance with commitments made. Any state subscribing to such an arrangement has two basic objectives: firstly, to obtain confidence that other parties to the arrangement are respecting their own commitments; secondly, to demonstrate its own compliance to the international community. Being able to derive confidence about the actions of others rests on the assumption that such confidence is soundly based: in other words, that the verification process is effective, impartial and applied without discrimination to all the parties to a given agreement. States also recognize that, from the international perspective, verification by technically competent inspectors whose loyalty is to an impartial, international organization can create a higher level of confidence than could be obtained through unilateral, bilateral or regional verification measures.

The cooperative aspects of OSI in a multilateral setting provide a valuable service function. Perceived compliance by states with verification-related obligations builds confidence and trust and can bring dividends in terms of their relations with other states. From the wider perspective, reluctance to agree to or cooperate with the verification process provides timely warning of possible non-compliance and enables response or enforcement mechanisms to be activated. The "up close and personal" aspect of OSI also brings benefits that no amount of sophisticated technology or instrumentation can alone provide: the on-site presence of a competent, trained inspector eases familiarity with facilities, plants and operating parameters and contributes to a picture of what is "normal". This makes it easier to identify any unusual or ambiguous events and to seek clarification, from the outset, at a low threshold. Additionally, human observation and inspection can achieve

results that even technology at the cutting edge cannot. OSI contributes greatly to transparency, the key to a high degree of confidence in a state's activities.

It also has its limits. It is simply a tool of verification and of itself can neither give complete assurance of compliance nor predict future intentions. What it can do is to confirm that no clandestine or irregular activities appear to be taking place at a particular location at a particular point in time. Viewed more widely, however, one cannot extrapolate only from OSI that a state is in overall compliance with its obligations. Other elements, for example information analysis to obtain "the big picture" country-wide, are required in any attempt to do that. Neither can OSI exclude the possibility of non-compliance. This is clear from experience in Iraq and in the Democratic People's Republic of Korea.

Iraq demonstrated that threats to the nuclear non-proliferation regime could come — despite earlier suppositions to the contrary — from within its own ranks. Also well known is that the experience with Iraq highlighted the shortcomings and limitations of the nuclear safeguards system as then implemented, including aspects of its OSI. This and other relevant experience has led, as you will read in detail in one of the contributions to this issue, to a wholesale strengthening of the safeguards system, including new access and corollary rights for IAEA inspectors.

All of the OSI systems identified in this issue must continue to evolve. Environments for inspection change, inspection technologies evolve and the resources available for verification can vary according to states' priorities. Efforts now underway will, we hope, contribute further to peace and security. However, continuing vigilance is required with regard to the verification of compliance with non-proliferation pledges. Verification tools must continue to be appropriate to the tasks. In some cases — notably, in relation to biological weapons — effective verification needs to be put in place. A future Fissile Material Cut-off Treaty will freeze the production of nuclear material for nuclear weapons and pave the way for further nuclear arms reductions. OSI systems designed as part of the verification processes for such agreements will likely incorporate many of the features identified in this publication. OSI is now firmly on the map and universally accepted as a key element of ascertaining compliance and deterring non-compliance.

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The IAEA's Additional Protocol

Rich HOOPER

With International Atomic Energy Agency (IAEA) Board of Governors approval of the Protocol Additional to Safeguards Agreements (INFCIRC/540) in May 1997, an extensive three and a half year development programme (called "Programme 93+2") for strengthened and more efficient safeguards came to conclusion. Programme 93+2 has been a major effort by the IAEA Secretariat and included the direct involvement of the Standing Advisory Group on Safeguards Implementation (SAGSI) and a large number of member states.

Ultimately the strength of the safeguards system depends upon three interrelated elements:

- the extent to which the IAEA is aware of the nature and locations of states' nuclear and nuclear-related activities;
- the extent to which IAEA inspectors have physical access to relevant locations for the purpose of providing independent verification of the exclusively peaceful intent of a state's nuclear programme; and
- the will of the international community, through IAEA access to the United Nations Security Council, to take action against states that are not complying with their non-proliferation commitments.

Since 1991, IAEA access to the Security Council has been re-affirmed and the IAEA Board of Governors has approved a number of specific measures that greatly increase IAEA access to information and to locations. Some of the new measures are being implemented under existing safeguards agreements. Other measures require new legal authority provided for in the Additional Protocol approved by the Board of Governors in May 1997.

This paper provides a summary of traditional safeguards and the limitations of that system, the conceptual development and associated measures that comprised Programme 93+2 and the Additional Protocol and concludes with a discussion of issues related to implementation.

Traditional Safeguards

International nuclear material safeguards consists of a complex control system based on material accountancy with the technical objective of providing for "... the timely detection of diversion of

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significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or of other nuclear explosive devices or for purposes unknown, and deterrence of such diversion by the risk of early detection" (para. 28, INFCIRC/153). Each non-nuclear weapon state (NNWS) party to the Nuclear Non-Proliferation Treaty (NPT) undertakes to accept IAEA safeguards on all nuclear material within the state's territory or under its jurisdiction or control. The basic procedural elements of the safeguards system are facility design review and verification, maintenance of facility operating records, reports on facility operations and on-site inspections (OSI). The system requires the concerted action of nuclear facility operators, state authorities and the IAEA inspectorate.

The safeguards system based on nuclear material accountancy is directly analogous, both in concept and in basic procedural elements, to a financial accounting system. The role of the inspectorate is analogous to that of the independent financial auditor. Both systems have the objective of building confidence. The financial audit is intended to build confidence in the public regarding the management of public institutions. The safeguards system builds confidence in the international community that states are complying with their non-proliferation commitments.

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Financial accounting is concerned with the collection of data describing the economic activities of a firm. These data are summarized in the form of financial statements. Auditing is the independent verification of the "fairness" (correctness) of the financial statements. The auditor collects data useful for verification from several sources and by different means. The acquisition of reliable audit information at minimum cost is a continuing aspect of the audit function.

Nuclear material accountancy records are maintained by facility operators for each facility under safeguards. Basically two kinds of reports — comparable to financial statements — are made by facility operators, through the cognizant state authorities, the State System of Accounting and Controls of nuclear material (SSAC), to the IAEA:

- The Inventory Change Report (ICR) gives details, for each nuclear material category, of all receipts (credits) and shipments (debits) of nuclear material.
- Periodically the facility operator performs a Physical Inventory Taking (PIT), which results in a detailed list, again for each nuclear material category, of the nuclear material that exists in the facility's inventory at a particular point in time.

These data provide the basis for the IAEA's independent verification activities in exactly the same sense that the financial statements of a firm provide the basis for the auditor's assessment of "fairness". The strategy for independent verification of inventory changes and for the verification of the periodic statement of inventory by a facility operator are central to nuclear material accountancy. The strategy depends primarily on the type and design of the particular facility and the type and quantities of nuclear material being handled at it. The time period between successive inventory statements is called a material balance period. The verified inventory statement at the end of one period becomes the beginning "book inventory" for the period that follows. In a manner exactly analogous to the closing of financial records for a specific fiscal period, a statement of inventory by a facility operator marks the closing of material accounts for a material balance period.

The intensity (i.e. the frequency and extent) of the IAEA's independent verification of inventory and inventory changes is determined by the values assigned to technical implementation parameters such as a significant quantity and timeliness ("timely detection"). The IAEA has defined a "significant quantity" as the amount of a particular material (e.g., plutonium) that a state would need to make

a nuclear explosive device. "Timeliness" is related to the estimated time needed to convert diverted material into the components of a nuclear explosive device. The uniform implementation of safeguards is maintained in all states with Comprehensive Safeguards Agreements (CSAs) through application of technical implementation criteria. These implementation criteria provide detailed requirements and procedures for how safeguards are to be implemented in any given circumstance. New technical measures for improved and more efficient safeguards are under constant development and the implementation criteria are revised as new technical measures become available. Each year the IAEA produces a Safeguards Implementation Report that is submitted to the Agency's Board of Governors. The report describes the implementation of safeguards in each facility and state. In 1997 the IAEA carried out 2,499 OSIs in 670 facilities throughout the world. The bulk of this effort was committed to safeguards in states with CSAs.

Limitations of Traditional Safeguards

Comprehensive or full-scope safeguards is to be applied to all nuclear material, once it has been processed to point suitable for enrichment or introduction into a reactor, in NNWS who have made a non-proliferation commitment (i.e., states parties to the NPT or one of the various regional agreements). Safeguards conclusions are based on an assessment that the material accountancy systems are in conformity with accepted accounting principles and that there has been no material mis-statement (through independent verification of nuclear material flows and inventories). However, as is the case with the financial auditor, the assurances provided by the safeguards system pertain to the correctness of information provided by the state and not to the completeness of that information.

However, as is the case with the financial auditor, the assurances provided by the safeguards system pertain to the correctness of information provided by the state and not to the completeness of that information.

The issue of completeness is not new. It was debated at length by states' representatives negotiating the model CSA (i.e., the legal basis for comprehensive safeguards) twenty-five years ago. The resultant compromise was that the safeguards system would pertain only to nuclear material declared by the state with the tacit assumption that those declarations would be complete. During the twenty-five years of IAEA comprehensive safeguards, no diversion of material under safeguards or the subsequent utilization of diverted material has ever been detected. However, when a state accedes to the NPT and provides the IAEA with an initial report describing material and facilities, as required by the CSA, how can the IAEA be confident that the initial report is complete without extensive investigation of historical operating records and related data? Even a detailed investigation may not produce the desired results when historical records are incomplete or other information substantiating the initial report are not made available. This is a particularly difficult problem when a state is suspected of having produced unsafeguarded weapon-usable material prior to joining the NPT or some other agreement requiring comprehensive safeguards. Moreover, a complete initial report does not prevent a state from subsequently building secret facilities or secretly producing material. Inspector access under a CSA is limited under routine inspections to specified points in declared facilities (these points of access are called "strategic points" and they are identified as the access necessary for the IAEA to meet its material accountancy obligations for a particular facility). With this limited access the Agency's ability to detect an independent undeclared production cycle that makes no use of safeguarded material is circumscribed. This was essentially the situation that came to light in Iraq following the Gulf War.

The Conceptual Development

The conceptual framework for the evaluation of information for material accountancy safeguards was well established at the time INFCIRC/153 was negotiated. It evolved from a series of considerations that attempted to find a balance between what was needed to maintain technical rigour and independence on one hand and what was doable and affordable on the other. Basic to those considerations was the conclusion that a safeguards system based on any imaginable form of direct verification, whereby the verification authority would maintain parallel and independent records and accounts, was neither doable nor affordable. The analogy between the safeguards verification regime as an audit function directed at state/operator maintained records and accounts and the independent audit necessary to maintain public confidence in financial institutions follows directly.

In February 1992, the Board affirmed that the scope of comprehensive safeguards is not limited to nuclear material declared to the Agency by a state but that it also includes nuclear material subject to safeguards under the agreement which has not been declared. The requirement that the safeguards system provide assurances that state's material declarations are correct and complete is at the core of strengthened safeguards.

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As before, there is no imaginable form of direct verification that states' nuclear material declarations are complete that is doable and affordable. However, the whole of a state's nuclear programme (present and future) involves an interrelated set of nuclear activities that imply (and are implied by) the existence of certain equipment, infrastructure, telltale traces in the environment and a predictable utilization of nuclear materials. This provides the basis for a conceptual development involving an expanded declaration, information evaluation, new technical measures and inspector access as integrated parts of an additional kind of audit function. An audit function intends, when implemented, to accumulate, indirectly, assurances that states' nuclear material declarations are complete by assuring the absence of activities that could indicate the presence of such material. And, as an audit function, everything that is done in the way of evaluation, verification and the seeking of additional information is in the context of a declaration.

Traditional material accountancy safeguards has developed through the definition of observables/indicators of diversion or of circumstances where the possibility of diversion cannot be excluded. These indicators are constantly tested against states' declarations of nuclear material inventories, flows and facility operations. Strengthened safeguards provides for a new kind of "observational vantage point" comprised of state declarations regarding nuclear and nuclear-related activities that constitute the whole of their nuclear programme and the utilization of nuclear material, increased inspector access, new technical measures and broadly based analysis of information. An important development in this regard is the so-called "Physical Model".

Nuclear material suitable for the manufacture of weapons does not exist in nature. It must be manufactured from source material through a series of discrete and definable steps (i.e., mining and milling, conversion, enrichment, fuel fabrication, irradiation, reprocessing, etc.). Each step can be accomplished through any one of several processes where the choice of process for a given step depends, to some extent, upon the processes chosen for both the preceding and succeeding steps. The Physical Model is an attempt to identify, describe and characterize every known process for carrying out each step necessary for the production of weapon-usable material. Thus, any possible route from source material to special fissionable materials is describable as some combination of processes identified and characterized in the Physical Model. Each process for carrying out a given

step is described and then characterized in terms of indicators of the existence of that process. The indicators of the existence of a process may be specialized and dual-use equipment, nuclear and non-nuclear materials, environmental signatures, requirements for specific technical skills and so on. The model was the combined work of department staff and a small group of experts from member states. It will always be a work-in-progress subject to periodic review and update but a form of closure was achieved recently with a Consultants' Meeting where each component was subjected to a detailed review by additional experts from ten member states.

Just as the overall technical objective of traditional safeguards translates to the testing of the hypothesis of "no diversion", the objective of strengthened safeguards is met through a country-level evaluation taken to be the testing of the hypothesis that "there are no undeclared nuclear activities". It is a detailed technical evaluation of the internal consistency of the state's declaration and a point-by-point comparison between indications of activities from all information available to the Agency and what the state says they are doing or they plan to do. The process of information evaluation and the inspection process are inextricably linked as many of the sub-hypotheses (or questions) regarding the absence of nuclear activities (including facility misuse) are, or only can be, tested through direct observation. Some hypotheses to be tested through direct observation are by design, others arise through the need to resolve inconsistencies between information collected by the Agency and a state's declaration. Information is relevant to this technical evaluation only to the extent that it indicates, directly or indirectly, the existence of a nuclear activity or the presence of nuclear material. The conclusion that there are no undeclared nuclear activities can only be inferred from the absence of any evidence to the contrary. This absence does not prove that there are no undeclared nuclear activities. It says that from all information available none such activity has been observed and, in the absence of such observation, there is no reason to reject the hypothesis.

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Programme 93+2 Measures

Detailed descriptions of the measures proposed under Programme 93+2, organized under the headings access to information, access to locations and the rational use of resources, are available in a number of places[1] and they will not be repeated here. A summary of the measures and the status of their implementation follows.

Measures Approved Prior to May 1997

The process of strengthening and otherwise improving the safeguards system has been underway for some time. During 1991 the Board considered, and in 1992 confirmed, the right of the Agency to use special inspections as provided for in CSAs. In 1992 the Board took decisions regarding the early provision and use of design information and in February 1993 the Board endorsed a voluntary reporting scheme on imports and exports of nuclear material and exports of specified equipment and non-nuclear material.

Initial implementation of Programme 93+2 measures began in June 1995 when the Board agreed to the Director General's plan to proceed immediately with the implementation of those

measures deemed to be within the legal authority provided by existing CSAs. Measures being implemented under existing legal authority include additional information from states regarding facilities that once contained or will, in the future, contain nuclear material subject to safeguards, the expanded use of unannounced inspections, the collection of environmental samples at locations where inspectors now have access and the use of advanced technology to remotely monitor the movements of nuclear material.

Safeguards has always required concerted actions by the IAEA Inspectorate, state authorities and nuclear facility operators. The strengthened safeguards system places an even greater emphasis on cooperation. Increased cooperation has a number of dimensions. One dimension is a systematic evaluation, within the interest and capabilities of individual State (or Regional) SSACS, of ways to achieve efficiencies through enabling actions by the SSAC and through a sharing of resources. A SSAC questionnaire dealing with the legal basis and technical capabilities of SSAC was sent to fifty-nine states and two regional systems. The responses provide the basis for ongoing consultations toward increased cooperation while preserving the IAEA requirement to come to its own independent conclusion.

The early provision of design information is incorporated in all new and most existing Subsidiary Arrangements. The Voluntary Reporting Scheme now includes fifty-two states. A total of 1,827 reports on the production of source material or the export of pre-safeguards nuclear material intended for non-nuclear uses and 298 reports on the export of equipment and non-nuclear materials as specified in INFCIRC/254/Part 1, Rev. 2 have been received. Letters have been sent to states requesting information on nuclear fuel cycle operations, particularly those prior to the starting point of safeguards, and on certain closed down or decommissioned nuclear facilities which: (i) were built but where nuclear material was never introduced or (ii) where the facilities were closed down and the nuclear material removed prior to the entry into force of the CSA. Most states have responded to these requests.

Initial implementation of environmental sampling has focused on enrichment facilities and certain kinds of hot cells. The objective is to provide increased assurances of the absence of undeclared operations involving enrichments to levels higher than declared or of reprocessing. Baseline sample collections have been carried out in eight enrichment facilities in five states and thirty-nine hot cell complexes in twenty-six states. The results of baseline sample collections are discussed with the state and the operator when they are available to the Agency. The IAEA Clean Laboratory for Safeguards for the handling, screening, analysis and archiving of environmental samples was commissioned in December 1995 and was fully operational in July 1996. The Network of Analytical Laboratories has been extended to include laboratories with specialized capabilities for the analysis of environmental samples. The extended network now includes five laboratories in four states with more expected in the near future.[2]

The information available to the Agency through its traditional safeguards activities, augmented by additional information from states, results from environment sampling, information collected from open sources and information from databases available elsewhere in the Agency, is systematically evaluated for indications of nuclear activities in CSA states, which may not be known to the Agency.[3] This process of broader information evaluation will be greatly strengthened with the additional information about a state's nuclear activities required under the Additional Protocol.

The Agency is preparing for increased utilization of unannounced routine inspections and the use of advanced technology to remotely monitor the movements of nuclear material through a series of demonstration field trials. Advanced technology in the form of digital surveillance cameras, electronic seals and other monitoring devices in conjunction with real time or near-real time transmission of data, appropriately authenticated and encrypted, to IAEA Headquarters is being

tested. The equipment is installed at locations in Switzerland, South Africa and the United States involving semi-static stores of direct-use material. The transmission of data is through both satellite systems and phone lines. The use of unannounced inspections for several applications is also being tested. The combination of remote monitoring and unannounced inspections provides the possibility of reduced inspection effort even within existing implementation criteria.

A basic tenet in meeting the requirement that the findings of the SSACs (e.g., nuclear material flows and inventories) are independently verified by the Agency is that the findings are reported to the Agency in a manner that, realistically, make them subject to verification. Historically, even though the reporting may have been within the terms of the agreement, the findings of the SSAC regarding nuclear material shipments and receipts and certain other safeguards events (e.g., movement of casks in a spent-fuel storage area) are often not reported to the Agency in a manner that makes the findings realistically subject to verification under circumstances short of continuous inspector presence. This has been the single biggest obstacle to the effective use of unannounced inspections, to the use of remote monitoring as a real verification tool (rather than simply the unattended collection of data) and to the "making full use" of the SSAC (para. 31, INFCIRC/153). The material accountancy reporting requirements contained in existing safeguards agreements are not directly addressed in the Additional Protocol. However, the voluntary provision of additional information on facility operations (Article 2.a.(ii), INFCIRC/540), Agency access to modern means of communication (Article 14, INFCIRC/540) and the requirement that states provide inspectors with multi-entry visas (Article 12, INFCIRC/540), were intended to provide the basis for improved nuclear transparency and for making full use of the SSAC through unannounced inspections and remote monitoring with resultant improvements in efficiency and effectiveness to the benefit of both the Agency and states. This was a primary objective of Programme 93+2.

Training courses dealing with the collection and handling of environmental samples, the Physical Model and enhanced observational skills are now part of the Department of Safeguards's regular training programme. Modules of the Introductory Course on Agency Safeguards for new inspectors are being added or modified to reflect the new implementation initiatives. Similar changes are being made in the training course for SSAC personnel. Other training courses dealing with information evaluation and design information verification at closed down facilities are under development.

Measures Contained in the Additional Protocol

The Additional Protocol is comprised of a foreword, a preamble, seventeen operative articles, an article containing definitions and two annexes. The IAEA Board of Governors used the foreword to express their expectations as to how the provision of the Additional Protocol would apply to CSAs and to other agreements for the item or facility specific application of safeguards (i.e., Voluntary Offer Agreements with the NWS and the INFCIRC/66 Agreements with India, Pakistan and Israel). The Board indicated their expectations that:

- states with CSAs would accept all measures in the Additional Protocol without change in substance;
- NWS would accept those measures consistent with their obligations under Article 1 of the NPT; and
- the INFCIRC/66 states would accept those measures pursuant to safeguards effectiveness and efficiency objectives.

The preamble contains a general objectives statement and reiterates admonitions contained in

safeguards agreements that safeguards is to be implemented in a manner that does not hamper economic and technological development for peaceful uses; that respects health, safety and physical protection requirements and the rights of individuals; that any information coming to the Agency in the course of implementing safeguards be kept confidential; and that the frequency and intensity of Agency activities be kept to the minimum consistent with the objectives of strengthened, more efficient safeguards.

Measures provided for in the operative articles of the Additional Protocol approved by the IAEA Board of Governors on 15 May 1997 include:

- information about, and inspector access to, all aspects of states' nuclear fuel cycle, from uranium mines to nuclear waste and any other location where nuclear material intended for non-nuclear uses is present;
- information on, and short-notice inspector access to, all buildings on a nuclear site;
- information about, and inspection mechanisms for, fuel cycle related research and development;
- information on the manufacture and export of sensitive nuclear-related technologies and inspection mechanisms for manufacturing and import locations;
- the right of the state to "manage" the access of Agency's inspectors to prevent the dissemination of proliferation-sensitive information, to meet safety or physical protection requirements or to protect proprietary or commercially sensitive information as long as such arrangements do not preclude the Agency's meeting the objectives of strengthened safeguards;
- the collection of environmental samples beyond declared locations when deemed necessary by the IAEA; and
- administrative arrangements that (i) improve the process of designating inspectors, (ii) provide for the issuance of multi-entry visas (necessary for unannounced inspections), (iii) provide IAEA access to modern means of communications, (iv) provide for the possibility of subsidiary arrangements to the agreement that stipulate detailed procedures on how selected measures will be implemented, and (v) describe the requirements for entry into force.

The Additional Protocol in combination with the Safeguards Agreement provides for as complete a picture as practicable of a state's production and holdings of nuclear source material, the activities for further processing of nuclear material (for both nuclear and non-nuclear application), and of specified elements of the infrastructure that directly support the state's current or planned nuclear fuel cycle. The elements of the Reporting Scheme are incorporated in the Additional Protocol as legal obligations. Annexes 1 and 2 provide detailed specifications of the activities, equipment and non-nuclear materials to be reported on under Articles 2.a.(iv) and 2.a.(ix) respectively.

Increased access for inspectors is provided to help assure that undeclared nuclear activities are not concealed within declared nuclear sites or at other locations where nuclear material is present. Inspection mechanisms are also provided for instances where there appear to be inconsistencies between all information available to the Agency and the declaration made by states regarding the whole of their nuclear programme.

The collection of environmental samples is a new technical measure available to the Agency under existing Safeguards Agreements. The Additional Protocol greatly adds to the value of this measure through increased access for inspectors. In addition to the so-called location-specific application of environmental sampling, the Additional Protocol also provides for the future application of environmental sampling in a monitoring or wide-area mode. Procedures to implement wide-area environmental sampling require approval by the Board of Governors.

The Additional Protocol also contains measures that address three long-term administrative problems. States will be obliged to provide inspectors with multi-entry visas covering at least a period of one year and to accept simplified inspector designation procedures whereby an inspector approved by the Board is automatically designated to a state party to the Additional Protocol unless the state objects within three months of the Board's action. Further, the Agency is assured of access to modern means of communication (i.e., satellite) existing in a state or, if satisfactory means do not exist, the state is obliged to consult with the Agency regarding other ways to meet Agency communication needs.

The relationship between the Additional Protocol and the Safeguards Agreement is specified in Article 1. The Safeguards Agreement and the Additional Protocol are to be read as a single document with, in cases of conflict, the provisions of the Additional Protocol prevailing. States' concerns regarding the confidentiality of sensitive information to be provided to the Agency under the Additional Protocol were addressed through requirements that the Agency maintain a stringent regime for the protection of such information and that the regime be periodically reviewed and approved by the Board of Governors.

Implementation Issues — How Far, How Fast?

At this juncture, it is not possible to predict how rapidly the Additional Protocol will come into force but initial indications are positive. At the conclusion of the Board of Governors' December 1998 meeting, thirty-eight states had signed Additional Protocols that had been submitted and approved by the Board. This includes Canada, China, Japan, the United States and the fifteen states comprising the European Union (one agreement covering the thirteen NNWS of the Union and separate ones for France and the United Kingdom). The Additional Protocols to the CSAs with Australia, the Holy See, Jordan, New Zealand and Uzbekistan have entered into force. Canada and Japan expect that their Additional Protocols will enter into force before the end of 1999. Meeting entry into force requirements for the states of the European Union and the United States may prove to be a lengthy process. A number of other states, including the remaining NWS — the Russian Federation — have initiated discussions with the IAEA Secretariat pursuant to their Additional Protocols.

Programme 93+2 was designed for states with CSAs with the IAEA. However, it was acknowledged early in the programme that the implementation of certain measures in other states (i.e., the NWS and the INFCIRC/66 states) could both enhance the effectiveness of programme implementation in CSA states and improve the effectiveness and efficiency of the safeguards that are implemented in these other states. This so-called "universality" issue was a central feature in the negotiation of the Additional Protocol. Each of the NWS indicated which of the measures contained in the Additional Protocol they are prepared to accept during the 15 May 1997 meeting of the Board. Both the Board and the open-ended committee of the Board that negotiated the Protocol expressed their expectation that adoption of the Additional Protocol in CSA states (the Additional Protocol in its entirety) and in non-comprehensive safeguards states (selected measures) would maintain a certain "parallelism". Several CSA states indicated that evidence of action toward adopting the Additional Protocol in other states would be necessary to obtain approval of the Additional Protocol in their parliaments.

Another significant implementation issue relates to the application of the Additional Protocol in the large number of states with a CSA that includes the Small Quantities Protocol (this suspends the implementation of a significant portion of Part 2 of INFCIR/153 based on the state's declaration

that it possesses no or little nuclear material subject to safeguards). In principle, the Additional Protocol applies to these states and a large educational effort will be required as a basis for their action in this regard (112 states have, or are expected to have, a Small Quantities Protocol as part of their CSA with the Agency).

Preparations by the IAEA Secretariat to implement the Additional Protocol involve the development of a whole new infrastructure. In the near term, this includes:

- guidelines and format for preparation and submission of declarations pursuant to Article 2 of the Additional Protocol for states with and without a Small Quantities Protocol;
- negotiation arrangements, the development of model language that anticipates the need to incorporate certain measures in subsidiary arrangements and the development of model language for required communications to states;
- the technical basis and guidelines for complementary access; and
- the development of detailed internal procedures for the conduct of activities associated with technical measures specified in the Additional Protocol.

An initial version of the guidelines for the Article 2 declarations was distributed to states in early September 1997. Much of the other work was planned for completion by the end of 1998. Evolution of the safeguards implementation criteria that provides for a full integration of the new measures with elements of the traditional system will take time and experience; however, the ingredients are now in hand for a greatly strengthened and more efficient safeguards system. Finally, the Additional Protocol, which provides the legal basis for the most intrusive multilateral verification regime in history, provides strong testimony to the political commitment of IAEA member states to preventing a repeat of the kind of situation uncovered in Iraq following the Gulf War.

Notes

1 R. Hooper, Strengthening IAEA Safeguards in an Era of Nuclear Cooperation, Arms Control Today, November 1995, p. 15; B. Pellaud, Safeguards and the Nuclear Industry, Core Issues, no. 5, The Uranium Institute, London, 1996.

2 J. Cooley, E. Kuhn and D. Donohue, The IAEA Environmental Sampling Programme, IAEA Symposium on International Safeguards, IAEA-SM-351/182, Vienna, October 1997.

3 A. Nilsson et al., Evaluating Information — Key Function of the New Safeguards System, IAEA Symposium on International Safeguards, IAEA-SM-351/122, Vienna, October 1997.

The CWC: a Unique OSI Framework

Leslie-Anne Levy

Whoever first uttered the phrase "the devil is in the details" might well have been a veteran of the Chemical Weapons Convention (CWC) negotiations. When faced with the labyrinthine task of ridding the world of poison gas weapons, the international community rose to the occasion and developed an equally complicated solution. The CWC — officially the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction — is the result of over a decade of negotiations at the Conference of Disarmament (CD) in Geneva. Although the treaty itself spans some fifty pages, the inclusion of annexes on verification and confidentiality boosts the total length to nearly two hundred pages. Contained therein are provisions covering everything from sampling procedures to inspector immunity.

The expansive goals of the CWC are not without precedent, as other arms control agreements have had related missions or incorporated similar tools. The Biological Weapons Convention banned an entire class of weapons and the Nuclear Non-Proliferation Treaty sent international inspectors from the International Atomic Energy Agency (IAEA) to industrial facilities. Thus, some elements of the CWC mandate have been part of the arms control world for some time already. What sets the CWC apart from these agreements, however, is the vigour with which the treaty embraces those goals and takes them one step further. The CWC pushes the envelope by banning production, stockpiles and use of chemical weapons and by introducing on-site inspections more widely into the chemical industry. These revolutionary provisions prompted one former Director General of the IAEA to comment:

> The CWC provides for verification by on-site inspections — both routine and challenge; it provides for investigation of alleged violations and for inspection of both military and civilian facilities; and it contains specific provisions for multilateral verification of destruction of chemical weapons production facilities. It marks a considerable achievement in arms control and disarmament. Successful implementation of the CWC will have an impact beyond the scope of the Treaty.[1]

One key element that differentiates the CWC from the rest of its arms control colleagues is its unique on-site inspection framework. Based on data declarations filed by member states with the CWC's implementing body, inspectors routinely venture to both military and industrial facilities on an unparalleled scale. In the event that concerns about compliance arise, states can call for a challenge inspection, a short-notice process governed by rules that balance the international community's interests in ensuring compliance and the inspected state's needs to protect confidential information. This paper will address the important elements of this unique on-site inspection construct, examining

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their structure as outlined in the CWC and their implementation during these first years of the Convention. Also examined are areas of concern that have emerged during the early stages of implementation, which could conceivably undermine the agreement if left unattended.

Establishing a Global Chemical Database

With the 29 April 1997 entry into force of the CWC, the world began the arduous process of rolling back the threat of chemical weapons. The treaty requires the destruction of chemical weapons arsenals and production facilities over a ten-year period. Commercial facilities fall into the CWC fold as well because of their activities with dual-use chemicals that can potentially be diverted to manufacture chemical weapons. By March 1999, the treaty could boast 121 members from all corners of the globe.

The CWC is simultaneously an extraordinarily broad and an exceptionally rational agreement. Implicit in the treaty is recognition that various chemicals and facilities pose diverse risks and thus must be monitored differently by the CWC's verification mechanisms. Since a kilogram of the nerve agent sarin is deadlier than an equivalent amount of a commercial chemical with dual-use applications, it makes sense that these substances and facilities handling them be monitored with varying degrees of intensity.[2] Similarly, the reporting obligations, allowances for facilities and dual-use chemical production, the frequency of inspections and the duration of inspections also vary depending on the dangers associated with the controlled chemicals and the purposes for which they are being used.

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The broad goals of verification in the context of the CWC are: to detect non-compliance with treaty provisions; to deter violations from occurring in the first place by raising the likelihood that inspectors would discover such activity; and to build confidence among member states that all are upholding its provisions. That sweeping mandate translates into several specific verification responsibilities: to monitor existing chemical weapons stockpiles; to ensure the destruction of declared chemical weapons; to identify and oversee the destruction of existing chemical weapons production facilities; and to monitor the peaceful application of dual-use chemicals and safeguard against their diversion.[3] In order to fulfil those obligations, negotiators developed a two-prong verification regime comprised of national declarations and on-site inspections.

The foundation of CWC verification is the set of declarations of past and present activities that each member is required to file with the Technical Secretariat.[4] When considered in the aggregate, these declarations allow the international inspectorate to assemble a reasonably comprehensive picture of chemical weapons capabilities and of facilities handling dual-use chemicals in member states. Information on military and industrial facilities heretofore sequestered from the eyes of all but those operating these plants must now be deposited with the Technical Secretariat on an annual basis. On-site inspections in turn grow out of the data in the declarations.

All industry facilities are subject to inspections, but for practical purposes only those that cross the high-use threshold automatically receive inspections. Those sites are considered to be of greater proliferation risk. Reporting is designed to describe whether certain chemicals are being produced or consumed at a given facility, as well as the quantities involved. (Table 1 summarizes these declaratory and inspection threshold quantities.) Through constant tracking of activities with dual-use chemicals, the inspectorate ostensibly can piece together use patterns of these substances

Table 1. Thresholds for annual data declarations and routine inspections

Type of facility	Type of activity to be reported for previous calendar year and anticipated for next calendar year	Annual production threshold for reporting	Threshold for inspections
Schedule 1	Production, processing, consumption, acquisition, import and export data	100g	100g
Schedule 2	Production, processing, consumption, import and export data	1kg benzilate 100kg (Amiton, PFIB) 1 metric ton for other Schedule 2 chemicals	10 kg benzilate 1 metric ton (Amiton, PFIB) 10 metric tons for other Schedule 2 chemicals
Schedule 3	Production, import and export data	30 metric tons	200 metric tons
Other chemical production facilities	Production data for previous calendar year only	30 metric tons for discrete organic chemicals containing phosphorus, sulphur or fluorine	200 metric tons

Source: Chemical Weapons Convention, Verification Annex, Part VI, para. 10, 11 and 28; Part VII, para. 3 and 12; Part VIII, para. 3 and 12; Part IX, para. 1 and 9.

that might signal diversion toward chemical weapons development. Even though inspectors will not set foot in every plant declared to be involved with scheduled chemicals, the Technical Secretariat retains a font of information on a broad spectrum of facilities.

Despite the illusion given by the mountains of declaration information received already, states have actually been slow to submit their declarations. As of 9 March 1999, the Technical Secretariat had received declarations from only 91 of the 121 states parties, not all of which are complete submissions. States failing to meet the declaration requirements are in violation of the treaty's clear deadlines for submission. These violations, however "technical" they may be, in fact translate into real implementation problems, since no routine inspections can occur without the declarations. What remains to be seen is the reaction of treaty members over coming months to this shirking of CWC obligations. What, if any, action will states take to urge violators to uphold the treaty's terms? Especially during this early phase of treaty implementation, member states should take care to demonstrate commitment to the agreement. Otherwise, states parties could develop bad habits, routinely missing deadlines or not taking seriously their obligations under the CWC. If straightforward requirements, such as filing declarations, are left unattended, treaty members run the risk of starting down a slippery slope where states pick and choose the treaty provisions they care to uphold.

Update on Activities of the Technical Secretariat

During the CWC's early years, the Technical Secretariat's field efforts have been extensive. From entry into force to 9 March 1999, some 430 routine inspections had taken place in close to thirty countries. By and large, these inspections unfolded smoothly.[5] Thus far, the majority of the

missions have focused on chemical weapon-related sites because they are considered to be of higher risk. The CWC requires that they be inspected first and more frequently than commercial facilities. After meeting the initial deadlines, the inspectorate began to look at industrial sites as well. As chemical weapon arsenals are destroyed over the coming decade, the focus will gradually shift from military to industrial facilities, a transition that is already evident. For example, in the first year of operations, 90% of the just over 200 inspections that unfolded occurred at military sites. By 9 March 1999, that distribution had shifted to 67% occurring at military sites and 33% at industrial locations. Table 2 offers a more detailed breakdown of the inspection distribution.

Table 2. Inspections under the CWC (through 9 March 1999)

Chemical weapons-related facilities	289
Schedule 1	44
Schedule 2	83
Schedule 3	314
TOTAL	430

Of the approximately 480 positions filled within the Technical Secretariat by the end of January 1999, nearly 200 were inspectors. The individuals comprising the inspectorate hail from some sixty countries. Some have decades of professional experience in analytical and industrial chemistry, as well as backgrounds in chemical and conventional munitions. In preparation for fieldwork as inspectors, these specialists augmented their professional skills with an additional five months of treaty-related training. The CWC inspectors spend upwards of 120 days per year in the field in conditions that are often difficult and stressful.[6]

In the 1999 budget approved in November 1998 by the Conference of States Parties, verification costs are budgeted at approximately $38 million, or 55% of the near $69 million total annual budget of the Organisation for the Prohibition of Chemical Weapons (OPCW).[7] Some 300 inspections are anticipated during 1999, a slight increase over the activities of the previous year.[8] The costs of running on-site inspections have been less than originally expected.[9] In 1998, inspections were budgeted at just over $32 million, decreasing to $30 million in 1999. The drop in cost is largely the result of innovative inspection planning and greater than expected operational efficiency on the part of the inspectorate. Inspections have been conducted with fewer inspectors than originally thought necessary. The use of sequential inspections has also lowered costs, allowing inspectors to conduct multiple inspections at different facilities during a single trip. Such steps contribute to improved overall long-term operational efficiency that some might consider uncharacteristic of an international agency.

The CWC's More Intrusive Arm: On-Site Inspections

If declarations form one leg of the CWC verification framework, then on-site inspections — both routine and challenge — form the other. Routine inspections follow the initial declarations and are designed to confirm that the information provided by states is indeed an accurate reflection of the activities taking place at a given site. Challenge inspections pick up where routine visits leave off, being called upon only in instances of credible suspicions of non-compliance.

Once all the initial declarations are filed, thousands of military and industrial facilities will be eligible for inspection under the CWC. However, the actual incidence of inspections will vary from facility to facility according to the nature of activities taking place at the site. That is, facilities housing chemical warfare agents found on Schedule 1 will be watched most closely. On the other hand, inspectors will visit less frequently sites where Schedule 2 and Schedule 3 chemicals are present.[10]

The treaty stipulates that inspectors are to be granted "unimpeded access" to the site,[11] provided that their business is conducted expeditiously and with as little inconvenience to the inspected state as possible.[12] The Technical Secretariat gives inspected states anywhere from 36 to 120 hours advance notice of a routine inspection, depending on the type of facility being visited and whether it is the first time a site is being inspected. Prior to each inspection, the inspectorate engages in several weeks of preparation including preliminary evaluation of data from declarations, preparation of the inspection plan and mandate, assignment of the inspection team members, assembly of travel documents and equipment, and briefings to inform inspectors about the location they are to visit.

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Procedurally, standards and guidelines exist for application during inspections at all facilities.[13] Upon arriving at the designated point of entry, inspectors are escorted to the site within twelve hours. There they spend a maximum of three hours being briefed by staff on specifics of the facility's activities and safety requirements. Once on site, the inspectors proceed within the parameters delineated in the treaty itself and in the facility agreement, if applicable. Inspectors have the right to examine records and interview personnel. They may also visit relevant parts of the facility, including chemical production, storage and waste treatment areas. If necessary, inspectors can ask to take photographs or samples. In addition, they can place seals and tags on munitions. Within twenty-four hours of completion of the visit, inspectors brief host personnel on their preliminary findings. Back at The Hague, inspectors review field results with Technical Secretariat analysts. A final report that includes comments from the inspected party is prepared within thirty days.[14]

The description of these inspections as "routine" is somewhat of a misnomer. True, they are less contentious and politically charged than the more intrusive challenge inspection. True, inspected states parties are notified in advance of the arrival of Technical Secretariat personnel. True, step-by-step procedures on how to conduct the inspections — including time allotments for briefings and approved equipment — are laid out in the CWC's Verification Annex, subsequent Conference of States Parties decisions and facility agreements. But given the tremendous variety of facilities that fall under the umbrella of the CWC, each visit reflects the unique nature and activities of that particular location. Inspections are not cookie-cutter field trips; they are opportunities to develop a clearer picture of a state's military and industrial chemical activities. As one veteran of the nuclear safeguards experience noted, "... every inspection is the opportunity to discover."[15] In short, even routine inspections can turn up unexpected activities at declared sites.[16]

Although the routine inspection process has run smoothly, a few potholes have emerged along the way. One area of concern grows out of the protection afforded inspectors and the notebooks they use during inspections. The CWC provides the most stringent of protections for its inspector corps, incorporating key provisions of the Vienna Convention on Diplomatic Relations. Inspectors, their papers and correspondence are considered inviolable.[17] Such fundamental protections enable inspectors to be frank in their field analysis, take notes and make assessments based on the evidence before them, free from risk that their private materials will be confiscated. Although this protection is central to inspection activities, controversy over its application has surfaced among member states as to whether inspector notebooks are indeed inviolable. Some treaty members have argued that inspected states retain the right to make copies of all materials amassed by inspectors during the course of their visits.[18] Others maintain that notebooks are off-limits, fearing that inspectors might be hesitant to pen critical assessments if they knew that their private papers were liable to be made available to inspected parties.[19] The treaty includes such immunities specifically to ensure frank inspector assessments. Removing those protections runs contrary to the spirit of the agreement.

Transparency among member states has also arisen as a sensitive topic, with members not wanting information gleaned from declarations and routine inspections to be shared with others. Such restrictions on flows of information undermine the confidence-building and reassuring role of routine inspections. With time, however, that sensitivity may wane for several reasons. First, as the routine inspections continue, states may become more comfortable with the on-site visits. The procedures for guiding inspectors through sites and providing them with the necessary information will grow more familiar as routine visits continue during the coming years. Second, states may also become more confident in the Technical Secretariat's ability to protect sensitive information. These first years have proven that the treaty's inspection system indeed works if treaty members let it: proprietary data can be guarded as inspectors conduct their duties according to the highest professional standards.

Upping the Ante: Challenge Inspections

While other arms control agreements include an on-site activity described as "non-routine",[20] those inspections have very limited effectiveness because inspected states have the right to refuse an inspection request or only declared installations are eligible for on-site visits. The "anywhere, anytime" foundation of the CWC challenge inspection framework establishes a rigorous framework that does not fall prey to the same shortcomings.

A challenge inspection can fill the information void that routine visits simply cannot address, namely at undeclared facilities. Challenge visits are geared to examine substantive accusations raised by one member state about another and are more narrowly focused, designed to play an investigative role regarding a specific question or set of questions. To guard against capricious challenge inspection requests, inspectors cannot be dispatched simply at the hint of a frivolous allegation.[21] Rather, the requesting party must show good cause for suspicions of non-compliance.[22] If the Executive Council decides by a three-quarters vote that the inspection is not merited, the request will be rejected. The inspections unfold on extremely short notice, with inspectors arriving at the challenged state's designated point of entry in as little as twelve hours from the time the Director-General provides notice of the inspection. Strict time guidelines govern the challenge visit, as shown in Figure 1. Despite concerns before the CWC's entry into force, no abuse of the challenge inspection mechanism has occurred. In fact, none have actually transpired.[23]

Challenge visits are geared to examine substantive accusations raised by one member state about another and are more narrowly focused, designed to play an investigative role regarding a specific question or set of questions.

Although challenge inspections at declared sites are indeed possible, prohibited activities are more likely to occur at undeclared facilities, away from the eyes of inspectors conducting routine visits. Consequently, inspectors on a challenge visit will need to bring a full suite of equipment (for example, a gas chromatograph/mass spectrometer and non-destructive evaluation equipment) in order to be prepared to handle a full range of contingencies. Due to their sensitive nature, challenge inspections would proceed based upon "managed access" wherein inspectors negotiate sufficient access to address the core issues of the challenge without exposing confidential materials of the inspected party. Inspected states must take steps to demonstrate compliance, but they need only present information absolutely necessary to do so. They are not required to reveal sensitive information unrelated to the challenge inspection mandate. The managed access concept bridges the gap between states' interests in shielding legitimate secrets and inspectors' needs to confirm or dismiss suspicions.[24] A challenged facility can shroud equipment, shield key documents and log off computers. Inspectors

retain their rights to use approved equipment and collect documentation, photographs and samples, insofar as that information is relevant to the ongoing compliance investigation.

Upon conclusion of the challenge visit, the inspection team would file a fact-based report conveying the data accumulated during the on-site mission and commenting on the degree of cooperation afforded them by the host state. The Technical Secretariat files a report with the Executive Council, which is later disseminated to all states parties. The Executive Council reviews the information in the report and makes recommendations to the Conference of States Parties.

That the challenge inspection provision has not yet been called into action inspires both relief and uneasiness on the part of CWC observers. One of the oft-cited arguments against the inclusion of this tool in the CWC structure was that it would be a cover for "fishing expeditions" in member states for proprietary information. No such abuse has occurred during these initial months, perhaps an indication that the message that a challenge inspection was to be only a last resort option indeed made it through to states parties. However, an absence of challenge visits does not automatically signify that concerns about compliance do not exist. Only a handful of member states have exercised their right to review declarations, yet rumours of incomplete submissions exist. If members have legitimate compliance concerns but are hesitant to make use of the treaty's tools to address them, inevitable questions arise as to whether the treaty is actually working as designed. Furthermore, since the challenge inspection provision is not being used, the Technical Secretariat runs the risk of being ill-prepared when the time comes for a real challenge inspection — a situation that is virtually guaranteed to be both highly stressful and highly politicized. In light of that, additional training exercises could well play a valuable role in ensuring that future challenge inspection missions run as smoothly as possible.

Conclusion

All things considered, the CWC's first two years have proceeded relatively smoothly. The inspectorate has set into motion a complex arms control verification system, visiting hundreds of military and commercial facilities and analyzing thousands of pages of declarations. The inspection process has unfolded more efficiently than originally envisioned. No earth-shattering clashes have emerged among member states. That being said, the time for celebration has not yet arrived, as the treaty remains in the early stages of implementation. With the treaty still so young, the world should refrain from issuing final judgement on either the CWC's achievements or shortcomings. Areas of concern certainly exist, be they related to declarations or on-site inspections. Treaty observers indeed should be aware of the sticking points that are emerging and act to ensure that they do not grow into larger problems. Only time will tell whether these contentious issues — which are not treaty-threatening at the moment — develop into more sizeable rows.

What is certain, however, is that the CWC has taken arms control into uncharted territory. The treaty's breadth and the tools used to implement it go further than previous disarmament agreements. The coupling of routine and challenge on-site inspections offer member states a unique way both to demonstrate their upholding of the treaty's provisions and to address their suspicions of non-compliance. The novel on-site inspection framework of the CWC sets a precedent that balances fairness and a high degree of intrusiveness, providing tangible steps to help translate the goal of chemical disarmament into reality.

The CWC has taken arms control into uncharted territory.

Notes

[1] Hans Blix, Statement to the First Session of the Conference of the State Parties of the Organisation for the Prohibition of Chemical Weapons (OPCW), 8 May 1997.

[2] The CWC establishes three lists, or schedules, that categorize chemicals according to their toxicity. Schedule 1 chemicals are military agents and super toxic chemicals that have little or no commercial use. Schedule 2 includes substances that have limited commercial applications but are considered high risk chemicals because they are direct chemical weapons precursors. Schedule 3 chemicals are used in large quantities commercially, but are also precursors. Some Schedule 3 chemicals — phosgene, for instance — have even previously been used on the battlefield. See the Chemical Weapons Convention, Annex on Chemicals.

[3] Thomas Stock, History of the Negotiations on the CWC — Short Overview, SIPRI-Saskatchewan-Frankfurt Research Group on Effective Implementation of the Chemical Weapons Convention, Paper 13, 1995, p. 41.

[4] To implement its provisions, the CWC created the Organisation for the Prohibition of Chemical Weapons (OPCW), based in The Hague, The Netherlands. The OPCW is comprised of three parts: the Technical Secretariat (the inspectorate that carries out the CWC's verification activities); the Conference of the States Parties (the oversight body that meets annually and is composed of all states parties, each of equal vote); and the Executive Council (the forty-one member executive arm that meets several times a year to more closely oversee the inspection activities). See the Chemical Weapons Convention, Article VIII.

[5] One survey conducted during the early stages of implementation rated the level of cooperation on the part of inspected parties as above average in 90% of the completed missions. Progress in The Hague: Quarterly Review No. 21, The CBW Conventions Bulletin, No. 39, March 1998, p. 18.

[6] Inspectors "will be expected to undertake extensive travel under less than typical business trip conditions with a high likelihood of unpredictability and involving the physical and mental stresses of an inspection atmosphere." Preparatory Commission for the Organisation for the Prohibition of Chemical Weapons, Note by the Executive Secretary: Recruitment and Training of Technical Personnel and Support Staff, PC-IV/6, 21 September 1993.

[7] Assuming 2 Dutch Guilders (NLG) to the U.S. dollar. OPCW, C-III, a Round of Intense Discussions, OPCW Synthesis, Issue 1/99, p. 8. For a full breakdown of the 1999 budget, refer to Organisation for the Prohibition of Chemical Weapons: Programme and Budget 1999, document C-III/DEC.16, 23 November 1998.

[8] From April to December 1997, approximately 125 inspections took place. During 1998 that number increased to around 250.

[9] One analyst opposing the treaty gauged the total number of inspectors needed to implement the CWC to be close to 500, boosting estimated annual labour costs to $145 million. That figure did not include travel, equipment or other administrative expenses. See Kathleen Bailey, Problems With a Chemical Weapons Ban, Orbis, Spring 1992, p. 245.

[10] The frequency of visits to Schedule 2 sites will be determined based on a risk assessment garnered during the facility's initial inspection, which is to take place within three years of the treaty's entry into force. Chemical Weapons Convention, Verification Annex, Part VII, para. 16 and 18. Schedule 3 facilities outnumber the others but are considered to be of lower risk. Thus, inspections will occur there even less frequently, with each state receiving no more than twenty per year. Chemical Weapons Convention, Verification Annex, Part VIII, para. 16.

[11] Chemical Weapons Convention, Verification Annex, Part II, para. 45.

[12] Chemical Weapons Convention, Verification Annex, Part II, para. 40.

[13] These steps are outlined in the Chemical Weapons Convention, Verification Annex, Parts II–IX. For a more inside account of on-site inspections, see OPCW, Through the Eyes of an Inspector: Preparations, Reporting, Debriefing, OPCW Synthesis, Issue 1/99, p. 9.

[14] The tight chain of custody for inspection reports and the strict confidentiality requirements governing much of the information contained in them put the Technical Secretariat under real time pressure to get complete and final reports ready within the thirty-day window.

[15] Statement by David A. Kay in Administering the Chemical Weapons Convention: Lessons from the IAEA, Amy E. Smithson, ed., Occasional Paper no. 14, The Henry L. Stimson Center, Washington, DC, March 1993, p. 23.

[16] For example, routine inspections by the IAEA at the Democratic People's Republic of Korea's seven nuclear facilities unearthed discrepancies between what activities they admitted to pursuing and what the inspectors actually saw.

[17] Chemical Weapons Convention, Verification Annex, Part II, para. 11 and 12.

[18] Chemical Weapons Convention, Verification Annex, Part II, para. 50.

[19] For more detailed examination of the immunity issues, see Amy E. Smithson, Rudderless: The Chemical Weapons Convention at 1½, Report No. 25, The Henry L. Stimson Center, Washington, DC, September 1998, p. 30–32.

[20] Examples include the unannounced inspections of the IAEA's safeguards system and the short-notice inspections

under the Intermediate-Range Nuclear Forces Treaty.

[21] Information in support of a challenge inspection request can include: the nature of the suspected activity, the types and amounts of chemicals or munitions thought to be involved, and time frame in which the treaty violations are thought to have occurred.

[22] The request originates with the state party. The Director-General then relays the challenge to the Executive Council. Should the Executive Council decide ex post facto that the right to call for a challenge inspection has been abused, the requesting party can be assessed the costs of the inspection. Chemical Weapons Convention, Article IX, para. 23.

[23] In February 1998, a challenge inspection exercise held in the United Kingdom gave participants the opportunity to test out procedures for guarding confidential proprietary information while still managing to address the concerns of the challenger. The exercise proved a useful endeavour, as it underscored the need for inspectors to gain field experience with equipment and procedures prior to an actual challenge visit. Consequently, the Director-General urged the addition of similar exercises to the 1999 budget. Progress in The Hague: Quarterly Review No. 22, The CBW Conventions Bulletin, June 1998, no. 40, p. 11.

[24] The inspectors' access is limited to only the areas of a facility or the equipment that is crucial to addressing the challenger's allegations. Chemical Weapons Convention, Verification Annex, Part X, para. 44.

START Implementation: A Report

Joseph P. Harahan

As an arms control treaty, the Strategic Arms Reduction Treaty (START) of 1991 is one of the largest and most comprehensive post-Cold War agreements. In forty-seven pages of text and 650 pages of protocols, annexes, definitions, statements and memoranda of understanding (MOUs), the treaty codifies in international law specific obligations and rights that the United States and Soviet Union[1] (and its four successor states — the Russian Federation, Ukraine, Belarus and Kazakhstan) had to carry out in reducing their nuclear weapons and delivery systems — the land-based missiles, intercontinental bombers and submarine-launched ballistic missiles (SLBMs). Over nine years of negotiations (1982–1991) produced an extremely detailed treaty that included all of the signatory parties' strategic offensive arms, as well as all strategic delivery vehicles and attributed nuclear weapons. One way to understand the complex fifteen-year international agreement is to focus on four key phrases or words: "arms control", "strategic arms", "reduction" and "treaty".

In seeking to reduce all arms control treaties to their barest essentials, scholars have observed that states engaging in arms control negotiations are "generally military rivals and potential enemies in war".[2] Mutually suspicious, these rival states developed or acquired land and sea-based armaments for national protection, or in the case of these two nations, for nuclear deterrence. During the Cold War (1948–1989), both the United States and the Soviet Union built very large, militarily credible nuclear deterrence forces that consisted of specialized military personnel, intercontinental strategic delivery systems (bombers, missiles and submarines), thousands and thousands of nuclear weapons, national fail-safe command and control systems, and operational war plans. During the first two decades of the Cold War, American and Soviet leaders and their senior military commanders reacted strongly to the perceived threats of each other's military forces. Threatened and genuinely afraid, they engaged in a full-scale nuclear arms race. As a consequence, by the early 1960s both the United States and the Soviet Union had developed and fielded so many bombers, fighters, missiles, artillery and submarines capable of delivering nuclear weapons that they had achieved superpower status.[3]

Then beginning in 1963 and continuing over the next twenty-five years American, Soviet, British, French and other national leaders negotiated and signed a series of arms control treaties and agreements that defined, limited and, to a degree, stabilized the nuclear arms race. The string of treaties began with the Limited Test-Ban Treaty of 1963, continued with the Non-Proliferation Treaty (NPT) in 1967, the Strategic Arms Limitation Interim Agreement and the Anti-Ballistic Missile Treaty in 1972, Strategic

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Arms Limitation Treaty (SALT) II in 1979, the Intermediate-range Nuclear Forces (INF) Treaty in 1987, and START in 1991.[4] All of these treaties represented major, sustained bilateral and multilateral diplomatic efforts. For START, for example, United States Secretary of State James A. Baker testified to the Senate that the United States had sent its negotiators to Geneva for nine years, had conducted special ministerial sessions in Geneva, Washington, DC, Houston and Moscow, and had convened and participated in presidential-level summit meetings in Geneva (1985), Reykjavik (1986), Washington, DC (1987), Moscow (1988), Malta (1989) and Washington, DC (1990).[5] While not every aspect of these high-level ministerial meetings or summits was exclusively devoted to the nuclear arms reduction treaty issues, they were a major part of all of them. For the Soviet Union, negotiating these arms limitation and reduction treaties held a central role in their diplomacy for more than twenty years.[6] By the time that Presidents George Bush and Mikhail Gorbachev signed START in the Kremlin on 31 July 1991, there had been a prolonged effort to craft arms control agreements that would limit and stabilize the superpowers' nuclear forces.

Treaty negotiations were always prolonged and difficult. Over and over the same problems surfaced. Mutual suspicions meant that verification methods would remain outside of national territories: no intrusive on-site inspectors would be prying around sensitive military bases and facilities. Asymmetrical force structures made resolution on equal numerical reductions a problem. Then there was the continuing problem of the military services and scientific laboratories developing significant new technologies and modern strategic weapons, such as road- and rail-mobile intercontinental ballistic missiles (ICBMs), SLBMs, multiple independently targeted re-entry vehicles, and long-range cruise missiles. These new technological developments complicated treaty negotiations significantly when it came to defining new types of weapons, accounting for them when deployed, and verifying their distinguishing characteristics during proposed on-site inspections. There were times when national negotiators were instructed to exclude discussions of the new technologies, because military commanders and strategists believed that they made their nuclear forces stronger.[7]

Further complications came in the late 1970s and 1980s. Both the United States and the Soviet Union developed and fielded new ballistic missile systems that caused an expansion in the superpowers' nuclear forces. With microelectronics, new gyroscopes and reengineering, the size and weight of the nuclear warheads were reduced. By 1979, the Soviet Union had developed, tested and fielded 308 SS-18 ICBMs with ten nuclear warheads each. The United States began deploying large, modern Trident submarines with ten warheads per missile. In addition, the Soviet Union was fielding a powerful force of more than 650 road-mobile SS-20 intermediate-range ballistic missiles with three nuclear warheads each. These missiles placed all of NATO at risk. In response, the United States, with the concurrence of the alliance nations, deployed in Western Europe 234 modern Pershing II missiles and 443 mobile ground-launched cruise missiles capable of launching nuclear warheads. These new missiles threatened the Soviet Union and the other Warsaw Pact nations. By the mid-1980s it seemed as if both of the world's superpowers were engaged in a renewed nuclear arms race. To some strategists and senior leaders in both the Soviet Union and the United States, the existence of a strong nuclear deterrence force was seen as superior to signing and implementing incomplete and unverifiable arms control treaties.[8]

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Consequently, by the late 1980s there were two powerful, often conflicting forces in every serious negotiation over the future of the American and Soviet nuclear forces. The first imperative was to limit the nuclear arms race by negotiating, signing, ratifying and implementing nuclear arms control treaties, which sought to define, channel and constrain nuclear weapons. In both nations, national leaders, congressional representatives and Duma legislators endorsed these treaties. At the same time the second driving force was the development of new weapons and technologies that promised an ever more invulnerable nuclear force that could ensure national survival, deter aggression

and lessen any attempts at national or alliance intimidation. If the object was national survival, then modern nuclear forces were not just desirable but necessary. Most of the same leaders, representatives and legislators who endorsed the arms control agreements, supported — even demanded — modernization of their nation's nuclear forces. START ended this dichotomy.

A Treaty That Imposed Controls Over all Strategic Offensive Arms

In START, "arms control" meant capping the bilateral nuclear arms race in two ways. First, it established numerical ceilings, called "central limits", on strategic delivery vehicles and deployed warheads. Seven years after the treaty entered into force, the United States and Soviet Union had to have no more than 1,600 strategic delivery vehicles — bombers, ballistic missiles and submarines; and no more than 6,000 deployed warheads. These limits are in effect for fifteen years; only withdrawal from the treaty could alter these numerical ceilings and reignite a nuclear arms race. The treaty contained sublimits for two types of strategic offensive weapons. For deployed mobile ICBMs, there could be no more than 1,100 warheads, and for the Soviet's multiple-warhead, fixed-silo SS-18 ICBM force, there could be no more than 1,540 warheads. A further provision limited the number of ballistic missile warheads, as opposed to strategic bombers, to 4,900 warheads. Second, the treaty closed off several types of future strategic weapons, either by banning them outright or by setting up a system to carefully monitor the advent of new missile technologies. Thus, there was an outright ban on the development of any new type of ICBMs or SLBMs with more than ten warheads. Treaty negotiators reached agreement on a series of definitions that detailed what constituted a "new" type of ballistic missile and how warheads would be attributed to these future systems. The treaty also banned development of multiple-warhead, long-range, nuclear air-launched cruise missiles. It limited the number of ballistic missiles in storage depots and training facilities. There were several other limitations on ballistic missile launchers and attributable warheads.

The reason that the comprehensive treaty contains so many provisions, annexes, statements and protocols controlling these strategic weapons is that the two signatory nations had agreed after nine years of negotiations to reduce their nuclear forces by only 40%. This meant that nearly 60% of the nuclear delivery systems and warheads would remain deployed in the field with the operational military commands. Those nuclear forces would constitute each nation's strategic deterrence forces. An implicit assumption, which emerged during treaty negotiations, was that both the United States and the Soviet Union would be modernizing their operational nuclear forces in the future. Consequently each demanded assurances in the treaty that the other nation could not exploit new weapons technologies to gain a strategic advantage, either through developing new weapons or by modifying existing ones. Future technologies, especially ballistic missiles, were subject to limits, testing restrictions, special monitoring, cooperative measures and special on-site inspections. Controlling future strategic arms modernization efforts became one rationale for negotiating and agreeing to START's complex and comprehensive verification system. It was designed to monitor both future and existing strategic nuclear operational forces.

With regard to the existing strategic forces, both sides acknowledged that over the fifteen-year duration of the treaty their nuclear combat commands would be experiencing constant changes. In normal times, there would be routine deployments of submarines at sea, movement of road-mobile missile regiments across land roads and fields, flights of long-range heavy bombers, periodic maintenance of ballistic missiles located in the fixed ICBM silos, and all sorts of exercises for operational, security and safety reasons. In abnormal times there would be major changes in the structure of the nuclear forces.

When the Soviet Union collapsed and the geopolitical system changed in the early 1990s, there were huge shifts in the composition and character of the nuclear forces. Ukraine, Belarus and Kazakhstan agreed in the May 1992 Lisbon Protocol that they would be parties to START and would eliminate all of their inherited strategic missiles, bombers and warheads. They also declared their intention to sign and ratify the 1967 NPT. The Lisbon Protocol and the NPT drove the Ukrainian, Belarusian and Kazakh decisions to eliminate their ballistic missiles and bombers, as well as transfer their warheads to the Russian Federation for reprocessing and destruction. In every treaty nation, including the United States and the Russian Federation, there were reductions in strategic bombers, ICBM missiles and silos, ICBM road-mobile launchers, and SLBM missiles and submarines. In addition, excess submarine facilities, air bases and missile fields were being closed.

Two treaty nations, the United States and the Russian Federation, were modernizing a part of their nuclear forces with new ballistic missiles at the same time they were reducing older weapons. In both nations, selected ICBM launchers were being converted from older to newer missiles. As a consequence, new facilities were being opened. Also, from 1995–1998, ballistic missiles were being flight-tested to measure reliability, accuracy and performance. In addition, production continued on certain types of new ballistic missiles, their launchers and new strategic bombers. These new strategic weapons were being deployed to operational units in the field. Essentially, START established an "arms control" system to monitor all of the activities of the operational nuclear forces whether they were deployed, stored, transported or being reduced, over the vast territories of the former Soviet Union and the United States.

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The treaty's monitoring system began with a provision authorizing the use of, and non-interference with, a signatory nation's National Technical Means (NTM). This term, NTM, meant that each signatory nation had the right in international law to unimpeded use of its national satellite and other monitoring systems to verify treaty compliance. First authorized in the SALT I Interim Agreement in 1972, NTM had become so accepted in international arms control treaties by 1991 that it became the cornerstone for monitoring all of the strategic offensive weapon systems included in START. Recognizing the primacy of the existing NTM monitoring system, the treaty authorized specific, additional "cooperative measures". Seven times a year, one party could request another to display their open road-mobile launchers, rail-mobile launchers and heavy bombers at their operational bases for observation by NTM. During every missile test flight, parties were obligated to exchange telemetry data tapes, interpretative data and acceleration profiles. This telemetry data allows all parties to ensure that the missiles being flight-tested do not exceed the agreed criteria for new missile types.

Prior to the signing of the treaty in July 1991, the United States and the Soviet Union had exchanged extensive data on the numbers, locations and facilities of all of their strategic offensive forces. Later in January 1995, following the last of the five nations' ratification and the treaty's entry into force in December 1994, new, updated force data was exchanged by all signatory nations. Since then, the five nations have exchanged updated force data every January and July. It is this force data that is compared with the information independently gleaned by each nation's NTM. Not only does the treaty require the parties to exchange this semi-annual data, but it also requires special notifications on the movement of non-deployed ICBMs, SLBMs and heavy bombers. When a strategic bomber, equipped with a long-range air-launched cruise missile, takes off for a training mission for longer than twenty-four hours, a message must be sent to the other treaty signatory nations. Given the complexity of the nuclear forces, thousands and thousands of messages are transmitted each year under the treaty.

The treaty's "arms control" system consists of the authorized use of NTMs, the mandatory biannual force data, the nearly continuous notifications and data derived from twelve types of on-site inspections and exhibitions. They are: baseline data inspections, data update inspections, new facility inspections, suspect site inspections, re-entry vehicle inspections, post-exercise dispersal inspections, conversion or elimination inspections, close-out inspections, formerly declared faculty inspections, technical characteristics exhibitions, distinguishability exhibitions and heavy bomber baseline exhibitions. In addition, the treaty authorizes the national inspectors of the United States and the Russian Federation to conduct continuous monitoring at the perimeter of one mobile ICBM assembly facility in each nation.

A Treaty That Incorporated All Strategic Offensive Arms

In July 1991, the date of the treaty signature, the United States stated in its official declaration that it had 2,246 ICBMs, SLBMs and heavy bombers, and 11,769 warheads.[9] The Soviet Union stated that it had 2,498 strategic delivery vehicles and 10,271 warheads.[10] On 31 July 1991, the United States declared that it had deployed 1,000 ICBMs in three weapon systems — Minuteman II, Minuteman III and Peacekeeper. The United States had 672 SLBMs deployed in three systems — Poseidon, Trident I and Trident II. For the long-range, heavy bombers, the United States declared 574 aircraft in two systems, the B-52 (H, G models) and the B-1B. A heavy bomber was defined as a bomber with a range of greater than 8,000 kilometres, or equipped for delivering long-range nuclear air-launched cruise missiles (ALCMs). During treaty negotiations, each of these ICBM and SLBM weapon systems were assigned, according to an agreed-upon formula, an "attributable" throw-weight and number of warheads. In the same way, treaty negotiators assigned a number for the nuclear weapons, including ALCMs, attributable to each deployed long-range bomber. The United States' treaty weapon systems, warheads and sites are included in Table 1.

The Soviet Union's strategic nuclear forces included a larger number of weapon systems than the United States. By 1991 when the treaty was signed, the Soviet Union had developed, tested and deployed in its nuclear force ICBMs in multiple systems — SS-11s, SS-13s, SS-17s, SS-18s, SS-19s, SS-24s and SS-25s. One of these ICBM types, the SS-25, was a road-mobile missile system; one was a rail-mobile system, the SS-24; while six were deployed in fixed silo-based launchers — SS-11s, SS-13s, SS-17s, SS-18s, SS-19s and SS-24s. Within its nuclear forces, the Soviet Union had 940 SLBMs deployed in five systems — SS-N-6s, SS-N-8s, SS-N-18s, SS-N-20s and SS-N-23s. Each of these ICBMs and SLBMs was assigned, according to a negotiated treaty formula, an "attributable" number of warheads and throw-weight. For long-range bombers, the Soviet Union declared 162 aircraft in two types, with several variants. The types were the TU-160 Blackjack bomber and the TU-95 Bear bomber. For the TU-95s there were seven variants. Associated with the Soviet long-range bombers were two types of long-range, nuclear air-launched cruise missiles — AS-15As and AS-15Bs. All of the Soviet Union's bombers, missiles and sites declared as treaty items in START are included in Table 1.

Following the collapse of the Soviet Union in December 1991, its strategic offensive weapons were divided among four of its successor states — the Russian Federation, Kazakhstan, Belarus and Ukraine. The Russian Federation, as the direct successor state inherited the bulk of all the strategic nuclear forces. Essentially, the other three states received those strategic forces that were based, stored, tested or manufactured on their national territory. In real terms, the Russian Federation's SRF and its Air Force operated, maintained and secured all of the operational nuclear weapons and warheads, regardless of the national ownership.[11]

Table 1. American and Soviet START nuclear weapon systems in 1991

U.S. nuclear weapon Systems	Quantity Deployed SNDVs	Accountable warheads	USSR nuclear weapon systems	Quantity deployed SNDVs	Accountable warheads
ICBMs:			**ICBMs:**		
MM-11	450	450	SS-11	326	326
MM-111	500	1,500	SS-13	40	40
PK (silo)	50	500	SS-17	47	188
Total	**1,000**	**2,450**	SS-18	308	3,080
			SS-19	300	1,800
			SS-24 (silo)	56	560
			SS-24 (mobile)	33	330
			SS-25 (mobile)	288	288
			Total	**1,398**	**6,612**
SLBMs:			**SLBMs:**		
Poseidon	192	1,920	SS-N-6	192	192
Trident I	384	3,072	SS-N-8	280	280
Trident II	96	768	SS-N-17	12	12
Total	**672**	**5,760**	SS-N-18	224	672
			SS-N-20	120	1,200
			SS-N-23	112	448
			Total	**940**	**2,804**
Heavy bombers:			**Heavy bombers:**		
B-52 (ALCM)	189	1,968	Bear (ALCM)	84	
B-52 (non-ALCM)	290	290	Bear (non-ALCM)	63	63
B-1	95	95	Blackjack	15	120
Totals	**574**	**2,353**	**Totals**	**162**	**855**
Total	**2,246**	**10,563**		**2,500**	**10,271**

SNDV Strategic nuclear delivery vehicle
Sources: Annex A, B & C, *START*, 31 July 1991.

Kazakhstan inherited from the former Soviet Union over 100 ICBMs and strategic bombers. At the large SRF base at Zhangiz-Tobe and Derzhavinsk, the Soviets had 104 SS-18 ICBMs, equally divided between the two sites. Each of the SS-18 ballistic missiles had ten warheads, making a total of 1,040 for these fixed-silo, heavy ICBMs. In addition, the new nation inherited forty TU-95 Bear strategic bombers based at Semipalatinsk. Within Kazakhstan, there were two testing facilities that fell under START, one at Leninsk, the other at Semipalatinsk. Finally, the Soviets had located a rocket motor production facility at Pertropavlovsk in northern Kazakhstan. All of these weapons, warheads and facilities fell under the provisions of START. Kazakhstan was the first of the former republics to ratify the treaty, with its parliament voting its approval in July 1992. Eighteen months later, it acceded to the NPT, which was a condition demanded by the Russian Federation for START to enter into force.[12]

Belarus was the smallest of START nations. It had the fewest nuclear weapons, warheads and facilities of any signatory nation. In the 1980s, the SRF had positioned three regiments of SS-25 road-mobile ICBMs, each equipped with a single warhead, at Mozyr missile base in southern Belarus. In the same decade, the SRF had based another three regiments of SS-25s at Lida. Consequently, when Belarus became an independent nation in late 1991, it inherited a total of fifty-four SS-25 ICBMs,

including their launchers, missiles and warheads. In addition, there was a former Soviet ICBM storage facility at Kolosovo, and an elimination facility at Lesnaya. Belarusian ratification of START and accession to the NPT was aided immensely by the public's reaction to the Cherynobl nuclear disaster five years earlier. The public was overwhelmingly anti-nuclear; consequently when the treaties came before the parliament for a vote, they won easy ratification in February 1993. Later that same year, the United States and other Western nations pledged monetary aid to assist the Belarusian government in destroying the weapons and removing the warheads.[13]

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Ukraine inherited the second largest number of nuclear weapons and warheads from the former Soviet Union. Its nuclear arsenal surpassed China, Great Britain and France, and made it the third largest nuclear power in the world in 1992. Specifically, its nuclear forces consisted of 130 SS-19 ICBMs, each capable of carrying six nuclear warheads. It had forty-six SS-24 ICBMs, each equipped with ten warheads. The nation also inherited twenty-four strategic bombers, which were divided into a wing of heavy bombers located at Priluki, and a wing at Uzin Air Base. In addition, Ukraine inherited large missile production factories at Dnepropetrovsk and Pavlograd; a missile storage facility at Mikhaylenki; a testing facility at Pomerki; a repair facility at Belaya Tserkov; and an elimination facility at Sarny. Initially, all of these missile sites, air bases and facilities were under the control of the Russian SRF and the Air Force. Since Ukraine had the strongest nationalist movement of any of the inheritor states, it asserted its sovereignty over these nuclear forces. The Russian high command resisted, which caused major problems in the Ukrainian parliament, the Rada, when it came time to ratify START and accede to the NPT. START was rejected on several occasions, then approved with so many qualifications as to be unacceptable to the other parties, and finally ratified unconditionally. In early 1994, both the United States and the Russian Federation gave Ukraine security guarantees regarding the permanence of its borders, prior to the Rada's ratification of START and the NPT.[14]

The Russian Federation, as the direct successor state to the Soviet Union inherited the largest part of its nuclear arsenal. Due to the geography of the former Soviet Union, the Russian Federation took possession of all of the nuclear submarines, the SLBMs and warheads. At the time when the treaty entered into force, December 1994, the Russian Federation had 728 SLBMs deployed in five submarine systems — SS-N-6, SS-N-8, SS-N-18, SS-N-20 and SS-N-23. These submarines were located at six submarine bases, four in the Barents Sea, one in the Sea of Japan and another in the northern Pacific Ocean. At that time, Russia also had 419 fixed-silo ICBMs — SS-11s, SS-13s, SS-17s, SS-18s, SS-19s and SS-24s with a combined total of 3,080 attributable warheads. These ICBMs were located in missile fields associated with sixteen SRF bases throughout the Russian Federation. In the area of road-mobile missile systems, it declared that it deployed 318 SS-25 ICBMs, each equipped with single-warheads. These mobile, transporter/erector launchers were based at seven sites in western and central Russia. Only the Russian Federation developed and fielded an ICBM that could be launched from a train. In treaty-terminology, this weapon system was known as a rail-mobile ICBM. Russia had thirty-six missiles mounted on rail cars, each capable of launching a missile with ten nuclear warheads. These rail-mobile systems were based in three separate regiments, located at Bershet, Kostroma and Krasnoyarsk. Finally, there were four air bases — Engels, Mozdok, Ukrainka and Ryazan that based eighty-nine Bear and six Blackjack bombers. All were subject to the multiple layers of monitoring under the provisions of START.[15]

If it seems that all of these descriptions of weapons, warheads and sites are voluminous, remember that these were the largest nuclear arsenals in the world and that the negotiators set out to incorporate all of the nuclear weapons into a single, comprehensive arms control treaty. At the same time, they negotiated a treaty that would actually reduce nuclear weapons and warheads.

A Treaty That Reduced Strategic Offensive Arms

Reductions began before START entered into force. The United States and the Russian Federation led in setting up elimination facilities and initiating programmes to reduce their strategic forces. Thus, by 5 December 1994, the day the treaty actually entered into force, hundreds of bombers, missile silos, missile transporters and submarines had been destroyed. All of this early destruction was done in accordance with the monitoring provisions of the treaty. The experience of the United States illustrates why these weapons were eliminated in lieu of a fully ratified treaty. Because START took nine years to negotiate and over two years to ratify, military planners in the United States Air Force and United States Navy had developed programmes in the late 1980s to modernize their part of the nation's operational nuclear forces throughout the 1990s. Along with these modernization programmes, the military services had requested funds to eliminate obsolete strategic weapons and warheads. Consequently, both the air force and navy initiated major weapons elimination programmes shortly after the treaty was signed in July 1991. By December 1994, the month the treaty entered into force, the United States had already reduced some strategic offensive arms[16] (see Table 2).

Table 2. United States Strategic Arms Reductions, 1991–1994

ICBMs	377 Minuteman II missiles removed from silos
	450 Minuteman II warheads removed from missiles
	41 Minuteman II silos destroyed
SSBNs	15 submarines eliminated
SLBMs	240 Poseidon and Trident I missiles eliminated
Bombers	205 B-52 C, D & F models destroyed

During the same years, the Soviet Union and the successor states were embroiled in turmoil. Yet, these nations, especially the Russian Federation, began the process of reducing their strategic nuclear forces. From 1991 through 1994, they eliminated 542 launchers, including nearly 300 fixed-silo ballistic missiles, over 200 SLBMs, and virtually all of the Bear strategic bombers.

Once the treaty went into effect (December 1994), there were three mandatory phase points:

- Phase I: entry into force, plus thirty-six months (i.e., December 1997) 2,100 total launchers;
- Phase II: entry into force, plus sixty months (i.e., December, 1999) 1,900 launchers; and
- Phase III: entry into force, plus eighty-four months (December 2001) 1,600.

Each of these phases had an equivalent numerical benchmark for the elimination of the warheads:

- Phase I: 9,150 warheads;
- Phase II: 7,950; and
- Phase III: 6,000.

As of today, reductions have exceeded these mandatory phase points. Table 3 indicates the weapons eliminated from December 1994 through December 1998.

What is the Status of START Today ?

Is START still important today? Well, for the future of nuclear arms control and reductions it remains the founding document for the next century. It is an international legal treaty between sovereign nations. Signed by national leaders, ratified by elected parliaments or congresses, and

implemented under international law, this treaty has a permanence beyond a single administration or government. In times of great stress between nations, such as the war for Kosovo, this treaty possess a legal status and a body of experience that should allow it to bridge national differences.

Besides the authority of international law, START provides all of the parties, and especially the Russian Federation and the United States, with a clear blueprint for controlling all existing strategic offensive arms, all future weapons and technologies, and all changes in the operational nuclear forces. At first glance it may seem that the treaty might be irrelevant for those nations with sophisticated satellite monitoring systems. But that is not the case. START mandates that, in addition to permitting monitoring by NTM, the signatory nation must provide specific data on every weapon system, every movement of the strategic nuclear delivery vehicles, every new system, every closed out system, every site or base, and every reduction/elimination. Each nation has the right to send up to ten inspectors to the missile, submarine and bomber sites in order to conduct intrusive on-site inspections that confirm the accuracy of the mandatory annual data for the weapons and warheads at that site. These inspection teams can go to the production sites, storage sites, training facilities, rail deployment areas and road-mobile repair facilities. Since the treaty entered into force in 1994, hundreds of on-site inspection teams have gone to the respective nations, conducted inspections at the declared START sites in accordance with the treaty's protocols, and returned with reports to their respective nations.

Table 3. START Reductions, 1994–1997

	1991 (Signature)	1994 (entry into force)	1997 (entry into force + 36 months)	1998 (Actual)	2001 (7-year goal)
United States	2,246	1,838	2,100	1,485	1,600
Former Soviet Union	2,498	1,956	2,100	1,594	1,600
Russian Federation		1,596		1,484	
Ukraine		196		110	
Kazakhstan		104		00	
Belarus		36		00	
Category 2: Strategic Warheads					
	1991 (Signature)	1994 (entry into force)	1997 (entry into force + 36 months)	1998 (Actual)	2001 (7-year goal)
United States	11,769	8,824	9,500	7,986	6,000
Former Soviet Union	10,271	9,568	9,500	7,612	6,000
Russian Federation		6,914		6,680	
Ukraine		1,438		932	
Kazakhstan		1,040		00	
Belarus		36		00	

Sources: Annex A, B & C, of START MOU, 31 July 1991; START MOU, January 1995; Arms Control and Disarmament Agency compilation from START MOU, January 1998.

If there was a dispute on-site, or an unresolved question concerning access to the weapons or facilities, then each signatory nation had the right to take that issue to a treaty-authorized commission, the Joint Compliance and Inspection Commission (JCIC). Its responsibility is to take up implementation issues and recommend solutions. The JCIC began meeting in Geneva, Switzerland a few weeks after the treaty's signature in July 1991, and it has met periodically ever since. To date, there have been twenty sessions, usually lasting five to six weeks, and the joint five-nation commission has issued forty-two agreements and more than fifty joint statements. During the past eight years, this small commission has functioned as a technical policy body regarding treaty implementation issues.

In addition, there are START's sequenced reduction goals, as noted above. To have these specific end-state numbers, to complete all reductions in seven years, and to do it by closing off technological and quantitative options, goes far beyond any benefits that a single nation would accrue from having a good satellite monitoring system. Further, START II builds directly on the first treaty.[17] It sets lower central limits, lowering the total strategic warheads to 3,000 to 3,500 in a two-phased reduction. It establishes incentives for future force modernization programmes away from launchers and systems capable of launching multiple warheads, to deployed systems with single warheads. All of the existing comprehensive data, monitoring and verification systems of START I would remain in effect.

Two scholars, Gloria Duffy and Richard Dean Burns, have written works which allow us to set this vary large, multi-year START arms control and reduction treaty into perspective. Duffy, writing in an essay on treaty compliance, reminds us that the negotiating phase is only the prelude. She observes that "the real substance of arms control lies in whether or not the parties are successful in accomplishing the objectives set out by the agreement, that is, whether they uphold the agreement over time." Contrasting the drama and publicity of the treaty signatures and ratifications with the slow, persistent work of actual implementation, she argues that "it [compliance] is arguably the most substantial and significant aspect of the arms control process."[18]

Finally, Burns reminds us that in the past government leaders, diplomats and scholars came to expect too much of these arms control treaties. When making judgements on a treaty's success or failure, he would encourage us to ask a simple question: "What should one reasonably expect an arms control and disarmament agreement to accomplish?"[19] His answer, which can apply to START, is that it can achieve only two objectives: to reduce the feasibility of electing war by reducing the armaments available; or, if that should fail, to lessen the military violence in any subsequent hostility. Seen in this way, START is a specific, phased nuclear arms reduction treaty that is reducing the feasibility of nuclear war through its continuing implementation over time.

Notes

1 When the Soviet Union dissolved in December 1992, three new nations (Ukraine, Belarus and Kazakhstan) signed the Lisbon Protocol in May 1992 thus becoming signatories to START, along with the United States and the Russian Federation, the Soviet Union's direct successor state.

2 Allan Krass, "Arms Control Treaty Verification", in Richard Dean Burns (ed.), *Encyclopedia of Arms Control and Disarmament*, vol. 1, Charles Scribenr's & Sons, New York, 1993, pp. 297–315, quotation on p. 297.

3 McGeorge Bundy, *Danger and Survival: Choices About the Bomb in the First Fifty Years,* New York, Random House, 1988; John Lewis Gaddis, *The Long Peace,* New York, Oxford University Press, 1987; Michael J. Sadaro, *Moscow, Germany, and the West from Khruschev to Gorbachev*, Cornell University Press, Ithaca, 1990.

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CTBT Verification Regime: Preparations and Requirements

Wang Jun

On 10 September 1996, six weeks after the last nuclear test explosion of the declared nuclear-weapon states (NWS), the 51st United Nations General Assembly voted 158–3 to adopt the Comprehensive Nuclear-Test-Ban Treaty (CTBT). Two weeks later, over 130 states, including the NWS, signed the Treaty, breathing life into the "longest sought and hardest negotiated" international legal instrument prohibiting all nuclear test explosions in all environments for all time, regardless of yield and with no differentiation between the declared nuclear "have's" and "have not's". These historic events marked the beginning of a new era when the international society is governed by a norm that bans all nuclear test explosions. Months later, the Preparatory Commission for the CTBT Organization started functioning in Vienna. As of 9 July, there are 152 signatories and 38 ratifiers (including France and the United Kingdom, two of the NWS) and the numbers are growing.

All this may sound too good to be true judging from the stalemates found in multilateral disarmament efforts and the hurdles of the not-so-long-ago Cold War. Indeed, the CTBT would have been an impossibility had there not been the final demise of the East-West military confrontation that relied on mutual assured destruction to prevent escalation of conflict. The competitive game of the day was the ongoing perfection and regeneration of the "art" of nuclear weapons. That game is now over. Following forty years of strenuous disarmament efforts and with the changes in the global political climate, all the necessary precursors for the comprehensive test ban were in place.

Significance of the Treaty

What can be discerned as the specific significance of the CTBT? Based on some years of involvement in multilateral disarmament and direct experience with the entire CTBT negotiation process, the author has the following to offer:

- The CTBT came about against the backdrop of real nuclear weapon reduction, exemplified by the actual implementation of START I (1991), as well as the prospect of deeper nuclear weapon cuts under START II (1997) and further reductions. By capping the qualitative development of nuclear weapon programmes and introducing an effective global verification regime, the CTBT shall be instrumental for the process of general and complete nuclear disarmament.

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- The CTBT completed the final and comprehensive check on all nuclear test explosions, overtaking previous instruments such as the Partial Test-Ban Treaty (PTBT, 1963), the Threshold Test-Ban Treaty (TTBT, 1974), and the Peaceful Nuclear Explosions Treaty (1976), as well as enhanced the existing nuclear non-proliferation regime.
- The CTBT succeeded in getting all declared NWS and threshold states on board the negotiation process. Though the two recent nuclear testers have yet to sign the CTBT, the fact that they, together with all five NWS, participated in the full negotiations is in itself unprecedented, as compared with the NPT, PTBT or TTBT. By establishing a new international norm of banning all nuclear test explosions, the CTBT will be the paramount instrument for the two states to join if they decide to make an official and permanent obligation to ban any further tests.
- The CTBT also achieved many "firsts":
  - — The first treaty negotiated with the participation of almost all countries with nuclear capability and signed by all five NWS. The forty-four nuclear-capable states are required to sign and ratify in order to bring the CTBT into force;
  - — The first multilateral nuclear disarmament and non-proliferation treaty equipped with an independent remote monitoring system specially designed for compliance verification, the International Monitoring System (IMS); and
  - — The first regime of global, short notice on-site inspections (OSIs) that incorporates an over-flight element, in addition to other technologies (geophysical and radionuclides) for nuclear test signature search.

As noted in its preamble, the CTBT provides a universal and multilaterally and effectively verifiable nuclear test-ban regime, which would contribute "to the prevention of the proliferation of nuclear weapons in all its aspects, to the process of nuclear disarmament and therefore to the enhancement of international peace and security." Simply put, the CTBT sees no more tests, no new nuclear weapons and no more new NWS in the world.

On the other hand, a truthful understanding of the CTBT's scope and its verification regime shows that despite all the political significance, the Treaty provides a precise and legal definition of coverage, namely, the banning of nuclear test explosions and any other nuclear explosion (including de facto banning of peaceful nuclear explosions) and not the prohibition of nuclear weapons per se. Those who favour general and complete nuclear disarmament might see this as a limitation. However, a stronger argument would be that this Treaty, the highest achievable objective given the current prevailing international reality, represents a major step toward the ultimate goal of nuclear disarmament. This is because the cessation of all nuclear test explosions will effectively constrain the development and qualitative improvement of nuclear weapons. In other words, the development of new, advanced types of nuclear weapons can be stopped. It would be hard to contemplate leeway for the furtherance of new nuclear knowledge and technology within the framework of a nuclear weapon ban. A nuclear weapon ban has to be based on a test ban.

This Treaty, the highest achievable objective given the current prevailing international reality, represents a major step toward the ultimate goal of nuclear disarmament.

Building up the Verification System

A global remote monitoring network, the IMS, will be set up — as required by the Treaty for its verification regime. The IMS will consist of 321 remote sensing stations. This system employs four

technologies (seismic, radionuclide, infrasound and hydroacoustic) proven to be effective for the detection and location of nuclear test explosions conducted underground, in the atmosphere or underwater.

All signal data collected from these stations will be fed to an International Data Centre (IDC), situated in the headquarters of the Organization (the CTBTO), and the data and processed products shall be provided to all states parties in the form of bulletins. Through this arrangement, states parties with different technological capabilities will enjoy equal access to the huge global monitoring database — data quantity will reach 10 gigabytes per day once the network is completed. Based on these data and supplemented with information obtained through national technical means, states parties will be able to analyze certain ambiguous events and then decide if they wish to request further measures, such as an OSI. This is a perfect form of mutual monitoring and assurance, the core concept for verifiable treaty compliance.

Soon after the commencement of the Preparatory Commission, the IMS was under construction. Over two years have elapsed and the construction is progressing well and is basically on schedule. To date, fifty primary seismic stations have been established — almost all existed prior to the conclusion of the Treaty, the requisite site surveys for about one-fifth of the total will be accomplished within the year; of 120 auxiliary seismic stations, over three-fourth are now standing; almost all site surveys for the total of eleven hydroacoustic stations will be completed in 1999; and one-fifth of the total sixty infrasound stations, mostly non-existent prior to the Treaty, will pass the stage of site survey within the year.

For the IDC, progress is even more impressive. The computer hardware installation is by and large finished and with the introduction and upgrading of relevant system software, the IDC has already acquired its initial capability of data analysis. The IDC is already collecting data from three of the four technologies of the IMS. In the short period from July to November last year, the IDC was able to detect and locate with much accuracy over 1,000 seismic events globally. It is safe to predict that with the gradual build-up of the IMS stations and corresponding calibration activities, the IDC and the IMS will acquire event detection and location capability far better than the theoretical design threshold of 1,000 ton yield for underground events.

To date, the Provisional Technical Secretariat of the CTBTO Preparatory Commission, which started work on 17 March 1997 and employs a staff of more than 180, has implemented a budget of over US$100 million. Over half of the total has gone into capital investment of the verification infrastructure. At this pace and input, the establishment of the CTBTO verification infrastructure, particularly the IMS and the IDC, can be achieved in a few years. The gradual commencement of these verification components will be a realistic and physical process irrespective of the legal constraints that may come with the entry into force of the CTBT.

Another important verification component of the Treaty is OSI. The basic parameters for this intrusive and last resort activity are that upon the request of states parties and subject to the Executive Council's approval, an inspection team will be dispatched by the CTBTO Technical Secretariat within six days to the site (which may be as large as 1,000 km^2) where an ambiguous event had been detected. The inspection activities, proceeding from the lesser to the more intrusive according to the exact phases of operation, range from overflight observation, ground surface survey, seismic aftershock detection and location, other geophysical measurement techniques, radionuclide measurements (including noble gas detection), to the final stage of drilling into the suspected underground detonation point. The sole purpose of the inspection is to collect technical findings for the determination of the true nature of the event. The telltale evidence is the radionuclide products unique to nuclear explosions. A maximum of forty inspectors and assistants may participate in these undertakings — except the drilling activities, which may require more people. The maximum

duration for the entire inspection is 130 days.

Given that the most probable environment for suspected underground or subsurface nuclear test explosions would be in uninhabited areas and that the inspection activities themselves are technically varied and challenging, one prerequisite for the future OSI regime would be a readily available contingent of able-bodied and competent inspectors and their assistants.

Training of Inspectors

For the future CTBTO to acquire its full team of inspectors, training will be essential. One specific situation with regard to the Treaty's OSI regime is that there will not be a permanent inspectorate residing with the future Technical Secretariat, as is the case with the International Atomic Energy Agency (IAEA) or the Organisation for the Prohibition of Chemical Weapons. This is determined by the fact that all foreseeable OSIs would be rare events, on short notice and not of a routine nature. In addition, these inspections require highly specialized expertise mostly coming from national institutions. Only a large enough pool of specially designated inspectors, all qualified through training, can ensure the actual availability of inspectors on-call. If the required inspector cadres are two teams of forty persons each and the safe margin of required redundancy is five to one, the inspector roster size may well be around 400 persons. Then comes the question: how many trainees would have to pass the training programmes in order to acquire the sizeable roster? And yet, all this has to be achieved against the rare supply of able-bodied specialists for nuclear and other Treaty-permitted technologies for OSI. Just imagine how few people are there in the world who have actually had personal experience with nuclear test explosions and with sufficient first-hand knowledge of nuclear explosion related phenomenon and signatures and are therefore fit for the job.

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With all these difficulties in mind, and guided by the Preparatory Commission for the CTBTO, the Provisional Technical Secretariat has already developed training programmes and started introductory training courses, taking into consideration the following factors:

- technical mix and composition of an inspection team (see Table 1);
- rotational mode of operation of inspection team members, with the composition of the team to be adjusted to the different phases of inspection and the Treaty-permitted technologies;
- permanent back-up team capability and two simultaneous OSI missions requirements;
- highly diversified disciplines of expertise and special skills required of inspectors and inspection assistants;
- mandatory qualification for general training, such as Treaty and Protocol familiarization, OSI Operational Manual, policies and procedures, communication techniques, safety, code of conduct and administrative arrangements;
- specialized training required for specific inspection technologies, equipment operation, sample collection and handling, data analysis and processing, report drafting;
- cross-discipline training;
- "refresher" training for maintaining the constant readiness of inspectors; and

Table 1. Indicative Expertise Requirement for OSI

Activities (Drilling not included)	Goals	Techniques	Professions	Personnel
Position finding from the air	Confirm boundaries of the inspection area	Overflight equipment for location	Pilots/Navigators	2
Same at the surface	Same	Ground location equipment	Experts in ground position finding	2
Visual observation from air	Search for anomalies and/or artefacts	Video cameras, hand-held still cameras	Photographer, experts in nuclear test pheno-menology and signatures	2
Gamma-monitoring from the air	Search for radiation anomalies	Multi-spectral gamma-detectors	Radiation monitoring experts	2
Gamma-survey at the surface	Search for and identify radiation anomalies	Gamma-detectors, including energy resolution techniques	Same	3
Magnetic measure-ments from air	Search for magnetic anomalies	Equipment for magnetic field mapping	Magnetic field mapping experts	2
Same at the surface	Same	Same	Same	2
Multi-spectral imagery from the air	Search for heat and other anomalies	Infrared (night vision) devices	Experts in multispectral measurements	2
Same at the surface	Same	Same	Same	3
Environmental sampling at the surface	Detect radioactive anomalies	Equipment for sampling from above, at and below the surface	Experts in radioactivity sampling	4
Passive seismological monitoring	Search for aftershocks to localize inspection area	Low frequency seismometers	Seismologists	7
Resonance seismometry	Search for and localize cavities and rubble zones	Seismic sensors and sources	Seismologists	5
Electrical conduc-tivity measurement	Detect anomalies and artefacts	Electrical sensors and sources	Electrical engineers	2
Radar measurements	Detect underground anomalies	Ground penetrating radar device	Geophysicists	2
Total				40

Different phases of OSI do not require all the listed experts to be in the field, but there will be other inspection team members, covering administrative and logistic activities.

- varied forms of training, such as conventional classroom teaching, hands-on learning, tabletop or field exercises, and mock inspections.

Other Inspection-Related Training

CTBTO inspection-related training is not limited to inspectors and inspection assistants. The target groups also have to include national authority personnel of states parties, potential national escort team members, and certain policy-making governmental officials and experts. During 1998, the Provisional Technical Secretariat commenced the first OSI Introductory Course in Vienna within

the framework of the overall Training and Exercise Programme. Based on the successful experience, two more introductory courses and one tabletop exercise will be conducted in 1999.

The CTBTO Preparatory Commission is a new international organization and the process of building up its full training capacity will be a long and challenging one. However, there seems no other way but to forge ahead, since without qualified inspectors with adequate training, the verification regime would lose credibility and all the significance described at the opening of this article may be compromised.

On-Site Inspections: Experiences from Nuclear Safeguarding

Wolfgang Fischer and Gotthard Stein

On-site inspection (OSI) is a collective term for different forms of inspector access to a state territory under more or less strict and formally agreed rules in order to verify compliance. While OSIs are found in some environmental and human rights agreements, their main area of application is arms control and disarmament.[1]

Many agreements that include provisions for OSIs are the product of the post-Cold War era, and most refer to weapons of mass destruction: the Threshold Test-Ban Treaty, the Intermediate-Range Nuclear Forces Treaty, Strategic Arms Reductions Treaty, the Comprehensive Nuclear-Test-Ban Treaty, and the Chemical Weapons Convention; treaties concerning conventional weapons include the Conventional Armed Forces in Europe Treaty and the Vienna Document of 1994, and many other agreements, especially bilateral United States-Soviet/Russian ones (Peaceful Nuclear Explosions Treaty, Wyoming Memorandum of Understanding, Destruction Co-operation Agreement and Destruction and Non-Production Agreement).[2] A special case worthy of individual study is the UNSCOM OSI experience in Iraq (see article by Graham Pearson in this issue).

Other lesser-known OSI activities are frequently overlooked: such as the successful inspections in Germany within the framework of the Western European Union (WEU) in order to verify the non-production of chemical weapons.[3] Moreover, there is an important body of experience with a particular form of OSIs: the inspections of the International Atomic Energy Agency (IAEA) in non-nuclear-weapon states (NNWS) that are parties to the Non-Proliferation Treaty (NPT)[4] and, for the member states of the European Union (EU), the inspection activities of the European Atomic Energy Community (Euratom).[5] The extent of inspector access and the conditions under which IAEA inspections can take place have been disputed for many years, and there has been a gradual, sometimes pragmatic evolution with respect to inspectors' access to nuclear facilities and other places.

The Role of Inspections in Safeguards

The history of the utilization of nuclear energy is a history of safeguards.[6] Whereas it was rapidly recognized that nuclear energy would have to be safeguarded in order to make its military utilization less probable, the object and extent of safeguards remained controversial for a considerable period. Some of these concerns have become relevant again with the discussion on tightening safeguards after discovery of Iraq's proliferation.

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In the 1950s and 1960s, the United States, and later the Soviet Union, pressed for direct controls of both nuclear material and the nuclear plants and technologies in NNWS. Such controls would have permitted the IAEA extensive insights and rights of intervention in these countries. This included safeguards that would have given IAEA inspectors the opportunity to search for undeclared nuclear activities in NNWS at any time and any place. In the mid-1960s (during negotiation of the NPT) and between 1969 and 1971 when the IAEA Safeguards Framework Agreement (INFCIRC/153) for NNWS[7] was negotiated, the NNWS resisted these concepts. Whereas government and industry in the NNWS considered safeguards a major precondition for the use of nuclear energy, the safeguards suggested would have curtailed their promising — but in comparison to the nuclear-weapon states (NWS) still backward — nuclear development as well as their sovereignty. Such inspection rights would have strengthened the difference in status between NWS and NNWS. Furthermore, these intrusive inspections would have been a clear vote of "no confidence" by the NWS in the politically credible and trustworthy NNWS, most of them members of the NATO, the WEU and the European Community (EC).

The difficult negotiating process resulted in a "historic compromise" — INFCIRC/153 — which expressed the international political and economic balance of power at that point in time and one which was not modified in principle for more than twenty years. Germany and other states succeeded in agreeing upon a safeguards system that combined high efficiency with low costs, thus reducing the disruption of the daily operations of their nuclear industries. As agreed in INFCIRC/153, all nuclear material has to be put under safeguards (therefore, INFCIRC/153 was called the Full-Scope Safeguards or FSS system) but safeguards were restricted to monitoring the flow of nuclear material, the access of IAEA inspectors was limited to particular points in a nuclear facility (strategic and key measuring points), and their task was limited to the verification of this material flow (nuclear material accountancy). These FSS are aimed at the timely detection of diversion of a given amount of nuclear material from declared facilities.

The IAEA inspection system consisted of routine inspections, ad hoc inspections and special inspections. Most IAEA inspections were routine inspections in nuclear facilities with a facility attachment agreement between the state and the IAEA, which lays down the rights and obligations of each side in detail for each facility under safeguards. In nuclear facilities without such an attachment these inspections were called ad hoc inspections. Due to the lack of detailed agreed rights and obligations, the inspector access was not that limited in principle. But in reality most ad hoc inspections were conducted in a way similar to routine inspections, partly due to the fact that a facility operator must restrict inspector access to some areas due to safety reasons (e.g. protection from radiation). The third type of inspections, special inspections, remained dormant until the early 1990s, when they were briefly resuscitated in a failed attempt to use them under non-cooperative conditions in North Korea.[8]

Based on INFCIRC/153 the IAEA devoted itself in a routine, politically unspectacular and successful manner to safeguarding declared nuclear material, as confirmed by its annual internal Safeguards Implementation Report. The safeguards system worked well. But INFCIRC/153 had a particular implication: because of the "apolitical" allocation of safeguards resources according to the size of the fuel cycle (i.e. the amount and quality of nuclear materials), the safeguards effort was concentrated on the highly developed industrial countries with large fuel cycles, in particular Germany, Japan and Canada. About 75% of routine and ad hoc inspections were conducted in these countries, whereas few efforts were concentrated on unpredictable countries with a small declared fuel cycle — such as Iraq. The consequences became

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The official, narrow interpretation of safeguards and INFCIRC/153 (i.e., solely the numerical verification of the flow of nuclear material) has, however, never been shared by all those involved. In the United States, but also within the IAEA, there have been demands that when applying safeguards, the existence of undeclared materials and activities in NNWS should be assumed. This attempt to change some fundamentals of safeguarding was rejected, amongst others, by Germany and Japan with the argument that if the assumption of undeclared material were introduced in the safeguards concept then material accountancy could no longer be maintained as a closed material balance. Its confidence-building function would therefore be lost and in particular those NNWS with large fuel cycles would no longer be able to demonstrate their compliance. What would be the value of being a party to the NPT if parties to the treaty are treated with the same lack of confidence as non-parties? Nevertheless, a pragmatic solution had to be found to address the problem of undeclared activities and materials for the commercial enrichment facility of Uranium Enrichment Co. (Urenco).

The Hexapartite Safeguards Project

When it was decided in the 1970s to build multilateral enrichment facilities with centrifuge technology in Europe and to develop safeguards concepts for them, it was claimed that safeguards would also have to be capable of monitoring the process of enriching uranium itself. Although the assumption of undeclared activities was not strictly covered by the NPT or INFCIRC/153, states that carried a major safeguards burden found a practical solution to this problem.

It seemed at an early stage that nuclear material accountancy and its verification in such enrichment facilities could be solved in a relatively simple manner: the enrichment process is characterized by very good possibilities for measuring the hexafluoride, assaying the isotopes and carrying out mass determination by very precise weighing since the uranium hexafluoride must be kept in closed tube systems and process units. This would permit simple and transparent nuclear material safeguards procedures for which the enrichment facility can be divided into material balance areas with fixed key measurement points. However, the sensitivity of centrifuge technology put this simple solution into question since it had not been finally clarified whether the safeguards should be carried out with or without inspector access to the cascade hall. The operators of the plant feared for the protection of their know-how, the IAEA worried about its safeguards capability. The situation was further complicated since a contracting party can establish areas in facilities pursuant to INFCIRC/153 which are not accessible to IAEA inspectors. The situation in Western Europe was also characterized by the fact that inspectors from Euratom are not subject to such restrictions. They have access to all points of a facility but, if the IAEA inspectors' access is restricted, they cannot always be accompanied by these inspectors during their verification activities.

In order to solve these problems by consensus, the Hexapartite Safeguards Project (HSP) was started in 1980, comprising Germany, The Netherlands and Great Britain cooperating within the framework of Urenco, as well as Japan, Australia, the United States, the IAEA and Euratom.[9]

Essential concerns addressed by the working groups of the HSP were:

- The structural features of the facilities, which had to be "safeguards friendly";
- Nuclear material accountancy. It was found that the material balance of a facility can be adequately verified by IAEA and Euratom if the facility has a capacity of less than 2,000 tonnes of uranium separation per year;

- Processes and techniques for containment and surveillance without an inspector being granted access to the cascade hall. If inspections were dispensed with, suitable instruments and measures would have to be found to ensure that undeclared activities and materials would be detected in the cascade hall area. A working group was set up to investigate the possibility of "inspection-free" safeguards for the cascade hall;
- The opposite approach was pursued by another group — the development of safeguards strategies including access to the cascade hall. In this approach, models with different access rights were considered, ranging from completely unlimited access up to access limited with respect to frequency, time and scope. After in-depth analysis and considering various criteria, including the technology holders' interest in secrecy, the working group selected a model providing for a limited number of unannounced inspections in the hall (Limited Frequency Unannounced Access, LFUA). Special significance was attached to the element of the inspector's unannounced access due to its deterrent effect.

An evaluation group compared the results of the working groups and, after having compared the safeguards models without and with inspector access, chose the LFUA concept as the optimum solution provided that three conditions were fulfilled. Firstly, the LFUA model must be accepted and applied by all those involved, i.e. also by the NWS. In this way, equal treatment was claimed in principle for the first time for NNWS and NWS. Secondly, the individual verification activities must be clearly defined and described in advance. Thirdly, the secrecy problems resulting from inspector access to the cascade hall must be solved satisfactorily. These conditions were fulfilled.[10]

The HSP was able to solve the difficult question of IAEA inspectors' access to the sensitive cascade hall, to ensure the verification of material accountancy and invalidate the concerns about enrichment offering opportunities for undeclared activities, because the technically sophisticated modification of the cascade sequences required for illicit activities could not remain undetected. A substantial contribution to this effect would be the inspections in the cascade hall, which could include visual inspections and technical measures. In the case of visual observation, the inspector compares what has been declared with what is actually observed, for example, the presence of equipment, the features of the facility and the configuration of the enrichment process. Pictures of the design of the facility and other photographs may help. Furthermore, the inspector verifies the entire tube system for the nuclear material, both inside the cascade hall and at the wall breakthroughs up to the end points outside the cascade area. The frequency of routine inspections inside and outside the cascade hall is twelve times per year with the LFUA safeguards concept for facilities with up to 1,000 tonnes of uranium separation. The frequency of LFUA inspections inside the cascade hall is facility specific, between four and twelve times per year. The duration of the LFUA inspections in the hall is between one and eight hours, depending on whether the inspector only makes visual inspections or also performs measurements.

The LFUA model permits the inspector unannounced access to the cascade hall, specified in terms of time and space. It succeeds without any sophisticated safeguards apparatus and makes the inspector's permanent presence in the plant superfluous. This is equally true in reprocessing plants. Of political significance is the equal treatment of NWS and NNWS realized for the first time in the safeguards domain by the HSP. In this way, a model was created for later verification agreements that go beyond the narrower safeguards domain.

The Iraq Experience and its Consequences

Despite the HSP, the central issue of whether the existence of an undeclared parallel nuclear programme in NNWS may be officially assumed and whether safeguards should be oriented towards

the detection of such a programme had not been seriously discussed at the working level of the IAEA and not at all in the political body of the Board of Governors. And when such discussions have taken place in the media, some Western democracies with expanding fuel cycles were scrutinized and had to ward off assumptions about their credibility, while states with a probably high motivation for proliferation but with few declared nuclear activities received less attention. Even rumours that some NNWS, in particular Iraq, had a nuclear weapons programme, did not and could not change this situation. This was, firstly, due to the "apolitical" allocation of safeguards resources, partly an expression of an "apolitical" IAEA; and, secondly, to the fact that at the time of the East-West conflict a special inspection in sensitive cases or general modifications of the safeguards concept would not have found a consensus in either the Eastern or Western camp. The traditional low profile safeguards policy went smoothly as long as there were no serious disturbances in the safeguards routine.

But everything changed in 1991 with the detection of the Iraqi nuclear weapons programme.[11] For the first time, a party to the NPT, which had committed itself not to acquire nuclear weapons and was subject to FSS, had been caught in the act of clandestinely constructing nuclear weapons. The embarrassing aspect was that the extensive programme was not unmasked by IAEA safeguards[12] but only as part of the unique inspection rights of the United Nations Special Commission (UNSCOM) which Iraq had to accept after its defeat in the Gulf War.

However, if safeguards cannot detect clandestine parallel nuclear programmes, a central pillar of the non-proliferation regime will collapse. When this danger became apparent after the Iraqi case, discussions and activities were started to strengthen safeguards, re-establish their credibility and close this detection gap. In addition to increasing the effectiveness of safeguards, attention was directed towards raising their efficiency in order to make them more cost-effective, and release funds for monitoring other arms control agreements (for example, the proposed fissile materials agreement between the NWS).

If safeguards cannot detect clandestine parallel nuclear programmes, a central pillar of the non-proliferation regime will collapse. When this danger became apparent after the Iraqi case, discussions and activities were started to strengthen safeguards, re-establish their credibility and close this detection gap.

The Short Revival of Special Inspections

In principle, the IAEA could use special inspections pursuant to INFCIRC/153 as a "fall back" instrument to eliminate any inconsistencies arising within the FSS framework. INFCIRC/153 (§73) states that the IAEA may make special inspections in order to verify special reports[13] or if the information available is not adequate for the IAEA to fulfil its responsibilities. A special inspection is either additional to routine inspection efforts or involves access to information or locations in addition to the access specified for ad hoc and routine inspections, or both. Therefore, special inspections have the potential to unveil undeclared activities and nuclear materials if the IAEA knows where it has to go to and if access is granted by the state. In practice, however, special inspections did not have any significance since neither the IAEA nor the states on the Board of Governors wanted to raise any politically delicate doubts about the reliability of FSS and of the honesty of some NPT parties. This attitude changed when experiences with Iraq and North Korea made it very clear that the risk of nuclear proliferation within a NNWS is a function of its political system and not per se a function of the size of its (declared) nuclear fuel cycle, as implied in the safeguards concept. Many safeguards experts had long emphasized that an INFCIRC/153 state intending to acquire nuclear weapons would not divert nuclear material from its effectively safeguarded declared nuclear activities but instead create a clandestine weapons programme.

The Iraqi case brought about a brief revival of this forgotten type of inspection. Whereas there was broad agreement to "awaken" special inspections, there was also from the very beginning a lack of unanimity about some important questions. The United States demanded that special inspections should refer to all declared and undeclared activities by a NNWS in the sense of the 1960s — that meant investigating suspicions without any restriction (any time, any place) — an interpretation that was not acceptable to other countries. Another question was whether or not there should be fixed rules about the implementation of special inspections. However, as an instrument for specific situations it had to be individually tailored to each case. Therefore, flexibility seems to be one condition for the success of a special inspection — but at the cost of the state's sovereignty and the economic interests and legal rights of the concerned industries. Again, consent failed. Therefore, the Board of Governors merely confirmed the admissibility of special inspections in February 1992 with reference to the pertinent paragraphs in INFCIRC/153. But after only a few months disenchantment prevailed about the applicability of special inspections. Because the IAEA knew where it wanted to inspect, in February 1993 North Korea refused to accept a special inspection[14] and the IAEA's subsequent appeal to the Security Council did not lead to unanimous support on compulsory measures to force the inspection.

Experiences with Iraq and North Korea made it very clear that the risk of nuclear proliferation within a NNWS is a function of its political system and not per se a function of the size of its (declared) nuclear fuel cycle, as implied in the safeguards concept.

In order to escape from this dangerous dead end, the United States and North Korea agreed in bilateral negotiations on a controversial treaty in October 1994 (US-North Korea Agreed Framework and the Korean Peninsula Energy and Development Organization, KEDO), which intended to freeze and then dismantle the nuclear weapons programme in return for a reward (fuel oil and — under particular preconditions — new reactors that produce less plutonium).[15] Although the IAEA is still demanding a special inspection in North Korea, prospects for its realization are, at least for the time being, poor. Since the North Korean case, the usefulness of special inspections has been seen in a rather subdued light.[16] Consent emerged that instead of applying special inspections, the problem of unmasking undeclared activities should be solved by less politically sensitive means. The safeguards reform entered a new phase.

The Strengthened Safeguards System

The failed revival of special inspections was followed by lengthy and controversial discussions. This negotiation process[17] led to a broadening of the safeguards system through an additional safeguards framework agreement (INFCIRC/540),[18] known as the Strengthened Safeguards System. (See contribution by Rich Hooper to this issue.)

The IAEA's safeguards reform programme, called the "Programme to Strengthen the Effectiveness and Improve the Efficiency of Safeguards" (93+2) was initiated in 1993 by the Board of Governors and was based on a recommendation by the IAEA's Standing Advisory Group on Safeguards Implementation (SAGSI). In April 1993 SAGSI proposed that safeguards should provide confidence that there are no undeclared nuclear activities. It was the first time that an IAEA body went beyond the previous safeguards concept and emphasized the possibility that a NNWS could have an undeclared nuclear programme. Whereas INFCIRC/153 only verified the correctness of the nuclear declaration, the new challenge was how to verify the completeness of a state's declaration. Such a task was a challenge both for the IAEA and those states interested in effective safeguards, because many problems had to be solved — in particular with respect to inspector access.

It soon became clear that the legal basis of INFCIRC/153 was only sufficient to implement the so-called 93+2 Part I measures (environmental sampling in declared facilities), which were accepted by the Board of Governors in June 1995. In order to tailor safeguards to undeclared activities (the Part II measures), a new agreement would have to be negotiated. To this end, a panel was established by the Board in 1996 with the task of strengthening the effectiveness and improving the efficiency of safeguards (Committee 24). After contentious discussions it agreed upon the draft of the new Model Protocol agreement in May 1997 (INFCIRC/540), which was adopted by the Board in May 1997. The Strengthened Safeguards System is intended to close the gap in IAEA safeguards.[19]

Whereas INFCIRC/153 only verified the correctness of the nuclear declaration, the new challenge was how to verify the completeness of a state's declaration.

According to INFCIRC/540, the state has to declare its past, present and intended nuclear activities.[20] This includes, among others: the description of all relevant facilities, sites, the status and activities of the entire nuclear fuel cycle, including R&D activities relevant to the fuel cycle; as well as other activities related to nuclear facilities, including the development and fabrication of components for these facilities, information on nuclear source material to which no safeguards have been previously applied, and, upon request by the Agency, information on facilities and activities outside the nuclear facility site. Together with other information obtained from open sources and from intelligence, the IAEA expects to develop a clearer understanding of all relevant nuclear activities within a state and to derive indications of undeclared activities, should they exist.

To this end, the IAEA created a "Physical Model" detailing a nuclear fuel cycle. The Physical Model simulates successive steps to be followed in the course of the production of weapons-grade material and the construction of nuclear explosive devices. The first level contains the key activities, e.g. reprocessing, enrichment as well as accompanying weaponization. At the second level each of these key activities is broken down into specific routes or processes, for example, enrichment is represented by nine different processes. At the next level down, indicators are attached to the specific processes and their development, i.e. materials to be used, equipment, tools and training activities. The information available from a state's Expanded Declarations and from other sources will then be projected on the physical model and will assist the IAEA in identifying inconsistencies in declarations and in pointing to information gaps and suspicious items. Upon request by the IAEA, inspectors will have access to any place mentioned in the Expanded Declaration and on a selective basis to any place on a site where nuclear material is or was customarily used, including closed down facilities. When exercising its access rights, the IAEA may make use, as required, of visual inspections, examination of operating records, environmental samples and allowed measurement techniques. The new access rights are also extended to facilities, companies, sites and research institutions that do not use or possess any nuclear material, but which are related in some way to the nuclear fuel cycle and its technologies. This implies that safeguards are no longer related merely to the presence of nuclear material. But these new "complementary access"[21] rights of IAEA inspectors are not unlimited and unconditional: the concept of "managed access" was introduced.

Managed Access

From the very beginning of Committee 24 discussions, the Director General of the IAEA postulated that strengthening safeguards depends on enlarging the IAEA's verification rights and therefore its right to go to more locations and beyond the strategic and key measurement points of INFCIRC/153. Whereas most countries agreed in principle with this new complementary access, it

was disputed to what extent, under what conditions and according to what modalities such access should be granted.[22] When the IAEA demanded more or less unlimited and unconditional access to nuclear and non-nuclear proliferation-relevant sites, facilities and locations, both public and private, the states refused to accept this — from their perspective — absoluteness of complementary access.

After lengthy and difficult discussions an agreement was reached on both substance and procedures. First of all, it was agreed in a vague general clause (Article 4a, INFCIRC/540) that the IAEA "shall not mechanistically or systematically seek to verify the information referred to in Article 2", which regulates the information a state provides the IAEA. Furthermore, it was agreed that complementary access is broad but not unlimited, and has to follow procedures and be managed (Art. 7, INFCIRC/540). In this case the IAEA must give the state concerned advance written notice, and must specify the reasons for access and the activities to be carried out during access. Furthermore, the IAEA shall provide a state with an opportunity to clarify and facilitate the resolution of the question or inconsistency for which complementary access is sought — an important rule to avoid confrontations between a state and the verification agency over problems that are easy to solve with both sides' goodwill. Therefore, some form of "political" managed access has been agreed, offering a state the opportunity to solve a safeguards problem in advance of an inspection. Additionally, the inspected state has the right to have its own representatives accompany the IAEA inspectors. It was agreed that a request by the IAEA for complementary access shall not be denied by a state for lack of substantive justification, and that the purpose of such access may not be disrupted or held back by delaying actions on the part of the state.[23]

In order to solve the infamous problem of protecting sensitive information, a dual route was taken. Firstly, Article 7a on managed access states: "Upon request by [name of state], the Agency and [name of state] shall make arrangements for managed access under this Protocol in order to prevent the dissemination of proliferation sensitive information, to meet safety or physical protection requirements, or to protect proprietary or commercially sensitive information. Such arrangements shall not preclude the Agency from conducting activities necessary to provide credible assurance of the absence of undeclared nuclear material and activities at the location in question, including the resolution of a question relating to the correctness and completeness of the information referred to in Article 2 or of an inconsistency relating to that information."[24] Which practical effects the managed access has for such IAEA inspections remains to be seen. Managed access must find middle ground: too much "management" could protect commercial interests at the cost of safeguarding, whereas too much openness could contribute to a loss of secrecy and — a considerable risk — the proliferation of sensitive, weapons-relevant information. Secondly, Article 15 says that the IAEA "shall maintain a stringent regime to ensure effective protection against disclosure of commercial, technological and industrial secrets and other confidential information coming to its knowledge" in the implementation of INFCIRC/540. The details of this regime (principles, conditions of staff employment, procedures in cases of breaches of confidentiality) still have to be developed, approved and agreed upon by the Board of Governors. Again, many questions have been left for future negotiation and practical implementation.

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Implications for a Fissile Material Treaty

All verification systems must have the potential to discern undeclared activities. One lesson of the IAEA safeguards system is that in order to be successful, a verification agency must have (in

principle) the right to go to any place in a country under suspicion. But to find political agreement for such OSIs, a form of managed access has to be agreed upon. As noted above, such "management" must find a middle course between the protection of commercial interests and effective verification. Management depends on the political correlation of forces at a given moment and the peculiarities of the verification problem (e.g. chemical, nuclear, biological). But no one should overestimate OSIs, which are only one instrument of verification and, as a rule, are confidence-building measures. In order to be a strict instrument of verification, OSIs depend on accurate information and the political support of the international community and the Security Council when there is resistance by the state under scrutiny. The latter is the weakness of any verification system.

But no one should overestimate OSIs, which are only one instrument of verification and, as a rule, are confidence-building measures. In order to be a strict instrument of verification, OSIs depend on accurate information and the political support of the international community and the Security Council when there is resistance by the state under scrutiny.

Taking this into account, what could we learn from nuclear safeguards for a future Fissile Materials Treaty (FMT)? Firstly, in order to be effective, verification of a FMT would require a comprehensive declaration, even in the military domain. Any credible verification scheme would therefore require a declaration by the state of all nuclear material and of all existing fuel cycle related facilities and activities, including those facilities and activities where nuclear material has been produced before the entry into force of a FMT.

Secondly, effective verification and assurance of the completeness and correctness of the declaration can only be achieved by granting inspectors access to the declared facilities and, if necessary, to other places. Some form of managed access seems to be unavoidable, due to political, economic, safety and legal reasons.

Thirdly, a certain level of transparency, even of the military fuel cycle, is a primary requirement for the effective verification of a FMT. Arguments against transparency might be put forward with reference to national security.

Therefore, fourthly, the need to protect such sensitive weapons-related technology against the risk of proliferation by inspection activities points to an instrument of managed access in order to protect sensitive information. In general, the increased flexibility of the Strengthened Safeguards System will allow safeguards to be more easily adapted to special fuel cycles as compared to the rigid system based INFCIRC/153 measures alone. The Strengthened Safeguards System would therefore also be readily adaptable to the requirements of verifying a FMT in NWS and in the states not belonging to the NPT.

In order to verify a FMT effectively, the treaty needs to be comprehensive in scope.[25] With respect to the organization charged with the task of verification, presumably the IAEA, the verification of a FMT would require appreciably increased resources. The new Strengthened Safeguards System would appear to be most appropriate for verifying a FMT, because its adaptability to the special characteristics of certain fuel cycles contains the potential for increased effectiveness as well as cost efficiency.

As the new safeguards system evolves, the mechanistic criteria applied in the past with respect to timeliness and material categories should be subject to revision. The extent to which such payoffs will be possible will depend on the extent to which measures included in the Model Protocol provide confidence that no undeclared activities and facilities exist.

The future application of the Strengthened Safeguards System to all nuclear material and to all fuel cycle activities in NWS and non-NPT states, with the exemption of nuclear weapons, and to activities which would explicitly not be prohibited by a comprehensive FMT would strongly support

both the disarmament and the non-proliferation regime and would be a decisive step towards a highly efficient and cost-effective universal safeguards system. This would eliminate the necessity for development of an alternative to the new safeguards approach for the FMT.

Notes

1 See Wolfgang Fischer, Learning From Other Regimes: "Social Monitoring" As A Contribution To Effective Safeguards?, in: Seminar on Modern Verification Regimes: Similarities, Synergies and Challenges, pp. 103–110, Ispra, EU document EU18681EN. Proceedings from the 20th ESARDA Annual Meeting, Helsinki, May 1998.

2 See the homepage of the Defence Threat Reduction Agency (www.dtra.mil), formerly the On-Site Inspection Agency.

3 See Thilo Marauhn, Der deutsche Chemiewaffen-Verzicht. Rechtsentwicklungen seit 1945, Berlin, 1994.

4 There are IAEA inspections in some facilities of non-NPT states, and NWS have voluntarily offered some facilities for verification activities.

5 The rights of Euratom inspectors are considerably more extensive than those of the IAEA. Because the EU safeguards system is multilateral, proliferation resistant, effective and has an enforcement (sanction) component, the EU and the IAEA agreed on the "partnership approach": the IAEA recognizes the effectiveness and reliability of the EU system and therefore permits Euratom to function as the IAEA's "representative", thereby considerably reducing its own inspection efforts and only intervening as a quality controller for Euratom. Euratom and the IAEA implement joint inspections teams, or the IAEA applies the observation principle and verifies the results of Euratom safeguards.

6 See Lawrence Scheinman, The International Atomic Energy Agency and World Nuclear Order, Washington, DC, 1988; U.S. Congress, Office of Technology Assessment, Nuclear Safeguards and the International Atomic Energy Agency, OTA-Iss-615. Washington, DC, U.S. Government Printing Office, June 1995.

7 IAEA, The Structure And Content Of Agreements Between The Agency And States Required In Connection With The Treaty On The Non-Proliferation Of Nuclear Weapons, INFCIRC/153, Austria, June 1972.

8 Germany volunteered in 1989 for a special inspection in connection with the so-called Nukem scandal as a confidence-building measure. Nukem did not prove to be a safeguards problem.

9 See R. Gerstler et al., Das Hexapartite Safeguards-Projekt, Atomwirtschaft, January 1994, pp. 32–36.

10 Equal treatment was ensured by an exchange of notes by the governments involved and safeguards were agreed upon for the facilities in Almelo (The Netherlands), Capenhurst (United Kingdom) and Portsmouth (United States).

11 See the homepage of the Center for Nonproliferation Studies at the Monterey Institute of International Studies (www.cns.miis.edu) and its links to other sources.

12 The twice-yearly routine inspections failed to discover any indications of a nuclear weapons programme that had no discernible relation to the declared activities.

13 A state shall make such reports if there could be a loss or removal of nuclear material under safeguards.

14 The IAEA became aware of the weapons programme because there were some contradictions in the country's initial nuclear inventory. (This event confirmed the worth of the safeguards methodologies.) The United States contributed satellite images indicating an undeclared reprocessing site. It was the first time the IAEA accepted intelligence support.

15 For further information, see the homepage of the Nautilus Institute (www.nautilus.org).

16 In the early 1980s the Iranian government opened the country twice for some special inspections as a confidence-building measure which elicited no information about secret activities.

17 See Erwin Häckel and Gotthard Stein, eds., Tightening the Reign. Problems and Prospects of a Strengthened Nuclear Safeguards System, Heidelberg, Springer Publications, in print.

18 IAEA, Model Protocol Additional To The Agreements Between State(s) And The International Atomic Energy Agency For The Application Of Safeguards, INFCIRC/540, Austria, September 1997.

19 INFCIRC/540 is additional to INFCIRC/153. Nevertheless, there is a necessity to integrate both in order to make safeguards not only effective but also efficient. This work of integration has still to be done.

20 See W.-D. Lauppe and G. Stein, Possible Implications of the IAEA Strengthened Safeguards System on Future Cutoff Verification, in: 20th ESARDA Annual Meeting, op. cit., pp. 35–41.

21 Complementary means additional to the access rights according to INFCIRC/153.

22 See Reinhard Loosch, The History of the IAEA's Programme 93 + 2, in: Häckel and Stein, eds., Tightening the Reign, op. cit.

23 Ibid.

24 Article 2 of INFCIRC/540 concerns provision of information.

25 See Lauppe and Stein, Possible Implications, op. cit.

The UNSCOM Regime: Crucial On-Site Elements

Graham S. PEARSON

Although there are some who may argue that the situation in Iraq under which the United Nations Special Commission on Iraq (UNSCOM) operated was unique and thus a regime from which it is unsafe to draw conclusions, such an argument is quite wrong. Careful analysis of the work carried out by UNSCOM over the past eight years in the face of continued Iraqi non-cooperation has demonstrated the crucial importance of on-site inspections. Without on-site inspections, there could have been no progress on eliminating Iraq's weapons of mass destruction.

The UNSCOM regime was established by Security Council resolution 687 (1991),[1] which included several elements: deployment of a United Nations observer unit; arrangements for demarcating the Iraq-Kuwait border; the removal or destruction of Iraqi weapons of mass destruction and measures to prevent their reconstruction, under the supervision of a special commission and the Director General of the IAEA; and creation of a compensation fund to cover direct loss and damage resulting from Iraq's invasion of Kuwait.

UNSCOM was set up to implement Section C (paragraphs 7–14) of resolution 687 — the removal or destruction of Iraqi weapons of mass destruction and measures to prevent their reconstitution. The first of these paragraphs invited Iraq to reaffirm unconditionally its obligations under the 1925 Geneva Protocol and to ratify the Biological and Toxin Weapons Convention (BTWC). Paragraph 8 required Iraq to unconditionally accept the destruction, removal or rendering harmless, under international supervision, of:

> "(a) all chemical and biological weapons and all stocks of agents and all related subsystems and components and all research, development, support and manufacturing facilities related thereto;
>
> (b) all ballistic missiles with a range greater than 150 kilometres and related major parts and repair and production facilities;"

Iraq was required to submit, within fifteen days of the adoption of resolution 687, a declaration on the location, amounts and types of all the items specified in (a) and (b) above and agree to urgent, on-site inspection as detailed in (i) and (ii) below. Within forty-five days, the Secretary-General was to develop and submit a plan for:

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> "(i) the forming of a Special Commission which shall carry out immediate on-site inspection of Iraq's biological, chemical and missile capabilities, based on Iraq's declarations and the designation of any additional locations by the Special Commission itself;
>
> (ii) the yielding by Iraq of possession to the Special Commission for destruction, removal or rendering harmless, taking into account the requirements of public safety, of all items specified under paragraph 8 (a), including items at the additional locations designated by the Special Commission under paragraph (i) and the destruction by Iraq, under the supervision of the Special Commission, of all its missile capabilities, including launchers as specified under paragraph 8 (b)."

In addition, Iraq was required to "unconditionally undertake not to use, develop, construct or require any of the items specified", and the Secretary-General, in consultation with UNSCOM, was required to "develop a plan for the future ongoing monitoring and verification of Iraq's compliance" with this undertaking.

Consequently the three fundamental elements of resolution 687 are the following:

- declaration to UNSCOM of the locations, amounts and types of chemical and biological weapons;
- destruction, removal or rendering harmless under UNSCOM supervision; and
- an ongoing monitoring and verification (OMV) plan.

The OMV plan[2] was approved by Security Council resolution 715 (1991)[3] in October 1991 and was declared provisionally operational in October 1994.[4]

Over the past seven years, the work of UNSCOM can be regarded as eight phases:

- Phase 1: The setting up of UNSCOM and the initial inspections (1991);
- Phase 2: Continued inspections to determine the past programmes, hindered by incomplete and inaccurate declarations (1992–1993);
- Phase 3: Destruction of chemical weapons under UNSCOM supervision (June 1992–June 1994);
- Phase 4: Ongoing monitoring and verification (November 1993 onwards);
- Phase 5: Significant disclosures of past programmes (1995);
- Phase 6: Continuing difficulties (1996–1997);
- Phase 7: Increasing politicization (1997–1998); and
- Phase 8: Iraqi withdrawal of cooperation (August 1998–December 1998).

Using UNSCOM's work in regard to Iraq's chemical and biological weapon capabilities, this article considers the crucial importance of on-site activities in two broad areas: determination of Iraq's past programme and OMV.

Determination of Iraq's Past Programme

When UNSCOM was set up in May 1991, it was envisaged that Iraq would cooperate and that the tasks of UNSCOM would be complete within six months or a year. Consequently, UNSCOM was set up as a small group of some twenty to twenty-five individuals organized into five groups that

would cease to exist once they completed their tasks. Regrettably, Iraq never cooperated and instead has consistently taken a minimalist approach, providing as little information as possible and has sought to conceal its capabilities. Consequently, UNSCOM has had to carry out its work over a much longer period and had to involve significantly larger numbers of personnel to uncover the Iraqi programmes and prevent their reacquisition. UNSCOM has had remarkable success in uncovering Iraq's prohibited programmes and in ensuring that these capabilities were not being reacquired. During 1997 and 1998 this success led to increasing difficulties with Iraq, who through international lobbying and withdrawal of their limited cooperation have successfully managed to stop the work of UNSCOM.

When UNSCOM was set up in May 1991, it was envisaged that Iraq would cooperate and that the tasks of UNSCOM would be complete within six months or a year. Regrettably, Iraq never cooperated and instead has consistently taken a minimalist approach, providing as little information as possible and has sought to conceal its capabilities.

The initial inspections of Iraq were carried out using teams of experts drawn from Member States of the United Nations. The first report[5] of UNSCOM on 25 October 1991 noted that the inspections undertaken have had to be:

> "energetic, rigorous and intensive because of the failure of Iraq ... to adopt the candid and open approach to disclosure of its capabilities which is called for in ... Resolution 687 (1991). While co-operation from Iraq has generally been forthcoming at the field level ... in relation to the activities and resources declared by Iraq, a totally different attitude of non-cooperation, concealment and sometimes false information has emerged in relation to non-declared activities, resources and sites that have been designated by the Special Commission on the basis of its own assessments or of data supplied to it by States."

As UNSCOM had limited resources, the number of inspections that could be supported in Iraq at the same time was limited — which meant that inspection teams had to be withdrawn without completing their missions. Together with the lack of continuity in the chief inspectors, this was exploited to the maximum by Iraq to withhold information, thereby making the overall task much more difficult and extended.

Chemical Weapons

In the chemical area, a month-long inspection was carried out at the Muthanna State Establishment — the principal chemical weapons development and production facility which had been bombed during the Gulf War of 1990–91. The emphasis in the chemical weapons area was to inventory the remaining Iraqi chemical weapons, both filled and unfilled, and then to oversee the construction by Iraq of destruction facilities to achieve safe irreversible destruction of chemical weapons, agents and their production facilities.

Although Iraq was required to declare all its chemical weapons production equipment to UNSCOM inspectors, it became clear through on-site inspections that such equipment was being removed in attempts to hide it elsewhere in the country.

Destruction of Iraq's chemical weapons took place under UNSCOM supervision during the two-year period from June 1992 to June 1994. Very large quantities of weapons, agents and precursors were destroyed. However, Iraq claimed that it had also destroyed chemical weapons after the end of the Gulf War but had done so without UNSCOM supervision and thus in breach of resolution 687. This claimed unilateral destruction by Iraq has resulted in much additional work for both

UNSCOM and Iraq as UNSCOM has rightly insisted that Iraq provide verifiable evidence that such destruction did in fact take place.

A particular topic of increasing concern has been the extent to which Iraq has produced and weaponized the chemical agent VX. When UNSCOM first detected traces of VX degradation products, Iraq's initially responded that this was evidence of failed research. As time went on, it became clear to UNSCOM that sufficient precursors to produce more than 400 tons of VX had been imported by Iraq. In response Iraq gradually admitted that it had produced an increasing quantity of VX, which eventually reached almost four tons. The October 1995 UNSCOM report[6] stated that "Of greatest concern were the new revelations concerning the timing, extent and success of Iraq's programme for the production of the nerve agent VX" and went on to note "the gravity of the clear deception of Iraq in its Spring 1995 declaration to the Commission concerning the VX nerve agent".

During 1998 UNSCOM excavated and took samples from sites where Iraq claimed that SCUD missile warheads had been unilaterally destroyed. Remnants of such warheads showed the presence of traces of VX degradation products, thereby demonstrating that these warheads had been filled with VX.[7] Iraq has refused to provide any explanation, simply stating that "it had never weaponized VX".

Biological Weapons

In the biological area, the first inspection took place in August 1991 and the subsequent UNSCOM report[8] noted that Iraq had clearly violated its obligations to hand over to UNSCOM all its biological weapon-related items when it destroyed buildings at Salman Pak immediately prior to the first UNSCOM inspection there. A month later another report[9] noted that "Iraqi officials told the Special Mission that they had nothing further to add to what had already been provided to the two biological weapons inspection teams. They maintained that all documents and information related to the programme have either been handed over to the first biological inspection team or had been destroyed." UNSCOM was rightly sceptical. Primarily because of resource limitations in UNSCOM and the need to give priority to destruction of the declared chemical weapons, during the next three years UNSCOM gave priority to chemical weapons activities in Iraq.

By early 1995 UNSCOM had clear evidence that Iraq had had a biological weapons programme although Iraq still maintained that it only had a small biological research programme for military purposes.

Biological weapon capabilities were then readdressed starting in 1994. By early 1995 UNSCOM had clear evidence that Iraq had had a biological weapons programme although Iraq still maintained that it only had a small biological research programme for military purposes. The UNSCOM evidence included:

- The attempted importation by Iraq of three 5,000 litre pathogen grade fermenters;
- The procurement of thirty-nine tons of growth media in 25–100kg drums;
- The Al Salman facility for which four filling machines and a spray dryer were imported; and
- The Al Hakam facility, which was inconsistent with its alleged single cell protein role.

UNSCOM pressure led Iraq to admit on 1 July 1995 that it had had an offensive biological weapon programme, including the production of a number of biological agents, but denied the weaponization of such agents. The subsequent UNSCOM report[10] noted that Iraq had prepared a draft FFCD (full, final and complete disclosure) and stated that:

> "The July draft declaration contained many areas in which Iraq's disclosures were inconsistent with the Commission's information or where information was missing or unclear. These deficiencies followed a pattern: they appear to be designed to deny information that will either provide evidence of weaponization or reveal military connections with the biological weapons programme. There was also a strong suspicion that Iraq's new accounts of agent production, complex growth media consumption, were manipulated to provide what Iraq hoped would pass as a credible accounting for the missing media".

Iraq delivered its biological FFCD, still denying that any agents had been weaponized, to the Executive Chairman of UNSCOM on 4 August 1995. Later that month, General Hussein Kamel Hassan left Baghdad for Jordan. A week later, the Executive Chairman of UNSCOM was invited to return to Baghdad. This invitation said that General Hussein Kamel Hassan had been responsible for hiding important information on Iraq's prohibited programmes from UNSCOM and IAEA by ordering Iraqi technical personnel not to disclose such information and also not to inform Mr Tariq Aziz or General Amer of these instructions. When the Executive Chairman returned to Baghdad, Iraq informed him that the FFCD of 4 August 1995 should not be considered valid. Iraq then presented a vastly different account of its past biological warfare programme, admitting weaponization immediately prior to the outbreak of the Gulf War, including the filling of biological warfare agents into 166 bombs and 25 Al Hussein missile warheads.

Prior to leaving Baghdad, the Executive Chairman publicly stated that whilst very significant new information had been provided, not a single document that could help in verifying that information had been handed over. Shortly after saying this and whilst preparing to go to the airfield to leave Iraq, General Amer contacted the Chairman and requested that on his way to the airfield he visit a farm which had belonged to General Hussein Kamel Hassan, where items of great interest to UNSCOM could be found. On arrival at the farm (the Haider farm), the Chairman and his team found, in a locked chicken coop, numerous boxes that were packed with documentation, together with microfiche, computer diskettes, videotapes and photographs of prohibited hardware components. One prominently placed box contained all the materials on biological weapons. Examination of the contents of the boxes revealed well over half a million pages of documentation. While most of this related to the nuclear area, a large amount concerned the chemical, biological and missile areas. UNSCOM's initial assessment was that the bulk of the material in the missile, chemical and biological fields came from a number of the sites where Iraq's proscribed programmes had been carried out. However, documentation from the headquarters of the Military Industrialization Corporation was not included, nor were the relevant archives of the Ministry of Defence or the Intelligence Services.

Repeated UNSCOM inspections were then carried out to determine the actual scope of the Iraqi biological weapons programme and to verify the information provided in the revised declarations subsequently provided by Iraq. The April 1996 UNSCOM report[11] noted that Iraq, as recently as August 1995, admitted in an official letter that "it had been engaged in a dedicated concealment effort to hide proscribed items and documents from the Commission" and the report noted that this withholding of important information from UNSCOM had been taking place since the outset of the existence of UNSCOM. It further noted that as Iraq had admitted in 1995, "its full, final and complete disclosures over a number of years have been deliberately misleading". Additionally, "Iraq has recently admitted that the unilateral destruction had been carried out in order to downsize its proscribed programmes. Thus, according to Iraq, items were partially or totally concealed and all materials relevant to their existence were unilaterally obliterated as it was believed that their revelation would complicate matters and prolong the process with the Commission." Such actions made UNSCOM's task much more difficult and delayed the completion of its work.

These difficulties continued with the April 1997 report[12] noting that Iraq had "initiated a policy of deliberate concealment, denial and masking of the most important aspects of its proscribed weapons and related capabilities." In the face of this challenge, the inspection activities of UNSCOM and the integrated analytical work since 1991, supported by advanced techniques and applied science, have "led to the uncovering of the full dimensions of Iraq's complex programmes of mass destruction." Only in the last two years have the inspections unmasked a complete biological weapons programme. The report stated that "these accomplishments demonstrate that international weapons inspections under the auspices of the United Nations, if applied with first-rate expertise and modern technology, can achieve effective results."

During 1998, UNSCOM excavated the remains of SCUD missile warheads unilaterally destroyed by Iraq and analyzed samples taken from these remnants for traces of anthrax. These analyses showed that at least seven of the SCUD warheads had contained anthrax — a finding that was at variance with the Iraqi declaration that only five such warheads had been filled with anthrax.

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Ongoing Monitoring and Verification

At the beginning of October 1991, the plan for the future monitoring and verification of Iraq's compliance to its undertaking not to use, retain, possess, develop, construct or otherwise acquire any chemical or biological weapons or any ballistic missiles with a range greater than 150 km was transmitted[14] to the Security Council. The plan required UNSCOM (through inspections and aerial overflights, as well as through the provision of information by Iraq) to monitor and verify that activities, sites, facilities, material and other items, both military and civilian, are not used by Iraq in contravention of its obligations.

The plan requires the regular provision by Iraq of full, complete, correct and timely information. UNSCOM could designate for inspection any site, facility, activity, material or other item in Iraq, carry out inspections at any time and without hindrance, of any site, facility, activity, material or other item in Iraq, conduct unannounced inspections and inspections at short notice and inspect any number of declared or designated sites or facilities simultaneously or sequentially. UNSCOM would also consider and decide upon requests by Iraq to move or destroy any material, equipment or item relating to its nuclear, chemical or biological weapons or ballistic missile programmes, or material, equipment or any item relating to its other nuclear activities.

Detailed requirements for chemical and biological items and missiles were specified in Annexes 2, 3 and 4 of the plan respectively. Provision was also made for the annexes to be updated and revised by UNSCOM in the light of experience. Should there be any instances of non-compliance, UNSCOM has the right to "take it into custody and shall provide for its disposal, as appropriate" and "should the Special Commission discover any activity taking place in contravention of Resolution 687 (1991), 707 (1991) or of the plan, it shall have the right to call upon Iraq to halt the activity and to prevent its recurrence. The Special Commission shall also have the right to take any prohibited

item involved, including any documentation, into custody and shall provide for its disposal as appropriate."

The OMV plan was approved by resolution 715 (1991).[15] However, a month later, Iraq rejected[16] the OMV regime and did not accept it until November 1993.[17] During the following year, UNSCOM concentrated its efforts on the setting up of the OMV regime by carrying out baseline inspections aimed at drawing up protocols for each site to be monitored.

The UNSCOM report[18] of October 1994 was particularly detailed as it concluded that the OMV system was provisionally operational. It noted that the OMV regime was based on regular inspection of facilities of concern, on an inventory of all dual-purpose items (i.e. those which have permitted uses but which could be used for the acquisition of banned weapons) and on following the fate of all inventory items. Underpinning the inspections and the establishment and maintenance of accurate inventories would be a full array of interlocking activities: aerial surveillance with a variety of sensors, tags and seals; a variety of detection technologies; information obtained from other sources; and, when sanctions on the dual-purpose items were lifted, notification under the export/import control mechanism. None of those elements on its own would suffice to provide confidence in the system but together they "should constitute the most comprehensive international monitoring system ever established in the sphere of arms control."

It noted that confidence in the effectiveness of the OMV regime would depend, inter alia, on the following:

- Possession by UNSCOM of a full picture of Iraq's past programmes and full accounting of the facilities, equipment, items and materials associated with those past programmes, in conjunction with the full knowledge of the disposition of dual-purpose items currently available to Iraq. This information would provide the baseline data for OMV. Iraq was required to update its declaration on its dual-purpose activities and capabilities every six months.
- Completion of comprehensive OMV protocols for each site at which monitoring will be conducted. These protocols would be produced from the baseline inspections: these were inspections for the purposes of familiarization, tagging and inventory, sensor installation or protocol building as necessary. These would provide the basis for future OMV activities at that site.
- The OMV regime was designed to be robust. Experience has shown that, even when initially presented with inadequate declarations, UNSCOM had, through use of its various resources and of its inspection rights, elicited the information required to establish the OMV regime. However, should Iraq seek systematically to block the work of UNSCOM by, for example, preventing access to sites, UNSCOM would be unable to provide the Security Council with the assurance it required concerning Iraq's compliance with the terms of resolution 687.

In addition to conducting OMV activities at sites for which OMV protocols have been prepared, the monitoring teams based at the UNSCOM Baghdad Monitoring and Verification Centre would also conduct visits to various institutions at which research is undertaken but which might not need to be subject to regular monitoring. Such visits were to gain an understanding of the direction and level of Iraq's basic research that might be useful for the production of chemical or biological warfare agents. These teams would also seek to clarify outstanding anomalies in Iraq's declaration concerning its dual-purpose capabilities.

By April 1997, in the chemical weapons area, some 150 facilities in Iraq were being monitored and since October 1994, over 550 inspections had been carried out by the resident chemical monitoring group. The chemical monitoring teams based in Baghdad had discovered some 200 key pieces of undeclared dual-use equipment, such as heat exchangers, glass reactor vessels and distillation columns capable of use in proscribed chemical weapons activities. In addition, some 800 pieces of

related equipment have been located. Consequently, Iraq was not fully meeting its requirement to report on its holdings of dual-use equipment.

In the biological weapons area, by April 1997 some eighty-six sites were being monitored regularly. Several pieces of significant undeclared equipment, spare parts and supplies had been discovered in inspections. Iraq had still not declared all sites where dual-use equipment was present and the biological monitoring teams based in Baghdad continued to identify sites that Iraq should have declared.

Analysis

On-site inspections have been crucial to the success of UNSCOM in the face of continual Iraqi deception and obstruction. In this analysis, the importance of short notice inspections, visual observation, interviewing, identification of key equipment, auditing and sampling and identification are examined.

On-site inspections have been crucial to the success of UNSCOM in the face of continual Iraqi deception and obstruction.

Inspections

An essential element of UNSCOM has been the mounting of missions to Iraq to carry out on-site inspections and other activities associated with implementing resolution 687 and subsequent resolutions. Missions have ranged in size from just a few people to over fifty or more; duration has also varied from one day to several weeks or months. A particular characteristic of the UNSCOM missions has been that because UNSCOM has not had a large permanent staff, these missions have primarily been composed of individuals seconded by Member States of the United Nations to UNSCOM for the duration of the particular mission on which they have been engaged.

Visual Observation

The importance of visual observation has been particularly evident throughout UNSCOM's activities, especially in the face of Iraqi deception and obstruction. The value of U-2 and helicopter surveillance backed by on-site inspection has been shown as there were several instances of inspection teams being delayed at the entrance to facilities whilst Iraq moved equipment and materials out of the facility. Visual observation has also been essential in evaluating the role of sites and of the attempts made to conceal information.

Interviewing

Interviewing has been another key tool used by UNSCOM in the light of Iraq's declared absence of any relevant documentation. A number of missions have specifically focussed on interviewing key participants in the prohibited programmes in order to attempt to recover an account of what happened and when. This approach has also been necessary to try to verify Iraq's unilateral destructions for

which it asserts that there is no remaining documentation. Interviews have, however, been difficult as they are invariably carried out in the presence of Iraqi "minders" and there have been several cases where interviewees have been persuaded to change their recollections. Nevertheless, the inconsistencies between different accounts and the Iraqi declarations have helped to demonstrate that Iraq has not been forthcoming about its past programmes.

Identification of Key Equipment

The identification of key equipment has been particularly valuable in both the chemical and the biological areas. Inspections by UNSCOM throughout the past seven years have identified equipment that is relevant to the prohibited programme and which has not been declared or disclosed by Iraq. One of the earliest examples was the discovery in December 1991 at a sugar factory in Mosul of 100 items of metal-working machinery from the Muthanna chemical bomb workshop. Much later, UNSCOM identified equipment removed from Kuwait and located in many chemical facilities in Iraq. Dual-purpose equipment procured for the chemical weapons programme has been identified by UNSCOM and destroyed under UNSCOM supervision. In the biological weapons area, the location of fermenters, filling machines and spray dryers has been the subject of much attention by UNSCOM, with key equipment being destroyed under UNSCOM supervision.

Auditing

Auditing has been crucial to UNSCOM's activities. It has been particularly important that UNSCOM verify Iraq's FFCDs. Much emphasis has rightly been placed on achieving material balances for both weapons and for agents. Iraq has provided some information in its FFCDs whilst other documents have been found by inspection teams. The inconsistencies between the Iraqi FFCDs and other information found in Iraq has demonstrated that Iraq has continued to conceal and deceive its true capabilities from UNSCOM. Such auditing has been necessary across all areas being addressed by UNSCOM as the information relating to SCUD missiles, their indigenous production, and their warheads has to be correlated with information on the numbers of special warheads, filled with chemical and biological agents, which in turn have to be correlated to the quantities of agents produced by Iraq and the quantities of precursors or growth media imported into or produced by Iraq.

In October 1997 UNSCOM reported[19] material balances for the period 1981 to 1990 for chemical agents and their precursors and for chemical munitions (see Table 1). These balances made it clear that there are significant quantities unaccounted for and currently unverified in the absence of further documentary evidence from Iraq.

It is against this background that the importance of the document found in a July 1998 inspection detailing the Iraqi Air Force consumption of both conventional and special aerial bombs becomes evident. UNSCOM had reported[20] that this document was "a listing of munitions expended by the Iraqi Air Force" and which included "together with conventional munitions detailed, four particular types of other munitions were included. They were denoted as 'special'. These types have been declared by Iraq to have been used for chemical and biological warfare agent delivery." It was also noted that "the inspectors were able to take notes from the document. The notes revealed serious discrepancies between Iraq's declarations on the consumption of chemical bombs and the data copied from the document on the expenditure of these weapons." Iraq regarded this document as

Table 1. Chemical Agent and Munitions Material Balance 1981–1990

Material	Quantity in tons	Remarks
Precursor chemicals	more than 20,000	Some 4,000 tons of declared precursors have not been verified
CW agents produced	3,850	Several hundred tons additional CW agents could have been produced
CW agents consumed during 1981–1988	2,870	No documents or information have been provided to support the declared quantity
CW agents destroyed under UNSCOM supervision	690	Verified by UNSCOM
CW agents discarded during production or destroyed during bombing	290	No supporting documentation for 130 tons declared discarded or destroyed
Munitions	**Quantity**	**Remarks**
Empty munitions produced and procured	247,263	107,500 empty casings have not been verified
CW filled munitions	152,119	Several thousand additional munitions could have been filled
CW filled munitions consumed during 1981–1988	101,080	No documents or information have been provided to support the declared quantity
CW filled or empty munitions destroyed by Iraq unilaterally	29,172	15,620 not verified due to destruction method
CW filled and empty munitions destroyed under UNSCOM supervision	38,537	Verified by UNSCOM
CW filled and empty munitions discarded during production or destroyed during bombing	78,264	No supporting documentation for 16,038 munitions declared discarded or destroyed

being irrelevant to the work of UNSCOM.

Auditing was just as important in the biological weapons area. In June 1998, UNSCOM said that the statements in the biological FFCD could not yet be verified in respect of: growth media material balance, agents produced/destroyed, munitions available, munitions filled and weapons destroyed.

Sampling and Identification

Sampling and identification has played an important role in the work of UNSCOM. The early sampling and identification work carried out in the survey of the Muthanna chemical weapons site demonstrated that Iraq had been working on a wider range of chemical agents than it had declared. In the later years, sampling and identification played a key role in demonstrating that Iraqi unilaterally destroyed missile warheads had been filled with the chemical agent VX and that more missile warheads had been filled with anthrax than had been declared. Sampling and identification had thus provided key evidence that Iraq's declarations continued to be false and inconsistent.

Conclusions

On-site inspection has been crucial for the work of UNSCOM in implementing resolution 687. Without these inspections, there could have been no uncovering of Iraq's past programme; no destruction of Iraq's weapons of mass destruction, equipment and facilities; and no assurance that Iraq was not reacquiring such a capability. The UNSCOM experience demonstrates clearly that an effective regime must include on-site measures.

Notes

1 United Nations Security Council, Resolution on the situation between Iraq and Kuwait, S/RES/687 (1991), 3 April 1991.
2 United Nations Security Council, Report of the Secretary-General submitting the plan for ongoing future monitoring and verification of Iraq's compliance with relevant parts of Section C of Security Council resolution 687 (1991), S/22871/Rev.1, 2 October 1991.
3 United Nations Security Council, Security Council Resolution on the situation between Iraq and Kuwait, S/RES/715 (1991), 11 October 1991.
4 United Nations Security Council, Report of the Secretary-General on the status of the implementation of the Special Commission's plan for the ongoing monitoring and verification of Iraq's compliance with relevant parts of Section C of Security Council resolution 687 (1991), S/1994/1138, 7 October 1994.
5 United Nations Security Council, Report of the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991), S/23165, 25 October 1991.
6 United Nations Security Council, Report of the Secretary-General on the status of the implementation of the Special Commission's plan for the ongoing monitoring and verification of Iraq's compliance with relevant parts of Section C of Security Council resolution 687 (1991), S/1995/864, 11 October 1995.
7 United Nations Security Council, Letter dated 5 August 1998 from the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991) addressed to the President of the Security Council, S/1998/719, 5 August 1998.
8 Special Report of the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991), S/23606, 18 February 1992.
9 United Nations Security Council, Further Report of the Secretary-General on the status of compliance by Iraq with the obligations placed upon it under certain of the Security Council Resolutions, S/23687, 7 March 1992.
10 United Nations Security Council, Report of the Secretary-General on the status of the implementation of the Special Commission's plan for the ongoing monitoring and verification of Iraq's compliance with relevant parts of Section C of Security Council resolution 687 (1991), S/1995/864, 11 October 1995.
11 United Nations Security Council, Report of the Secretary-General on the activities of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991), S/1996/258, 11 April 1996.

[12] United Nations Security Council, Report of the Secretary-General on the activities of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991), S/1997/301, 11 April 1997.
[13] United Nations Security Council, Letter dated 26 October 1998 from the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991) addressed to the President of the Security Council, S/1998/995, 26 October 1998.
[14] United Nations Security Council, Report of the Secretary-General submitting the plan for future ongoing monitoring and verification of Iraq's compliance with relevant parts of section C of Security Council resolution 687 (1991), S/22871/Rev.1, 2 October 1991.
[15] United Nations Security Council, Resolution on the situation between Iraq and Kuwait, S/RES/715(1991), 11 October 1991.
[16] Iraq rejection of OMV plan as reported in paragraphs 12 and 13 of United Nations Security Council, Special Report of the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991), S/23606, 18 February 1992.
[17] United Nations Security Council, Letter dated 26 November 1993 from the Minister of Foreign Affiars of Iraq addressed to the President of the Security Council, S/26811, 26 November 1993.
[18] United Nations Security Council, Report of the Secretary-General on the status of the implementation of the Special Commission's plan for the ongoing monitoring and verification of Iraq's compliance with relevant parts of Section C of Security Council resolution 687 (1991), S/1994/1138, 7 October 1994.
[19] United Nations Security Council, Report of the Secretary-General on the activities of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of resolution 687 (1991), S/1997/774, 6 October 1997.
[20] United Nations Special Commission, Letter from the Executive Chairman addressed to the President of the Security Council, 22 July 1998.

Examining Long-term Severe Health Consequences of CBW Use Against Civilian Populations

Hundreds of thousands of people have been killed or maimed and countless thousands are still suffering from exposures to chemical, biological and nuclear weapons. These include exposures during the First and Second World Wars, the Iran-Iraq War, the Tokyo subway attack, the "Anfal" campaign in Iraqi Kurdistan, and possibly during the Gulf War. Hundreds of thousands of survivors continue to suffer without help, essentially abandoned to face severe effects of weapons which are either carcinogenic (cancer-causing), teratogenic (causing congenital malformations) or neurotoxic (leading to profound neurological or psychiatric problems).

Real Threats

Exposure to chemical, biological or nuclear agents, either from military use or accidents, result in profound damage to people and the environment. Toxic residues from such weapons contaminate food and water supplies, cause sterility in people and animals, and can cause genetic damage spanning generations. Secondary consequences may spread across international boundaries, endanger millions, have effects on children yet unborn and on the fertility and health of future generations. The long-term implications thus differ from those posed by conventional weapons and defy responses planned for conflicts, terrorist attacks and accidents.

The sarin attack on the Tokyo subway system demonstrated the potency of such weapons, the difficulties in preventing their use and the inadequacy of the response system. Serious long-term neurological effects are now being reported not just among survivors, but also in the medical and emergency staff who responded to the incident. Unlike conventional arms, chemical and biological weapons attacks have deadly and disabling effects on emergency services personnel and persist in the environment. Such agents cannot be counteracted through conventional infrastructure and emergency responses.

Governments around the world now acknowledge the real threat of such weapons and the nightmare prospect of war and terrorism that destroy people and not buildings. Increasingly frequent industrial mishaps, train derailments, air crashes and other accidents have also resulted in exposures to a variety of highly toxic substances, and local jurisdictions have found themselves ill-prepared to respond. Emergency exercises in major cities and at defence establishments have demonstrated the inadequacy of current responses to the emerging threats. In the event of an attack or accidental

exposure, governments must develop new strategies to care for and treat the victims. New understandings of how chemical and biological agents work and how to ameliorate their effects must be developed.

The Attack on Halabja and the Anfal Campaign in Iraqi Kurdistan

The populations of towns in Northern Iraq, especially the town of Halabja, are the largest civilian populations ever exposed to chemical and biological weapons. In 1988, the Kurdish inhabitants of Halabja were aerially bombarded with a cocktail of chemical and biological weapons, including mustard gas and the nerve agents sarin and tabun. The nerve agent VX and the biological toxin aflatoxin were also probably used. The people were drenched in these agents and their food and water were contaminated. About 5,000–7,000 people of the total population of 80,000 died as immediate casualties of the attack and a further 30,000–40,000 of the population were injured, many severely. No one has yet established exactly how many people died in the aftermath of the weapons attack, their ages or where or how they died. Nor is there any information about how many people now suffer long-term effects of the weapons or what the effect has been on the population structure as a result of infertility, foetal and infant deaths, and susceptibility to early mortality in vulnerable groups such as children, the elderly and pregnant women.

In addition to these victims in Halabja, there are further affected populations throughout Iraq attacked by Saddam Hussein from April 1987 to August 1988. Hundreds of tons of chemical weapons were used in attacks on Northern Iraq. It has been estimated that between 100,000–200,000 were involved in these attacks, but full medical and scientific studies of the weapons, the victims and the survivors have not been undertaken.

Cocktail of Weapons — Huge Range of Medical Consequences

We have as yet incomplete knowledge about the major long-term effects of chemical weapons, particularly when delivered in the potent and synergistic cocktail of the Halabja attack. What we do know is that chemical weapons have long-term effects. Genetic effects cause mutations in DNA and thus lead to cancers and congenital malformations, thereby giving rise to a new and continuing form of genocide. Mustard gas (although one of the first chemical weapons) is a very potent cancer-causing agent and is known to be toxic to embryos. Many pregnancies in Halabja are lost because of the heritage from these weapons and many women have suffered infertility as a consequence. In addition to the effects they have on stillbirths and childhood malformations and deaths, they continue to severely afflict the living. Mustard gas burns to the cornea have caused blindness; to the skin have caused skin cancers, pain and ulceration; and to the lungs have caused recurrent infections, asthma, bronchitis and pulmonary fibrosis so severe that lung transplants would be the only possible option for therapy. The nerve agents have caused severe neuropsychiatric disorders. There are as yet few effective treatments to oppose the destructive effects due to the advanced technologies of weapons of mass destruction and so it is imperative that advanced medical help is now provided for the victims.

Long-term medical consequences include: cancers; congenital malformations; infertility and infant deaths; respiratory, cardiac, eye and skin problems; and neuropsychiatric disorders.

Health Challenges

The effects of chemical and biological weapons, as well as nuclear exposure, differ from those of conventional weapons which have easily observable effects and for which there are effective treatments. In contrast chemical, biological and nuclear agents act silently, and many of the most severe effects are long term and strike without warning. Delayed effects such as the development of cancers following exposure may occur five to ten years later. Survivors of chemical, biological and nuclear attacks suffer devastating effects on all organ systems. They face a multitude of physical and neuropsychiatric problems. There are no known treatments, and conventional therapies may exacerbate their symptoms. Immediate responses by emergency services and national agencies may save lives, but do not address middle- or long-term problems. A major difficulty is how to treat rare cancers that are common in this population, such as those of the larynx and nasopharynx, which developed as a result of mega-dosages of carcinogenic and mutagenic mustard gas. Neither is there any information either about methods for treatment of the neuropsychiatric effects of the nerve gases sarin, tabun and VX or the long-term medical effects on cardiac, respiratory, dermatological and ophthalmological systems of these weapons.

Pregnant women, young children and the elderly are at greatest risk from exposure to chemical weapons. There is an urgent need to treat this population so as to determine the best possible way of alleviating their suffering. Simple measures should be tested, such as the provision of folic acid to prevent birth defects; or iodine tablets and uncontaminated milk and food to prevent cancers of the thyroid, breast, bone and leukaemia.

Medical Infrastructure Severely Deficient

The enormities of the health problems facing the population of Northern Iraq are magnified by an appalling lack of medical resources and infrastructure. Despite the fact that they were attacked eleven years ago, the survivors have received minimal, if any, humanitarian assistance. Regional doctors, trained mainly in the United Kingdom, are extremely frustrated by a severe lack of medicines, equipment and health support. Basic sciences laboratory facilities are inadequate and research capacities limited. The deans of regional medical colleges report a complete lack of up-to-date textbooks and journals. Communication between regional hospitals and with the outside world are difficult. There is even a shortage of pencils and paper for patient records.

Available drugs are often outdated or impure and there are major problems with equipment and supplies as basic as oxygen for surgery. Virtually no advanced treatment or diagnostic equipment exists in Northern Iraq. No transplants of any kind (kidney, corneal, liver, lung, heart) take place. Major medical infrastructure problems are exemplified for the care of those with cardiac failure (especially the young), where no cardiac drugs or analgesics are available, nor cardiac surgery. Renal failure leads to death as there is no dialysate available for the kidney dialysis machines. Patients with major medical conditions can be referred to Mosul or Baghdad, but even if they make the long, painful and expensive journey, they often die without treatment. Furthermore, many fear their lives will be at risk if they travel south into Iraqi controlled areas.

There is no plastic surgeon in the region to repair major mustard gas burns to the skin or congenital malformations such as cleft lip and palate. With no specialist paediatric surgeon or paediatric cardiology facilities, children with major chemical or biological weapons induced cardiac defects die through lack of treatment. While there are many doctors in Iraq, such as those presently working in general surgery, there is a need for specialist training, for instance in the area of plastic

surgery to heal extensive mustard gas burns.

The serious deficiencies in health and medical infrastructure in Halabja and the three northern Governorates are exacerbated by United Nations sanctions and problems in implementation of Security Council resolution 986, which allows the sale of Iraqi oil in exchange for food and medicine. Northern Iraq has received only a very small part of the promised 13% entitlement of total medical supplies under resolution 986. The Iraqi regime, which oversees distribution of 986 supplies, rarely allows delivery of useful medicines and equipment requested by health authorities in Northern Iraq. The "Oil for Food" programme thus fails to meet the basic health needs of the population, let alone the special needs of chemical victims. As many doctors point out, Iraqi Kurdistan suffers from a double embargo — one by United Nations sanctions, the other imposed by the Iraqi regime on Kurdish regions. This situation continues to ensure steady deterioration of medical and other infrastructures.

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Healing Halabja — Helping the World

Since visiting Iraqi Kurdistan and the town of Halabja in January 1998, Dr. Christine Gosden and the Washington Kurdish Institute (WKI) have conducted extensive consultations with regional doctors, officials, international experts and humanitarian NGOs. The result has been a proposal to develop a post-graduate medical programme in Iraqi Kurdistan for treatment and research of chemical and biological weapon exposures. The proposed structure would ensure that the humanitarian/ medical response sensitively and ethically lays the groundwork for a stringent scientific process needed to determine the long-term affects of chemical weapons.

The proposed programme will facilitate development of strategies for conflict situation epidemiology, effective interventions, prevention, treatment and humanitarian aid. The model will facilitate cooperation between regional political authorities and administrative structures, and energize segments of civil society throughout Northern Iraq. The structure would integrate long-term international research and immediate health response efforts. Treatment and research programmes are also envisioned throughout Europe at research hospitals in Kurdish immigrant communities, as significant numbers may have faced exposure. Programmes among more accessible immigrant populations will provide critical patient databases for comparative studies with regional and control groups.

Working with physicians in Iraqi Kurdistan and international experts, Dr. Gosden and WKI have prioritized six "cornerstone" pilot treatment/research programmes:

- Cardiopulmonary;
- Neuropsychiatric;
- Cancers in children and adults;
- Congenital malformations, infertility and infant death;
- Medical disorders (including ophthalmological and dermatological.); and
- Palliative care (treatment for the terminally ill).

Minimal international support and assistance from some local NGOs will help establish a rudimentary post-graduate structure at three university hospitals and a hospital in Halabja to undertake

an initial detailed medical/demographic survey. Yet without substantial international assistance, medical treatment and research will not be possible, and the population will continue to suffer.

Conclusions

While there are many responses to the question of why there has been no rush to aid these people, if we continue to fail them and act as if they are beyond help, then the threats posed by chemical and biological weapons become much greater for all of us.

Even if we find it difficult to countenance providing humanitarian help, at least self-interest and the crucial issue of domestic preparedness should alert us to the relevance of this community for the wider population. For example, during the Gulf War, some American service personnel may have been exposed to a chemical cocktail. Their multisystem illnesses remain unexplained and have defied diagnosis and effective treatment. Additionally, as we have seen in both Northern Iraq and Chernobyl, these problems have affected not only local populations with immediate death, ill health and subsequent increases in the rates of congenital malformations and cancers, but have also had wider effects on millions of people hundreds of miles from the initial contamination. The Chernobyl accident has left a legacy of cancers, childhood malformations and genetic mutations, not just in Ukraine, but in countries throughout Europe. The environmental effects will persist for hundreds of years and the genetic damage will be passed on for generations. Therefore, no chemical, biological or nuclear exposure can be considered as a local problem.

The potency of the effects, such as the increase in aggressive cancers in the young which kill terribly and painfully ten years after the attack or children born malformed as a result of toxic effects, argues for renewed efforts for complete chemical and biological disarmament and the development of novel techniques to help and treat victims. Even if effective, the tools of disarmament to prevent the use of chemical and biological weapons would have come too late for the Kurds and others victimized by the Iraqi regime. But it is not too late to ease their massive suffering, and perhaps in the process, learn valuable lessons about treating victims of chemical and biological weapons.

For more information about the efforts to bring help to the survivors of Halabja, please contact:

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Summing Up Disarmament and Conversion Events

The following text is the introduction to Yearbook Conversion Survey 1999 — Global Disarmament, Demilitarization and Demobilization, by the Bonn International Center for Conversion's (BICC), which documents and analyzes world-wide disarmament and conversion efforts, including military expenditures, reorientation of military research and development, restructuring of defence industries, demobilization and reintegration of ex-combatants and disposal of surplus weapons. A topical study informs about efficient civilian use of military bases. ISBN 3-7890-6068-2, 180 pages.

The 1990s began with great hopes for a 'peace dividend': with the Cold War over, the world could harness resources freed from the military sector for peaceful development. This assumption has given way — at least in some parts of the world — to a more pessimistic point of view, namely that the expectations of deep cuts in the world's military arsenals have stalled and that conversion has not succeeded.

These prevailing notions can be traced to two main factors: first, perceptions of the process of peace-making, disarmament and conversion. Despite many success stories in conflict prevention, disarmament and conversion, the celebrated failures have contributed to this overly pessimistic opinion and resulted in despairing, sometimes even fatalistic political reactions. The second factor is the reality of conflicts, disarmament and conversion. Violent conflicts are still occurring in many parts of the world; disarmament faces serious challenges, and conversion is far from being an easy and smooth process. The expectations in the early 1990s, both in the public at large as well as of experts, underestimated the newly emerging causes of violent conflict, the multifaceted real or perceived barriers to rapid disarmament, and the technical and financial cost involved in organizing the process of reallocating military resources to non-military purposes.

However, while a reversal of the disarmament and conversion process in some countries or regions cannot be excluded, it must be emphasized that behind the noisy headlines of the many conflicts, there exists a string of positive, often silent achievements. Clearly, in total, the 1990s balance sheet of disarmament and conversion is positive. Global disarmament continued even in 1997 and 1998, although at a slower pace, and so did conversion. Despite the difficulties of implementing disarmament, numerous practical conversion projects are underway or have already been completed. The achievements in disarmament become quite clear if we recall the size of the military sector (the input of financial, human and material resources) at the end of the 1980s compared to now. There has been a drastic reduction and — as has been experienced during the last decade — disarmament and conversion have at least partly developed their own internal dynamics. One disarmament round can provoke another and a general expectation of quantitative decline — for example in the number of nuclear warheads — can result in a drive for unilateral reductions going beyond the negotiated thresholds. This internal disarmament dynamic can continue to work in the future as well.

Achievements and Failures

Today's international security environment is more complicated and complex than the antagonism that characterized the period of bipolarity. Clear-cut images of the enemy and the threat of all-out war and nuclear encounters have diminished and have instead been largely replaced by a concern over intra-state and regional conflict formations. The great optimism about the peace-

making capacities of international organizations such as the United Nations, the OSCE or other regional bodies has been tempered by such sobering failures as in Somalia or continuation of difficulties as in Angola, Bosnia and Kosovo. With the nuclear 'sabre rattling' of the superpowers coming to rest, the international community seems more inclined today to call for military intervention to prevent or stop wars. This tendency has motivated governments to transform armed forces and modernize their equipment, thereby enabling them to carry out such tasks. While the risks of threatening or using military force are more limited and predictable today, such actions are unfortunately often not the solution to the underlying problems of conflict. Nor is it easy to end military action in a given period of time; it is still easier to start than to end a military intervention.

New regional conflict formations, for instance in East and Central Africa, must be added to continuing older ones, such as in the Middle East, South Asia and South-East Asia. While the end of the Cold War ended the superpower domination over regional conflicts — and hence reduced tension — it has also laid open the complexity of the issue and the continuing existence of local and regional causes of conflict. Other international security worries of the 1990s are: weak (or collapsing) states, disintegrating armies and their factionalism and uncontrolled weapons, rather than clashes and combat between well-organized and heavily armed armies. Along with causing large-scale and horrific suffering, including death, injury, displacement, famine and so on, these processes jeopardize any development. As far as violent conflicts are concerned, international military clashes such as those between Iraq and the United States/United Kingdom at the end of 1998 are the exception rather than the rule. However, the most regressive disarmament and conversion 'event of the year' was probably the test of nuclear weapons by India and Pakistan in May 1998 since it will probably have long-term effects on the proliferation of weapons of mass destruction.

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Conversion complications, disappointments about the pace of peace processes and disarmament, and continuation of old and the outbreak of new disputes and conflicts have contributed to the slowing down of the disarmament and conversion dynamism of the early 1990s. The situation at the end of 1998 was characterized by contradictory trends rather than unilinear developments. The results are mixed:

- Promising peace agreements and their implementation, as in Northern Ireland and Central America, are contrasted by the unsettled conflict about disarmament of weapons of mass destruction in Iraq, the outbreak of war in the Democratic Republic of Congo and the military engagement of several African states on either side of the conflict, the reversal of the peace process in Angola and Sierra Leone, and the violent conflict between Eritrea and Ethiopia with increased arms imports in the Horn of Africa.
- The majority of countries are continuing to reduce their financial input into military arsenals, thus reallocation to non-military purposes continues. However, at the same time, heavy investments into arms programmes are being made especially in regions of tension. Also, major powers, notably the United States but also China, are set for increased spending.
- Several encouraging initiatives at different international levels to control the availability of small arms and the conclusion of the 'Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction' are contrasted by still uncontrolled proliferation of small arms into many areas of conflict and by the slow progress and lack of funds for demining programmes.
- De facto nuclear disarmament through reductions of nuclear warheads is contrasted by the

lack of advance in negotiated nuclear arms control, nuclear ambitions in South Asia and mounting technical and security problems in safeguarding nuclear materials in the Russian Federation. The increasing number of nuclear-weapon states and the stockpiling of weapon-grade materials increases the dangers of the use of nuclear weapons.

- The number of conventional major weapon systems deployed by the armed forces has been cut substantially and continues to be reduced. This quantitative disarmament, however, does not always result in a reduction of military power. On the contrary, modernization of weapon systems through integration of high technology with increased military firepower continues unabated in the large industrial countries.
- Negotiations about reductions of major weapon systems in the OSCE region are bogged down in 'nitty-gritty' bargaining; the bold concept of adjusting force levels to the changed security landscape in Europe has largely been lost. At the same time, however, quantitative reductions of weapon systems and personnel levels continue below the levels being negotiated.
- Defence industry consolidation at the company level has made much progress; production capacities have been brought down and — where the conditions were right — conversion of defence industries has worked. While many of the streamlined defence companies are doing extremely well, recording record profits, the real losers of this consolidation have been the defence industry employees since almost every second job in defence production has been lost during the last decade. A large number, but not all of these employees, have found employment outside the defence industry.
- Military base closures are both a challenge and an opportunity. Often, heavy and long-term investments are required to redevelop former military bases for environmentally secure civilian use. This has led to a costly and time-consuming redevelopment process. While some countries face great difficulties — due to the sheer size and number of bases as well as lack of economic opportunities — for other countries, base redevelopment has created new economic potential, especially job opportunities.

To many, the end of the Cold War meant an automatic reduction in worrying about nuclear weapons, large-scale reallocation and conversion of vast resources, and harnessing of a 'peace dividend'. However, this process — while, on balance, positive according to BICC findings — is complicated, costly and time-consuming. This does not mean that disarmament and conversion are not possible. On the contrary: they are a worthwhile investment in an ambitious political, social and economic process which requires creativity, stamina and resources.

BICC Findings

Global Disarmament

Global disarmament towards the end of the 1990s is unabated. According to BICC's Conversion, Disarmament, Demilitarization and Demobilization (BIC3D) Index the value for 1997 — the latest year of reporting — records disarmament of 3%, and a total of 29% for the period since the end of the Cold War. Of the four components of the BIC3D Index — military expenditures, weapons holdings, military personnel and employment in the defence industry — the largest contribution in 1997 came from the decreases in the number of weapon systems, clearly compensating for the slow process of disarmament in this category in previous years. In contrast, military expenditures were heavily reduced in previous years, but have recorded a stop in the reductions since 1997.

As analyzed in the 1996 Survey, two main factors are decisive for governments' efforts to arm or disarm: wars, and the availability of economic resources. First, at the top of BICC's disarmament ranking are countries which disarmed at the end of 'hot' wars in a number of areas in Africa and Latin America and at the end of the Cold War especially in Eastern and Western Europe. The other side of the coin is the fact that many countries at war or in regions of tension continue to strengthen their military arsenals, often despite extremely dire economic situations. Second, a number of countries ranking high on BICC's disarmament and conversion list are driven by economic motives. When the security situation allowed for reductions, those countries decided to cut their resource allocation to the military. There are strong indications that this behaviour is presently confirmed by a number of Asian countries affected by the 'Asian financial crisis'. Military programmes have been slowed down, postponed or cancelled in countries such as Indonesia, the Republic of Korea and Thailand. While a number of countries in East Asia invested heavily into arms modernization programmes when still booming economically, and the region as a whole disarmed on average by a meagre 5% in the period since the end of the Cold War, the process of expanding the armed forces seems to have slowed down now or even halted. It is likely that a process of gradual disarmament has commenced in this region.

Military Expenditures and Their Reallocation

Global military expenditure reductions, rapid in the first half of the 1990s, have come to a halt; even increases in spending seem possible in the near future. In absolute figures, military expenditures fell from a peak of more than US $1,030 billion in 1987 in an unbroken trend to US $683 billion in 1996 (in 1993 prices). BICC recorded a further slight decrease in 1997 to US $680 billion. Arms transfers were on the rise again in the second half of the 1990s. Various quite different developments are driving these trends. There are some countries and regions which were never much affected by the general disarmament trend in the late 1980s and early 1990s, such as South Asia and Northern Europe, and, at least until lately, East Asia. ASEAN countries reduced their military expenditures in 1997 for the first time while expenditures in West Asia (the Middle East) grew, although at a slow pace. But there are also some countries, such as the United States and a few countries in Eastern and Western Europe, where a reversal of the earlier trend to disarm is noticeable.

In some countries and regions, at the same time, military expenditures continue to decrease, for instance after the end of conflicts, opening up chances for local 'peace dividends'. The most important reason for reductions, however, are financial difficulties, such as in East Asian countries. On the global scale the prospects for reallocating savings from military expenditures to other purposes are shrinking.

Reorientation of Military R&D

Judging from the scarce data, it seems that spending on research for, and development of, new weapons and other military goods has also started to increase again. The modernization of weapons technology remains a high priority in some key countries. Even if a number of such technological developments never go into production, the policy of priority setting in favour of military R&D is intended to keep abreast with modern technological developments. Judging by its spending on military R&D, the United States — by far the largest spender on military R&D worldwide — is on a course of rearmament. In the Russian Federation by contrast, both military and civilian R&D have had difficult times. Despite political declarations and even budget plans to the contrary, military

R&D have experienced serious cuts due to the general economic, budgetary and financial crisis in the Russian Federation.

Conversion of the Defence Industry

The partial return of demand for weapons is improving the economic prospects for arms-producing companies in some countries, such as the United States and in Western Europe. Defence companies in the United States have gone through an extensive period of restructuring and consolidation which is also likely to come to Western Europe. However, even with growing businesses, the companies are continuing to reduce employment.

At the same time, large overcapacities in arms production continue to exist, for instance in the Russian Federation and China. Further downsizing is highly probable, partly to be better able to support a more efficient core of defence producers. This will create considerable demand for conversion, that is, for the expansion of civilian business to compensate for losses of defence orders.

Military Personnel and their Demobilization and Reintegration

The trend of a reduction of military personnel has continued in recent years. After the Cold War peak of a total of 28.8 million, the number of military personnel was brought down to 22.0 million in 1997. Reductions were concentrated in countries which announced and began demobilization and force reductions in earlier years, such as China and several countries in Europe. Peace settlements continue to add new opportunities and challenges for large-scale demobilization and reintegration. Much experience has been gained about the possibilities and difficulties of support for demobilization and reintegration, a new aspect of development assistance in the 1990s. Still, post-conflict demobilization is far from routine, and backlashes, such as in Angola in 1998, can occur.

Base Closures and Redevelopment

The process of base closures lagged behind other reductions in military sectors. Although a 'base closure gap' has developed globally, base closures are a most promising economic road to successful conversion. There are some major exceptions to the general 'base closure gap', such as Germany, where a great number of bases have been closed. In Germany, as well as in other countries with extensive base closures such as in the United States, it has become clear that base redevelopment is a lengthy process which nevertheless offers interesting economic opportunities. Base redevelopment will remain an important issue for a long time, especially in those parts of the world where it has been delayed and where base redevelopment faces serious environmental tasks.

Some lessons can be learned by studying successful base redevelopment. However, the overarching importance of regional economic factors limits the direct applicability of methods used in major industrial countries.

Surplus Weapons and Their Disposal

The reduction of the various types of weapons is currently the most dynamic element of disarmament, both in quantitative terms, as well as in its political dimensions. However, here also, disarmament and conversion have slowed down compared to the early 1990s, for instance in the nuclear field.

While the Chemical Weapons Convention entered into force in 1997, one of the remaining problems of the convention is the inability or unwillingness of the majority of states to provide the Organisation for the Prohibition of Chemical Weapons with the mandatory data needed to execute treaty verification. This also applies to the United States which has the second largest stockpile of chemical weapons on its territory. While the United States is dismantling chemical weapons at a quick pace, the Russian Federation is making little progress due to the political and financial difficulties of the destruction programme.

Although reduced by over 5% in 1997, major conventional weapon systems are still deployed in large numbers in military arsenals. The present stock of major conventional weapon systems is estimated by BICC to be over 435,000 pieces (more than half of them — over 220,000 — deployed in the OSCE countries). On the other hand, there are some encouraging developments in fields where little movement was noted earlier, such as control and collection of small arms. Initiatives to stop the circulation or restrict the easy availability of small arms have been taken both at the international level and, in several countries, nationally.

Unfortunately, there is not much prospect for the conversion of weapons which have become surplus. Weapon systems hardly ever have a potential civilian application. Thus, disposal and destruction, with all their difficulties, are generally preferable. However, to save the cost of destruction or to earn income, the transfer of surplus weapons — both legal and illegal — from countries where weapons are surplus to others where they may be used in conflicts is often chosen instead of destruction or safe storage.

Conclusion: The Changing Face of Conversion

Disarmament at the end of the 1990s is different from disarmament ten years ago. Correspondingly, conversion challenges and tasks are changing. Slowly, the 'disarmament shock' of around the end of the Cold War is wearing off. The period of the early deep cuts seems to be over and has given way to a more gradual approach. Some, though not all, of the core countries of the Cold War, which had the largest reductions in military resource use in the late 1980s and during the early 1990s, are slowly beginning to build up military sectors again, or, at least, to plan for more efficient armed forces on a stable level of financial effort. Military doctrines have been reformulated and the armed forces and their arsenals are being reformed, rationalized and modernized. Thus, investment and divestment in the military sectors are occurring in parallel. Reversion of earlier disarmament and conversion seems possible in some countries. Conversion in many countries is focusing on the long-term challenges, predominantly in

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the fields of base redevelopment, industrial downsizing, reform of the armed forces and disposal of weapons.

Some of the former antagonists of the Cold War, such as the Russian Federation and Ukraine, still have to master the difficult tasks of downsizing their armed forces and defence industry conglomerates in addition to redeveloping their military bases and decommissioning their stocks of surplus weapons. Civilian alternatives are not easy to find for personnel made redundant in the armed forces, the defence industry or the weapon labs in a transformation society struggling with many other economic and social adjustment problems.

The obstacles and difficulties to implementation of conversion are manifold and complex, particularly in both the transformation countries and the post-conflict societies. However, even if the military sector in the core states of the Cold War had reached a bottom level, disarmament and conversion demand would not stop but rather shift. The ending of conflicts and economic constraints continue to be major driving forces for reduced military resource use. Conversion usually needs investment, and the funds for such investment are scarce both after the end of conflict and in economic crises. Nonetheless, investing in conversion is, according to the experience of the last decade, a worthwhile investment promising a good return.

Instead of high hopes for easy 'peace dividends' — as were raised at the end of the Cold War — there is much practical work already underway and still much to be done. Many conversion experiences, both positive and negative, have been made during the last decade. The lessons learned are a solid basis for the present and future disarmament and conversion challenges. The practical work — though not as spectacular as the juggling with hundreds of billions of dollars which would be piling up if military budgets were cut — is nonetheless providing benefits to the international community, national societies, local communities, companies and individuals. But at the same time, major challenges — and often the hardest cases — still lie ahead. However the experience of the past shows that those challenges can be mastered.

On-Site Inspection in the Emerging BTWC Protocol

The weakness of the Biological and Toxin Weapons Convention (BTWC), which entered into force in 1975, in the absence of any verification measures has long been recognized.[1] Although in 1986 at the Second Review Conference, four confidence-building measures (CBMs) were agreed and then extended and developed in 1991 at the Third Review Conference, their implementation has been patchy and variable.[2] In 1991 following the Iraqi invasion of Kuwait and the collapse of the Soviet Union, the Third Review Conference established[3] an Ad Hoc Group of Governmental Experts (known as VEREX) to consider potential verification measures from a scientific and technical viewpoint. Nine of the twenty-one measures identified and evaluated by VEREX were on-site measures and the final report[4] of VEREX said that "The most frequently identified on-site measures in combination were on-site inspections (interviewing, visual inspection, identification of key equipment, sampling and identification, auditing)."

The Special Conference in September 1994 which considered the final report of VEREX agreed[5] to establish a further Ad Hoc Group (AHG) to "consider appropriate measures, including possible verification measures, and draft proposals to strengthen the Convention, to be included, as

appropriate, in a legally binding instrument". The AHG first met in January 1995 and by May 1999 had met thirteen times. It successfully transitioned in July 1997 to consideration of a rolling text of a protocol. A ministerial meeting[6] held at the United Nations in New York in September 1998, which was attended by ministers from thirty countries and supported by twenty-seven other states, underlined "the political and security imperatives of concluding, as a matter of priority, a protocol to the Convention .... The Ministers are determined to see this essential negotiation brought to a successful conclusion as soon as possible .... The Ministers call on all States Parties to accelerate the negotiations and to redouble their efforts within the Ad Hoc group to formulate an efficient, cost-effective and practical regime". Thus there is a clear political will to complete negotiation of the protocol.

On-site inspection (OSI) is a key element of the emerging regime and has been extensively debated by the AHG. Although there is not yet complete consensus, it is evident that the regime will include OSI although its precise nature and extent have yet to be finalized. The central elements of the regime are seen[7] as mandatory declarations of the most relevant facilities, a range of non-confrontational, non-accusatory yet infrequent unscheduled visits together with provisions for investigations on concerns about non-compliance with the BTWC. The AHG has been careful to utilize terminology that is different from that of the Chemical Weapons Convention (CWC) regime to avoid confusion as the two regimes are different.

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Visits

These are seen as primarily addressing the efficient and effective implementation of the protocol — and are not concerned with addressing non-compliance with the BTWC. As of May 1999, the draft protocol[8] contains provisions for randomly selected or transparency visits, declaration clarification procedures and voluntary visits.

Randomly Selected or Transparency Visits

Transparency visits to declared facilities would be infrequent and selected on a random basis. Their aim would be to check that declarations are consistent with the obligations of the protocol. As they would involve teams of no more than four, last no longer than two days and each state party would receive no more than two such visits a year, they would be a highly effective and efficient incentive for ensuring that declarations are both complete and accurate.

The activities to be carried out during such visits are detailed in the draft protocol and include provision for: a briefing of the scope and general activities of the facility, including details of the physical layout by means of a map or sketch; a visit to the areas relevant to the mandate of the visit; a review of the information in the facility's declaration; interviews of individuals; examination of documentation; and observation of equipment. Sampling shall not be conducted unless offered by the visited State Party.

Declaration Clarification Procedures

In order to address any ambiguity, uncertainty, anomaly or omission in a declaration, a range

of procedures ranging from correspondence with the state party through consultations with national authorities to clarification visits are proposed. Such visits would involve teams of no more than five and last no longer than two days. Furthermore, should a state party judge that it has already taken all reasonable steps to address the ambiguity, it can decline to accept the proposed clarification visit. As there will undoubtedly be errors in declarations, it is clear that there must be a procedure to address such errors so as to ensure that declarations are indeed accurate.

The activities to be carried out during such visits are also detailed in the draft protocol. They are currently closely similar to those for randomly selected or transparency visits.

Voluntary Visits

These are seen as having a variety of purposes including:

- to help compile individual facility and national declarations;
- to further the assistance and cooperation provisions of the protocol;
- to resolve a specific concern related to declarations (such a voluntary visit would in effect be a shortcut to the declaration clarification procedures); and
- to resolve a specific concern about possible non-compliance with the BTWC.

The contribution made by voluntary visits to the protocol will vary and depend on the rigour with which the future BTWC organization can carry out such visits. Currently, the language in the draft protocol for voluntary visits is less well developed.

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As declarations are the fundamental baseline element of the regime to strengthen compliance with the BTWC, it is vital that the regime contains measures that will efficiently and effectively ensure that declarations are both complete and accurate. Visits will achieve this in a highly efficient way. Various assessments[9] of the likely size of the future BTWC Organization have concluded that the strength would be around 200 with an annual budget of some $30 million — less than half the size and budget of the Organisation for the Prohibition of Chemical Weapons (OPCW). These assessments show that the number of inspectors would be in the range of 50–70 and would be able to carry out about 100 visits a year, based on visiting teams of about four spending two days on-site for each visit.

It is thus realistic to consider a portfolio of about 100 visits and to examine what mix of visits might be expected in such a portfolio. As previously noted, there are basically three types of visits:

- Transparency visits/Randomly selected visits
- Declaration clarification visits
- Voluntary visits — which fall into several categories:
  - — to assist in compiling individual facility and national declarations;
  - — to resolve any ambiguities related to declarations;

— to further the cooperation and assistance provisions of the protocol;

— to resolve a particular concern.

The frequency of some visits will vary with time after entry into force of the protocol as states parties gain experience in compiling declarations and in achieving accurate and complete declarations. Thus the number of voluntary visits to provide assistance in compiling facility and national declarations will decrease and, over time, approach zero. Likewise, the number of declaration clarification visits will also decrease, as the ambiguities, omissions and uncertainties in declarations will decrease, and, over time, approach zero. The number of voluntary visits to resolve any ambiguities related to declarations will also decrease and, over time, approach zero.

There are two categories of visits that can be expected to increase over time. First, the number of transparency visits should increase, as the numbers of declaration clarification and declaration assistance visits decrease, up to the limit that the future BTWC Organization is capable of carrying out each year. Secondly, the voluntary visits to further the cooperation and assistance provisions of the protocol can also be expected to increase as the number of states parties to the protocol increases. The concept in the draft protocol that transparency visits might, at the request of the visited state party, be extended to address cooperation and assistance provisions is an effective and efficient way of enhancing the benefits to states parties. The OPCW has shown that substantial savings can be achieved by sequential inspections.[10]

The portfolio of visits totalling some 100 visits a year would comprise primarily transparency visits and cooperation and assistance visits. The balance of the portfolio would be made up of declaration clarification visits along with voluntary visits for declaration assistance and for resolving declaration ambiguities.

Such a portfolio and frequency of visits would be effective and efficient in ensuring that declarations — the central foundation of the strengthened regime — are both complete and accurate. Without such visits, there would be no basis for states parties having confidence that declarations are either complete or accurate and, indeed, there would be a real danger that over time states parties would become lax in making their annual declarations — thereby defeating the objective of the protocol of building increased confidence in compliance with the BTWC.

Investigations

As of May 1999, there is developed language in the protocol for both field investigations (investigations of alleged use or of releases) and facility investigations (investigations of concerns about non-compliance with the BTWC). There is general agreement for such investigations although the detailed initiation procedures — whether a green light procedure as with the CWC in which a majority have to vote to stop an investigation, or a red light procedure in which a majority have to vote for an investigation to take place — are still being negotiated.

Detailed provisions are elaborated for the information to be submitted with a request for an investigation, for pre-investigation activities, for conduct of the investigation including interviewing, visual observation, sampling and identification. For field investigations provision is included for disease/intoxination-related examination and for the collection of background information. For facility investigations, provision is included for identification of key equipment, auditing and for examination of medical records.

There is also outline provision, as yet undeveloped, for investigations into whether a transfer has taken place in violation of Article III of the BTWC — the obligation by states parties not to

transfer materials or technology for prohibited purposes.

Conclusions

The negotiations for the protocol to the BTWC have taken place against the background of the entry into force and implementation of the CWC — the first global regime which addresses dual-purpose materials and technology — and the experience of UNSCOM. Although this background has not been explicitly evident in the AHG negotiations, there has nevertheless been an implicit recognition that neither the CWC nor the UNSCOM regime is an appropriate model. Whilst the CWC regime is undoubtedly that of the closest relevance to the BTWC protocol, it is recognized that the BTWC regime needs to be tailored to address the particular challenges of increasing transparency and building confidence in compliance with the BTWC.

It is evident that OSI — in the form of non-confrontational visits and of investigations of non-compliance concerns — is an essential element of an effective BTWC protocol. Non-confrontational visits are needed to ensure that declarations are both complete and accurate. Investigations are essential to address any concerns of non-compliance with the BTWC.

Notes

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Graham S. Pearson and Malcolm R. Dando

UNIDIR ACTIVITIES

The Costs of Disarmament

In order to present the cost-benefit analysis of disarmament, UNIDIR proposes to take key countries as examples and carefully research what their commitments to disarmament treaties means to them in terms of financial and resource costs. In addition, the project will try to ascertain what each country perceives are the benefits brought to them through their participation in the agreements and whether there is consensus that there is a net gain to the state in question. The aim of the project is to achieve a better understanding of the costs and benefits of disarmament agreements with a view to assisting policy-makers decide how money is spent on such commitments, which budget lines are best structured to handle such spending and how states could approach this aspect of negotiations in the future.

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Information Technology Warfare

UNIDIR and the Department for Disarmament Affairs are jointly sponsoring a conference on "Developments in the field of information and telecommunications in the context of international security" to be held in Geneva, from 25 to 27 August 1999. The object of this conference is to provide a forum for the exchange of ideas and views on the issues of information security, in particular with regard to unauthorized interference with or misuse of information and telecommunications systems and information resources, and the development of international principles that would enhance the security of global information and telecommunications systems and help to combat information

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terrorism and criminality.

The conference will be a private, off-the-record two-day expert meeting, followed by a two-hour panel discussion on the third day that will be open to the public.

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Fissile Materials

In April 1999, UNIDIR published *Fissile Material Stocks: Characteristics, Measures and Policy Options* by William Walker and Frans Berkhout. The publication is intended to support the Conference on Disarmament in its thinking on the range of options available to deal with stocks of fissile material. Additionally, in early 1999, UNIDIR commissioned a report on fissile material inventories to provide an up-to-date account of fissile materials, assess national policies related to the production, disposition and verification of fissile materials, and identify facilities and locations which might be subject to safeguards under a treaty.

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Forming a North-South Alliance to Address Current Problems of Biological Warfare and Disarmament

The first conference of this project, "Biological Warfare and Disarmament: Problems, Perspectives, and Possible Solutions," held at the Palais des Nations in July 1998, brought together people with a wide range of academic and career backgrounds — scholars in international law, political science, economics, history and the biological sciences, members of non-governmental organizations committed to disarmament and the peaceful development of the biological sciences, and specialists on the Biological Weapons Convention — to address current dimensions of the biological warfare problem. A goal of the conference was to achieve broad geographical, and especially non-western, representation and to provide a space where non-western perspectives could be seriously presented and discussed. The conference ranged broadly over the history and politics of biological warfare and disarmament,

encompassing such questions as the recent history of biological warfare, the impacts of the United Nations Special Commission inspections of Iraq and their implications for the biological weapons regime, the influence of the pharmaceutical and biotechnology industries on the regime, and the role of nuclear weaponry in shaping the regime. These questions are also explored in a symposium, drawing on selected conference papers, published in the March 1999 issue of *Politics and the Life Sciences*. More general legal, political and social dimensions of the biological warfare problem will be addressed in a book in progress. The project is supported by the John D. and Catherine T. MacArthur Foundation, the Ford Foundation, the New England Biolabs Foundation and the University of Michigan.

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Peace-keeping in Africa: Meeting the Growing Demand

This project examines current efforts to develop African capacities to undertake peace-keeping and peace enforcement operations. The project will analyze the reasons for the United Nations Security Council's growing tendency to sub-contract the promotion of peace and security to others and will pay particular attention to regional and sub-regional organizations. It will also review Western and African attempts to make "burden-sharing" work and propose policies to strengthen peace-keeping in Africa. Particular attention will be paid to capacity-building efforts of the United Nations and regional and sub-regional organizations. UNIDIR will publish the project's conclusions as a monograph.

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UNIDIR Disarmament Seminars

UNIDIR occasionally holds small, informal meetings on various topics related to disarmament, security and non-proliferation. These off-the-record gatherings allow members of the disarmament community, missions and NGOs to have an opportunity to discuss a specific topic with an expert.

Topics covered thus far in 1999 include fissile materials, the prevention of war, peace-building in West Africa, reducing nuclear dangers, and biological and chemical weapons programmes.

Speakers at recent meetings have included William Walker, Ambassador Jonathan Dean, Michael Krepon and Peter Batchelor.

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DATARIs

In cooperation with SIPRI (Stockholm International Peace Research Institute), UNIDIR has developed an on-line database of research institutes and projects around the world. The database can be accessed through UNIDIR's website and institutes can update their information via a password.

If you would like for your institute to be included in DATARIs, please contact:

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Publications Secretary
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Peace-building and Practical Disarmament in West Africa: Stimulating National Research

Under the heading of disarmament, development and conflict prevention, UNIDIR is currently developing a number of initiatives to promote peace and security in West Africa. UNIDIR's work in this region began with a conference co-hosted with the United Nations Development Programme (UNDP) in Bamako, Mali in November 1996. The Government of the United Kingdom has generously contributed to this project.

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The Transfer of Dual-Use Outer-Space Technologies: Confrontation or Cooperation?

The right of every state to develop outer-space technologies, such as launching capabilities, orbiting satellites, planetary probes or ground-based equipment, is in principle unquestionable. In practice, however, problems arise when technology development approaches the very fine line between civil and military applications, largely because most of the technologies can be used for dual purposes. This dichotomy has raised a series of political, military and other concerns that affect the transfer of outer-space technologies in different ways, particularly between established and emerging space-competent states. Accordingly, for many years several states have sought ways to curb the transfer of specific dual-use outer-space technologies, specifically launcher technology, while still allowing some transfer of these technologies for civil use. The results of this research will be published by UNIDIR.

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Study Group on Ammunition and Explosives

The Panel of Governmental Experts on Small Arms, which was established on 12 December 1995 by General Assembly resolution 50/70 B, delivered its report to the Secretary-General in July 1997. One of the recommendations of this report stated that "The United Nations should initiate a study on the problems of ammunition and explosives in all their aspects." Following this recommendation, a Study Group on Ammunition and Explosives was established by the Secretary-General pursuant to operative paragraph 3 of resolution 52/38J on "Small Arms". This group, chaired by Ms. Silvia Cucovaz (Argentina) held its first meeting at the invitation of the Department of Disarmament Affairs in New York on 27 April–1 May 1998. Two of the eight members of the Study Group are from UNIDIR: Dr. Christophe Carle and Lt.Col. Ilkka Tiihonen.

The Group's task is to assist in the preparation of the Secretary-General's report, to be submitted to the 54th session of the General Assembly. The final report is expected to be ready in summer 1999 prior to the opening of the General Assembly.

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UNIDIR Handbook on Arms Control

UNIDIR is producing a handbook that will explain the major concepts and terms relating to arms control. The handbook will be used as both a primer for an audience with limited familiarity with arms control and as a reference for students, scholars, diplomats and journalists who are more experienced in arms control matters.

The handbook will be organized as a thematically structured glossary of approximately 200 terms relating to arms control. Each term is situated within its wider context so that, on the one hand, a specific term can be looked up quickly, and on the other hand, an entire issue can be covered. Cross-references to other terms and concepts will point the reader to relevant related issues. The researcher designing and drafting the handbook will be assisted by an editorial committee consisting of regional and arms control experts.

The handbook will be published in 1999, in English and Arabic. It might be translated into other languages at a later stage.

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Geneva Forum

Together with the Programme for Strategic and International Security Studies of the Graduate Institute of International Studies and the Quaker United Nations Office, UNIDIR organizes an ongoing discussion series called Geneva Forum. Thanks to the generous support of the Government of Switzerland, Geneva Forum focuses on issues related to small arms and light weapons. Invited speakers will deal with specific thematic and/or regional dimensions of the issue. Geneva Forum is an occasional seminar held at the Palais des Nations that addresses contemporary issues. The series targets the local missions and organizations in an effort to disseminate information on a range of security and disarmament topics. The series seeks to act as a bridge between the international research community and Geneva-based diplomats and journalists.

If you would like more information about Geneva Forum, please contact:

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PUBLICATIONS

Fissile Material Stocks: Characteristics, Measures and Policy Options

In 1998, on the basis of the Shannon Mandate, the Conference on Disarmament (CD) established an ad hoc committee for negotiating a fissile materials treaty. The treaty is intended to achieve a ban on the production of fissile materials for military purposes in a non-discriminatory, multilateral and internationally verifiably manner. Stocks of fissile materials have accrued transnationally due to armament and disarmament processes, as well as to civil uses of nuclear power. However, very little is known in the public domain about the nature, size and whereabouts of such stocks, and the complexities surrounding their regulation and control. UNIDIR's report on fissile material stocks seeks to begin to redress this problem by providing factual background information on all of these important matters. The report categorizes and quantifies fissile material stocks, and examines the measures which have heretofore been developed regarding their control and management. The report also includes an overview of broad policy options available to states in addressing the stocks issue, which could prove valuable in informing negotiations in the CD.

Fissile material stocks: function, scale and distribution

- Characterization by type of inventory
- The scale, type and location of fissile material stocks

Measures relating to fissile material stocks: recent developments

- Military inventories: continuing absence of international regulation
- Transitional inventories: towards regulation and disposition
- Civil inventories: the extension of transparency

Policy strategies and options

- Stocks and the FMT: possible diplomatic approaches
- Possible measures for reducing risks posed by fissile material stocks

Fissile materials and their production processes

International safeguards and physical protection

William Walker and Frans Berkhout

Sales no. GV.E.99.0.15
ISBN 92-9045-131-9

Sensors for Peace

United Nations peace operations have a tradition of several decades, and their scope and importance has increased markedly since the end of the Cold War. Peacekeeping operations, both of the traditional and the extended type, comprise monitoring tasks as a central part of their mandates. Agreements or resolutions, whether they demand withdrawal behind a cease-fire line, keeping a buffer zone demilitarized, or banning heavy weapons in control zones or safe havens, require that compliance is checked reliably and impartially. The more comprehensive the monitoring, the more likely the compliance. In practice, however, monitoring duties often require the surveillance of such large areas that United Nations peacekeeping units cannot provide continuous coverage. Thus, peacekeeping personnel are permanently deployed only at control points on the roads or areas deemed most sensitive. Minor roads and open terrain are covered by spot-check patrols. This creates many opportunities for infractions and violations.

Unattended ground sensor systems allow all this to change. Unattended ground sensors are suited to permanent, continuous monitoring. They can be deployed at important points or along sections of a control line, sense movement or the presence of vehicles, persons, weapons, etc. in their vicinity and signal an alarm. This alerts peacekeepers in a monitoring centre or command post, who can send a rapid-reaction patrol immediately to the site to confront the intruders, try to stop them, or at least document the infraction unequivocally.

Unattended ground sensor systems generally have not been used in peace operations. Thus, the wider introduction of unattended ground sensor systems in future United Nations peace operations requires fresh study from operational, practitioner, system design and legal perspectives. Sensors for Peace is an excellent first look at this timely issue.

Introduction — Jürgen Altmann, Horst Fisher & Henny J. van der Graaf
The Use of Unattended Ground Sensors in Peace Operations — Henny J. van der Graaf
Questionnaire Answers Analysis — Willem A. Huijssoon
Technical Potentials, Status and Costs of Ground Sensor Systems — Reinhard Blumrich
Maintaining Consent: The Legality of Ground Sensors in Peace Operations — Ralph Czarnecki
Conclusions and Recommendations — Jürgen Altmann, Horst Fisher & Henny J. van der Graaf

Jürgen Altmann, Horst Fischer and Henny J. van der Graaf
Editors

Sales No. GV.E.98.0.28
ISBN 92-9045-130-0

Non-Offensive Defence in the Middle East?

Non-offensive defence (NOD) emerged as a proposed remedy to the military security problems of East and West during the latter part of the Cold War. Grounded in the notion of "cooperative security", NOD is premised on the postulate that states in the international system are better off pursuing military policies which take account of each other's legitimate security interests than they are in trying to gain security at each others' expense. Competitive military policies which seek to achieve national security through a build-up of national military means, may well be counter-productive and leave states more insecure. Seeking to procure national military security through a build-up of national armaments raises suspicions as to the purpose of these armaments, which in turn trigger countervailing armament efforts which ultimately lower the level of security for all. By making the defence of domestic territory the sole and clear objective of national military policies, NOD aims to strike a balance between the imperatives of ensuring adequate national military security and of avoiding provocation.

NOD aims towards national military defences strong enough to ensure adequate national military security, but not strong enough to be seen as threatening by others. The provision of adequate yet non-threatening military defence can be highly useful in a region such as the Middle East where political and military confrontations are inextricably linked, and where political settlement in the absence of military security is inconceivable. In the Middle East, NOD could reduce prevailing military tensions and open the way for broader political arrangements on the future of the region.

The introduction of NOD in the Middle East would not require that all Middle Eastern states adopt the same NOD model. Rather, each Middle Eastern state can select the particular NOD model most suitable to its requirements.

Non-Offensive Defence in the Middle East — Bjørn Møller
Non-Offensive Defence in the Middle East: Necessity versus Feasibility — Ioannis A. Stivachtis
Cooperative Security and Non-Offensive Defence in the Middle East — Gustav Däniker
Non-Offensive Defence and its Applicability to the Middle East: An Israeli Perspective — Shmuel Limone

Bjørn Møller, Gustav Däniker, Shmuel Limone and Ioannis A. Stivachtis

Sales No. GV.E.98.0.27
ISBN 92-9045-129-7

The Implications of South Asia's Nuclear Tests for Non-proliferation and Disarmament Regimes

On 7 and 8 September 1998, UNIDIR held a private, off-the-record meeting on The Implications of South Asia's Nuclear Tests for the Non-proliferation and Disarmament Regimes. This "track one and a half" meeting was designed to address the needs of policy-makers — governmental and non-governmental agents — in their assessment of the impact of the nuclear-weapons tests carried out by India and Pakistan in May 1998. The governments of Australia, Denmark, Italy, Norway, New Zealand and the United States generously sponsored the meeting.

More than fifty people from over twenty-five countries attended the conference. Each participant attended in his or her personal capacity as an expert and not as a representative of a country or a NGO. At the end of this two-day meeting, there was general agreement among participants that neither India nor Pakistan had enhanced its own security or international status by conducting the tests, but that the risk of nuclear war in the region is now greater. Also, it was recognized that the NPT and the CTBT had been in difficulty prior to the tests, although they remained the best solutions available to reduce potential for further conflict and therefore remained crucial. Finally, many participants expressed their concern that if India and Pakistan were rewarded in any way for demonstrating their nuclear capabilities, this may cause some NPT members to reassess their membership in the regime.

International response to the nuclear tests in South Asia was inadequate: there is a need for more coherent and collective action. Participants focused on practical suggestions to policy-makers to reduce the risk of war; to save the non-proliferation and nuclear arms control regimes; and to anticipate the effects of the tests on areas of regional tensions, particularly the Middle East.

The Responses to the Tests

Causes of the Tests

Consequences of the Tests

- Regional Security
- Consequences for Non-Proliferation and Disarmament

Damage Limitation

Developing the Non-Proliferation and Disarmament Agenda

Conclusions and Policy Options

- Main Summary
- Prevention of Nuclear War
- Saving the Non-Proliferation and Arms Control Regimes
- The Effects on Regional Tensions, Especially in the Middle East

GE.99-00415
UNIDIR/99/2

A Peace of Timbuktu: Democratic Governance, Development and African Peacemaking

Mali is admired for two recent accomplishments. The first is the country's transition to democracy, which took place in 1991–1992. This effort included the overthrow of Moussa Traoré's twenty-three year military dictatorship on 26 March 1991 — a process of military and civilian collaboration which fostered national reconciliation, a referendum for a new constitution, and elections which brought to power Mali's first democratically elected president, government and legislature. The second achievement is the peacemaking between the Government of Mali and the rebel movements in the northern part of the country: this process successfully prevented the outbreak of civil war and presents useful lessons in preventive diplomacy for the international community. The peacemaking culminated in a ceremony known as the Flame of Peace, when rebel weapons were incinerated in Timbuktu on 27 March 1996. This study of the events surrounding the uprisings in the North of Mali and the measures which restored peace (and those which will maintain it) is the result of a collaboration between the United Nations Development Programme and the United Nations Institute for Disarmament Research.

This peace process was remarkable for the way in which the United Nations agencies were able to help, discreetly dropping oil into the machinery of peacemaking. For a cost of less than $1 million, the United Nations helped the Malians to avoid a war, and lit the Flame of Peace. With less than $10 million, the United Nations became the leading partner of Mali's Government and civil society, in peace-building, disarming the ex-combatants and integrating 11,000 of them into public service and into the socio-economy of the North through a United Nations Trust Fund. The experience shows that not only is peacemaking better than peace-keeping, but that it is much cheaper.

A Peace of Timbuktu includes in-depth coverage of the following topics:

- Mali's History and Natural Environment
- The Build-up to the Crisis in Northern Mali
- The Armed Revolt 1990–1997
- Peacemaking and the Process of Disarmament
- The International Community as a Catalyst for Peace
- Ensuring Continued Peace and Development in Mali
- The Flame of Peace Burns New Paths for the United Nations

United Nations Secretary-General Kofi Annan has written the preface. The book includes maps, texts of relevant documents and laws, and a bibliography, as well as photographs by the authors and peace drawings by the children of Mali.

Robin Edward Poulton and Ibrahim ag Youssouf

Sales No. GV.E.98.0.3
ISBN 92-9045-125-4
Updated second edition now available in French

Nuclear-Weapon-Free Zones in the 21st Century

The establishment of nuclear-weapon-free zones (NWFZs) through the initiative of regional parties, approved by the United Nations General Assembly, and endorsed by the relevant external states, is an important contribution to non-proliferation, disarmament and, above all, to international security.

Jointly with OPANAL (The Organization for the Prohibition of Nuclear Weapons in Latin America and the Caribbean) and the Government of Mexico, UNIDIR convened an international seminar on "Nuclear-Weapon-Free Zones in the Next Century" in Mexico City on 13–14 February 1997 — the thirtieth anniversary of the Treaty of Tlatelolco's opening for signature. This book analyzes the role of the Treaty of Tlatelolco as the first effective expression of a NWFZ in a densely inhabited part of the globe. It also covers other NWFZs (existing or proposed). The relationship between NWFZs and peace processes, as well as cooperation among existing NWFZs, is also noted.

Towards the Consolidation of the First NWFZ in the World — Sergio González Gálvez
Precursor of Other NWFZs — Enrique Román-Morey
Tlatelolco and a Nuclear-Weapon-Free World — William Epstein
Actual Projection of the Treaty of Tlatelolco — Jorge Berguño Barnes
Major Paradigms of International Relations — Luis Alberto Padilla
Precedents and Legacies: Tlatelolco's Contribution to the 21st Century — John R. Redick
The Treaty of Rarotonga — Makurita Baaro
The Pelindaba Treaty — Isaac E. Ayewah
The Bangkok Treaty — Arumugam Ganapathy
A Nuclear-Weapon-Free Space in Central and Eastern Europe — Alyaksandr Sychou
A Possible NWFZ in Central Europe — Michael Weston
NWFZ in the Middle East — Nabil Elaraby
Middle East: Future Perspectives — Yitzhak Lior
Central Asia: Future Perspectives — Jargalsaihan Enkhsaikhan
Denuclearization Efforts on the Korean Peninsula — Seo-Hang Lee
South Asia and the Korean Peninsula — Kim Chan Sik
Towards the Zero Option in Nuclear Weapons? — Thomas Graham, Jr.
A World Free of Nuclear Weapons in the Year 2020 — Antonio de Icaza
The Role Carried Out by the Zones Exempt from Nuclear Arms — Joëlle Bourgois
Strengthening of OPANAL: New Challenges for the Future — Héctor Gros Espiell

Péricles Gasparini Alves and Daiana Belinda Cipollone
Editors

English Sales No. GV.E.97.0.29 ISBN 92-9045-122-X
Spanish Sales No. GV.S.97.0.29 ISBN 92-9045-124-6

Increasing Access to Information Technology for International Security

The European security landscape is undergoing a profound transformation at present, and there is an increasing need to improve mutual understanding of regional security issues in a rapidly changing world. Institutes and related organizations working in the field of international security have an important role to play in this regard.

This book contains a forward-looking appraisal of how information technology can best serve institutes and the security dialogue. It addresses issues such as how to promote concrete cooperation between research institutes in Europe and North America. Of particular importance is the appraisal of present and prospective demands for cooperative ventures between and among institutes in Europe, the United States and Canada. It also provides insight on how to put together intellectual, human, material and financial resources to foster cooperation, notably in the identification of partners, information needs, connectivity issues and fund-raising strategies. In this respect, a number of innovative recommendations are made in a plan of action to increase cooperation in the late 1990s and well into the next millennium.

Assessing Partnership Initiatives — Andreas Wenger & Stephan Libiszewski
Identifying the Needs of International Organizations — Anthony Antoine & Gustaaf Geeraerts
Increasing Interregional Exchanges and Partnerships — Seyfi Tashan
Information Needs and Information Processing in International Security — Gerd Hagmeyer-Gaverus
A New Approach to Conflict Prevention and Mediation Processes — Albrecht A. C. von Müller
A European Information Network on International Relations and Area Studies — Dietrich Seydel
Appraising the Status of East/West Connectivity Problems — Zsolt Pataki
The Need to Improve Basic East-West Computer Equipment and Supplies — Christoph Reichert
Connectivity Issues: Political and Financial Constraints — Edward Ivanian
American and European Foundations: A Stock-Taking — Mary Lord
Assessing International Grant Making by US Foundations — Loren Renz
European Fund-Raising: Innovative Cooperation Schemes — Xavier Pacreau
Assisting the Development and Consolidation of Democratic Security — Francis Rosentiel
Preparing Tomorrow's Research Establishments — István Szönyi
Joint Research Activities: The Bulgarian Experience — Sonia Hinkova

Péricles Gasparini Alves
Editor

Sales No. GV.E.97.0.23
ISBN 92-1-100759-3

The Transfer of Sensitive Technologies and the Future of Control Regimes

This book comprises papers by fourteen international experts from the diplomatic, military and academic communities in which they identify tomorrow's key technologies in both weapon systems and components, particularly emerging technologies that may become objects of control and constraint eight to ten years hence. This includes conventional weapons and weapons of mass destruction, but special attention is also given to sensor technologies and technologies for the collection, processing and dissemination of information. The authors attempt to identify cooperative technology transfer controls which are likely to forge new approaches to solve old problems. In this connection, the book presents imaginative and challenging ideas as regards the relationship between technology supplier and recipient states. This publication is essential to those who are interested in following the trends in the transfer of sensitive technologies in the next decade, as well as those concerned with the political and diplomatic issues related to such developments.

Foreword — General Alberto Mendes Cardoso
Major Weapon Systems — Ravinder Pal Singh
Chemical and Biological Weapons — Graham S. Pearson
Nuclear Weapons — Mark Goodman
Emerging Sensor Technology: Technology Transfer and Control — Leonard John Otten III
The Transfer of Space Technology — Masashi Matsuo
Impacts of the "Information Revolution" — Jeffrey R. Cooper
Chemical, Biological and Nuclear Weapons Enabling Technology — Michael Moodie
Launchers and Satellites — Mario Sciola
The Need to Ensure Technology Transfer — Jasjit Singh
Prospective Technology Transfer Controls — Alain Esterle
The Role of Intelligence Services — Rodrigo Toranzo
Intelligence Services and Non-Proliferation Control Instruments — The Brazilian Intelligence Service
The Export/Import Monitoring Mechanism (EIMM) — Frank R. Cleminson
Summary and Conclusions — Sverre Lodgaard

Péricles Gasparini Alves and Kerstin Hoffman
Editors

Sales No. GV.E.97.0.10
ISBN 92-1-100744-5

Curbing Illicit Trafficking in Small Arms and Sensitive Technologies: An Action-Oriented Agenda

Illicit trafficking affects both the stability of states and the safety of their populations. There are no national or regional boundaries delimiting this type of traffic: the problem is truly global and has multifaceted ramifications. Curbing its further development and proliferation calls for a better assessment of the phenomenon and a new way of looking at problems and identifying solutions. In a world of growing interdependence, one of our greatest challenges today is making bold decisions establishing new priorities and starting innovative cooperative ventures, while changing old ways of thinking and working.

Issues and Aspects — Jasjit Singh
Weapons of Mass Destruction — Alfredo Luzuriaga
Trafficking in Delivery System Technologies and Components — Genaro Mario Sciola
Small Arms, Drugs and Terrorist Groups in South America — Silvia Cucovaz
Central America and Northern South America — Daniel Ávila Camacho
The Role of Manufacturers and Dealers — Carlos Fernández
National and International Initiatives — Wilfrido Robledo Madrid
African and European Issues — Stefano Dragani
Small Arms Trafficking, Drug Trafficking and Terrorism — Antonio García Revilla
The Role of Arms Manufacturers and Traffickers — Rubén José Lorenzo
Developing New Links with International Policing — Donald Manross
Border Patrols and Other Monitoring Systems — Julio César Saborío A.
The Role of State — Swadesh Rana
Nuclear Materials and Vector Components — Olivier Mahler
Nuclear/Radioactive Substances — Hiroaki Takizawa
Illicit Trafficking in Nuclear Material — Pedro Villagra Delgado
Illicit Trafficking in Chemical Agents — Masashi Matsuo
Prospects and Strategies — Louise Hand
Awareness and Access to Biological Weapons — Malcolm Dando
Strengthening the Convention on Biological and Toxic Weapons — Louise Hand
The Role of Intelligence Services — José Athos Irigaray dos Santos
The Role of Export Controls in Addressing Proliferation Concerns — Sergei Zamyatin
Control Regimes for Toxic Chemicals and Pathogens — Malcolm Dando & Graham S. Pearson
Using Satellites to Track and Monitor Illicit Traffic — Panaiotios Xefteris & Maurizio Fargnoli
The Situation in Latin America — Marta Parodi
Other Regions in Perspective — Isabel Sarmiento
Strengthening International Cooperation — Patricia Salomone
Nuclear Issues — María José Cassina
Chemical and Biological Agents — Eduardo Duarte
A New Agenda for Control Regimes? — Luis Alberto Padilla
Final Recommendations — Eduardo Pelayo, Péricles Gasparini Alves & Daiana Belinda Cipollone

Péricles Gasparini Alves and Daiana Belinda Cipollone
Editors

English GV.E.98.0.8 ISBN 92-9045-127-0
Spanish GV.S.98.0.8 ISBN 92-9045-128-9

Building Confidence in Outer Space Activities

This book sets out to clarify some of the prerequisites and modalities of a confidence-building process in outer space. It is the result of efforts undertaken by several experts on outer space matters who examine the role of earth-to-space monitoring in enhancing the safety of outer space activities and preventing the deployment of weapons in that environment. The book concludes by proposing the creation of an International Earth-to-Space Monitoring Network (ESMON) as the most appropriate means to improve both transparency and predictability in outer space activities.

Preface — Sverre Lodgaard
Confidence-Building Measures and Outer Space — Frank Ronald Cleminson
Monitoring Outer Space Activities — Ralph Chipman & Nandasiri Jasentuliyana
CSBMs and Earth-to-Space Tracking: Existing Proposals — Laurence Beau
CSBMs in Outer Space: Some Political Considerations — Edmundo Sussumu Fujita
Artificial Satellites and Space Debris — Paolo Farinella
Rocket Launches — Péricles Gasparini Alves
Command and Control of Artificial Satellites — Fernand Alby
Radio Tracking and Monitoring: Implications for CSBMs — Péricles Gasparini Alves & Fernand Alby
Laser Systems for Optical Space Observation — Janet S. Fender
Monitoring CSBMs — Alexandr V. Bagrov
Radar/Interferometry and CSBMs in Outer Space — Wayne H. Cannon
Applying CSBMs to the Outer Space Environment — Péricles Gasparini Alves
Monitoring Scenarios for Different CSBMs in Outer Space — Péricles Gasparini Alves
Establishing an Earth-to-Space Monitoring Network — Péricles Gasparini Alves

Péricles Gasparini Alves
Editor

Available from Dartmouth
ISBN 1-85521-630-2

Evolving Trends in the Dual Use of Satellites

Earth-observation, global-positioning, communications and other satellite data are playing increasingly important roles in international security events. This book evolved from discussions by various experts in different areas of satellite technology and applications who met to debate the evolution and implications of such dual-use events. Particular emphasis has been given to providing an understanding of the policy orientation of space agencies and private companies both in traditional and emerging space-competent states. Moreover, the book aims at improving the knowledge of manufacturers, suppliers, users and experts of each others' capabilities and possibilities for cooperation. In this context, attention has been directed to a discussion on the different technical and financial aspects of satellite R&D, as well as the present and prospective markets for satellite data, particularly tomorrow's dual use of satellites.

Satellite Capabilities of Traditional Space-Competent States — Masashi Matsuo
Satellite Capabilities of Emerging Space-Competent States — Gerald M. Steinberg
Current and Future Remote Sensing Data Markets — Arturo Silvestrini
Prevention of, Preparedness for and Relief of Natural Disasters — Olavi Elo
Satellite Data and Man-Made Events — Giovanni Cannizzaro & Paolo Cecamore
New Civilian Applications of Satellite Data — Kiran Karnik
Conflict Prevention and Crisis Management — D. Ignacio Barbudo Escobar
Verification of Arms Limitation and Disarmament Agreements — Claude Jung
Dual-use Satellites — Stanislav N. Rodionov
The Argentine National Space Plan — Genaro Mario Sciola
The Romanian Space Programme — Ion-Alexandre Plaviciosu
Policy Orientations of Space Agencies: the French Example — Jean-Daniel Levi
Economic Interests and Military Space Systems — Scott Pace
Regional Organizations: the Experience of the WEU — Horst Holthoff
UNISPACE III: An Expression of Diplomacy for Development — Raimundo Gonzalez Aninat

Péricles Gasparini Alves
Editor

Sales No. GV.E.96.0.20
ISBN 92-9045-115-7

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