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Verification of Disarmament or Limitation of Armaments: Instruments, Negotiations, Proposals

Edited by
Serge Sur

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UNIDIR

United Nations Institute for Disarmament Research

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The work of the Institute aims at:

1. Providing the international community with more diversified and complete data on problems relating to international security, the armaments race, and disarmament in all fields, particularly in the nuclear field, so as to facilitate progress, through negotiations, towards greater security for all States and toward the economic and social development of all peoples;

2. Promoting informed participation by all States in disarmament efforts;

3. Assisting ongoing negotiations in disarmament and continuing efforts to ensure greater international security at a progressively lower level of armaments, particularly nuclear armaments, by means of objective and factual studies and analyses;

4. Carrying out more in-depth, forward-looking, and long-term research on disarmament, so as to provide a general insight into the problems involved, and stimulating new initiatives for new negotiations.

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Preface

The rapidly growing convergence of views on the value and methodology of verification of disarmament and arms limitation agreements has been a significant development in recent years. It has justified the importance UNIDIR has attached to its programme of verification research. A number of research reports and papers have already been published and in March 1990 the *UNIDIR Newsletter* had a special focus on the issue of verification.

In 1991 UNIDIR published through Dartmouth Publishing Company *Verification of Current Disarmament and Arms Limitation Agreements - Ways, Means and Practices* edited by Serge Sur. It contained detailed examinations of the verification procedures and practices of existing arms limitation and disarmament agreements. On the basis of this acquired experience it is logical, in addition to analysing more recent agreements like START and CFE, to discuss the likely verification scenarios in disarmament agreements now under negotiation or likely to be negotiated in the future. The various authors of this publication have examined the verification of different categories of weapons limitation in the broader context of the vastly changed international situation, the rapid pace of technological change and the new trends in verification.

The research project which led to this publication was co-ordinated by Professor Serge Sur, Deputy Director of UNIDIR, who has also edited this research report. The group of experts held two meetings during the period 1990-91 in Montreal and in Kiev. I would like to thank the relevant authorities for hosting these meetings. My thanks are due to all the authors of the book. I must also express my appreciation to Pamela Thompson and Brent Schindele who reviewed the English text and to Anita Blétry who prepared the manuscript for publication.

The views expressed by the authors of this publication are their own and not necessarily those of UNIDIR. Nevertheless UNIDIR commends this report to the attention of its readers.

Jayantha Dhanapala
Director

Editor's Note

The following texts were, for the most part, written in 1991, during an era that saw the dismembering of the USSR, the independence of its numerous republics, and the fledgling attempts to create a "Community of Independent States" (CIS). The appearance of new actors in Europe, their positions concerning disarmament and arms limitation negotiations, their legal status with respect to existing treaties - all this goes to emphasize the numerous problems that have still received only partial solutions. The reconstruction of a stable order of relations between European nations, old and new, will take time and promises to pose all kinds of unforeseen problems - problems whose solutions are at present impossible to envision.

After serious consideration, it seemed pointless to attempt to "update" these texts in order to bring them in line with the current situation. On one hand, the current endeavor is not styled after a series of newspaper articles, subject to the ever-changing flow of events. Rather, it addresses issues that are more permanent in nature, putting them into perspective within a broader period of time. On the other hand, such an updating process carries the strong risk of becoming an impossible task - even the time lapse between the texts' final editing and subsequent publication may make the new texts obsolete. Meanwhile, the fact that various authors have contributed to this publication would create the risk for contradictory time frames, jeopardizing the continuity of the book as a whole. This is particularly applicable in the case of the START and CFE agreements and negotiations. History marches on with the rapid gait of Achilles, while scholars can only follow it with the pace and prudence of a tortoise.

It therefore seemed to us that, despite the profound changes taking place within the international arena, the original text of the present research project would maintain its validity and interest - not only in terms of the present or the recent past, but for the future as well. The project examines certain aspects of verification in considerable depth, and its approach remains valid, largely because the actors are still confronted with the same fundamental problems and the same range of solutions.

Verification is one of the most important elements of the disarmament and arms limitation effort. The manner in which it has evolved, been enriched and developed, is certainly dependent on the development of international relations and the attitudes of the principal players. Meanwhile, verification procedures have become a sort of obligatory part of any disarmament negotiation or agreement, and their importance and prevalence has steadily increased. Likewise, in the framework of current negotiations, verification still occupies a central position. Proposals in the field of verification do not always meet with immediate success. But they are bound to be taken up again; they constitute an "intellectual reservoir", in which interest does not fade.

It is for these reasons that we now place this research report in the hands of the reader, leaving him to judge its merit for himself.

Geneva, March 1992

List of Acronyms

Ad Hoc PAROS Committee	Committee on the Prevention of an Arms Race in Outer Space
ABACC	Argentine-Brazilian Agency for Accounting and Control of Nuclear Materials
ABM	Anti-Ballistic Missile
ACA	Agency for the Control of Armaments
ASAT	Anti-Satellite Weapons
ASW	Anti-Submarine Warfare
ATTU	Atlantic to the Urals
BBC	Bilateral Consultative Commission
BTWC	Biological and Toxin Weapons Convention
BW	Biological Weapons
CBMs	Confidence-Building Measures
CD	Conference on Disarmament
CFE	Conventional Armed Forces in Europe
C^3I	Command, Control, Communication, Intelligence
COCOM	Committee for Multilateral Export Control
CORRTEX	Continuous Reflectometry for Radius Verus Time Experiments
CPC	Conflict Prevention Centre
CSBM	Confidence- and Security-Building Measures
CSCCA	Conference on Security and Cooperation in Central America
CSCE	Conference on Security and Cooperation in Europe
CSM	Command and Service Modules
CTB	Comprehensive Test Ban
CW	Chemical Weapons
CWC	Chemical Weapons Convention
DAP	Data Acquisition Phase
DDA	UN Department for Disarmament Affairs
DE	Directed Energy
DPI	Dual Pilot Implementation
DST	Defense and Space Talks
EEP	Entry/Exit Point
EOSAT	Earth Observation Satellite Company
EPCI	Enhanced Proliferation Control Initiative
ESA	European Space Agency

FSA	Free-Standing Agreement
GEODSS	Electro-Optical Deep Space Surveillance
GPALS	Global Protection Against Limited Ballistic Missiles Strikes
GSE	Ad Hod Group of Scientific Experts
HEU	Heavily Enriched Uranium
HRV	High Resolution Visible
IAEA	International Atomic Energy Agency
IBSS	Infra-red Background Signature Survey
ICBM	Intercontinental Ballistic Missile
ICJ	International Court of Justice
IDC	International Data Centre
INF	Intermediate-Range Nuclear Force Treaty
INTELSAT	International Telecommunications Satellite Organization
IR	Infra-red
IRAS	Infra-red Astronomical Satellite
ISI	International Space Inspectorate
ISMA	International Satellite Monitoring Agency suggested (France ISMA)
ISMA	International Space Monitoring Agency (USSR ISMA)
JCC	Joint Consultative Commission
JCG	Joint Consultative Group
JCIC	Joint Compliance and Inspection Commission
KE	Kinetic Energy
KH	Key Hole
LA	Layered Approach
LEO	Low Earth Orbit
MARVs	Maneuvring Re-Entry Vehicles
MBFR	Mutual Balance Force Reduction
MHV	Miniature Homing Vehicle
MIRV	Multiple Independently-Targetable Re-Entry Vehicle
MMW	Multi-Megawatt
MSS	Multispectral Scanner
MTCR	Missile Technology Control Regime

NASA	National Aeronautics Space Agency
NATO	North Atlantic Treaty Organization
NDC	National Data Centres
NNA	Neutral and Non-Aligned Countries
NORAD	North American Aerospace Defense Command
NPBWs	Neutral Particle Beam Weapons
NPS	Nuclear Power Source
NPT	Non-Proliferation Treaty
NSS	National Seismic Stations
NST	Nuclear and Space Talks
NTMs	National Technical Means
NWFZ	Nuclear Weapon-Free Zone
OAS	Organization of American States
OAU	Organization of African Unity
OOVs	Objects of Verification
OPANAL	Organismo para la Proscripcion de las Armas Nucleares en la Americana Latina (Agency for the Prohibition of Nuclear Weapons in Latin America)
OSI	On-Site Inspection
PARCS	Perimeter Acquisition and Attack Characterization System
PAXSAT	Peace Satellite (Canadian concept)
PNET	Peaceful Nuclear Explosions Treaty
PPMS	Perimeter/Portal Monitoring Systems
PTBT	Partial Test Ban Treaty
R&D	Research and Development
RMS	Remote Manipulator System
RSI	Random Selective Inspection
RSV	Random Selective Visits
RVs	Re-Entry Vehicles
SALT	Strategic Arms Limitation Treaty
SAR	Synthetic Aperture Radar
SATKA	Surveillance, Acquisition, Tracking, and Kill Assessment
SCC	Standing Consultative Commission
SCCC	Common System of Accounting and Control of Nuclear Material
SDI	Strategic Defence Initiative
SDIO	Strategic Defense Initiative Organization

SIGINT	Signal Intelligence
SIPA	Satellite Image Processing Agency
SLBM	Sea-Launched Ballistic Missile
SLCM	Sea-Launched Cruise Missile
SNF	Short-Range Nuclear Forces
SNM	Special Nuclear Materials
SPAS-II	Shuttle Pallet Satellite-II
SPOT	Satellite pour l'observation de la terre
SRAM	Short Range Attack Missile
SRI	Systematic Routine Inspection
SSBN	Nuclear-Powered, Ballistic Missile-Submarines
SSC	Command's Space Surveillance Center
START	Strategic Arms Reduction Talks Treaty
SVC	Special Verification Commission
SWU	Separation Work Unit
TASM	Tactical Air-to-Surface Missile
TM	Thematic Mapper
TLE	Treaty Limited Equipment
TTBT	Threshold Test Ban Treaty
UNGA	United Nations General Assembly
UNSCOM	United Nations Special Commission
UNSCR	United Nations Security Council Resolution
VCC	Verification Co-ordinating Committee
VLTTB	Very-Low Threshold Test Ban
VNIR	Visible and Near Infra-Red
WEU	Western Europe Union
WHO	World Health Organization
WTO	Warsaw Treaty Organization

Introduction[1]

Serge Sur

The classic problems of verification are well known. The primary concern is that of its definition. There is no general, official and universally-accepted formula. It is widely agreed, however, that the verification process includes the following components:

1. The existence of an obligation, the fulfilment and observance of which must be verified;
2. The gathering of information relating to the fulfilment of the obligation;
3. The analysis, interpretation and evaluation of the information from a technical, juridical and political viewpoint;
4. The assessment concerning observance or non-observance of the obligation, which concludes the actual verification exercise. While the problem of appropriate reactions to the possible violation of an obligation appears to be a logical consequence of this exercise, it is not in itself an integral part of verification.

Although it can be organized differently by each particular treaty, verification shows an unquestionable unity. Even if the solutions provided are different, verification poses certain common problems. UNIDIR, in an earlier research report, produced a detailed analysis of those problems by studying verification under the various treaties currently in force.[2] That research has provided a basis for the present study, which focuses on the most recent agreements that could not be taken into account in the previous study, as well as ongoing negotiations and principal proposals made in conjunction with them. In this respect, this study examines the major instruments or negotiations which form a new phase in disarmament and arms limitation and which are linked to the evolution of the international situation and its characteristic underlying political and strategic changes.

Without entering into a detailed analysis of the changes, it may be noted that the traditional agreements, both bilateral and multilateral, are based on a predominantly military and strategic approach which is geared towards maintaining and stabilizing established balances. The new international situation has increased the disarmament options and has currently given rise to particular interest in unilateral measures.[3] It also places disarmament in a broader concept of security, a concept in which political aspects are dominant and in which the economic dimension receives similar increased

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[1] The first part is written by Professor Serge Sur and the second by Alan Crawford.

[2] Serge Sur (ed.), *Verification of Current Disarmament and Arms Limitation Agreements - Ways, Means and Practices*, Aldershot, Dartmouth, 1991.

[3] Serge Sur (ed.), *Unilateral Measures and Policies of States in the Field of Disarmament and the Limitation of Armaments*, UNIDIR Symposium, 1992 (forthcoming). Contains *inter alia* the proceedings of a symposium organized by UNIDIR on this issue held in Paris on 24 January 1992.

attention. In this context, disarmament becomes an instrument and an illustration of the changes. It actively balances power configurations and is no longer just a sign of their stabilization.

Lastly, from a more technical point of view, the new nature and risks of the arms race, which are linked to the proliferation and development of armament technologies including dual-use technologies, raise new difficulties. It is therefore important to examine the totality of an armaments lifecycle - from research and development of weaponry to their withdrawal or destruction.

New Trends in Verification

In so far as it is possible to identify an underlying trend at this stage, the verification process appears to be undergoing a twofold evolution. On the one hand, it is fragmenting and, on the other, it is widening.

Fragmentation

Fragmentation is first of all the as a result of the ***increasing autonomy of the different phases*** that constitute the verification process.

The first phase of verification concerns *data collection.* This phase may itself be broken down into several components. Thus, basic data relating to the subject of the negotiations - quantity, location, nature of weapons, production or stockpiling facilities - may be provided before a treaty is concluded by the concerned parties. This information constitutes both a confidence-building measure and a phase in the verification process. Moreover, procedures and methods of collecting data may be tested in advance, on a voluntary basis, in order to determine and improve their effectiveness. Once the agreement has been concluded, the data gathered may be subject to confirmation procedures, to determine their accuracy. On this basis, the comprehensiveness and consistency of data may be subject to an overall assessment, which will condition the appraisal made of the implementation of the treaty.

The same process of fragmentation occurs in the core of the verification process, the *analysis of data* in order to determine compliance with obligations. This analysis involves a technical interpretation of the data gathered in other words, their translation from raw data into operational conclusions. It then involves, either as a subsequent stage or a parallel process, the analysis of the specific obligations of the parties, not so much in abstract terms as with respect to the actual situations on which the gathered data are based. Lastly, in case of doubtful or ambiguous activities, the analysis involves a strategic and political judgement concerning the nature and extent of a possible breach, so as to initiate appropriate reactions, a request for clarification, for rectification, consultations, etc.

Moreover, there is a tendency towards ***differential organization of each phase.***

While one should avoid overgeneralizing, the following comments may safely be made:

1. The initial provision of data is the responsibility of each State concerned, and usually involves an exchange of data. It may, however, involve some participation by international organizations. In this context, the idea of establishing a database within the purview of the United Nations should be noted;
2. There may be an established procedure for monitoring the data, possibly with on-site inspection measures, carried out by the parties on the basis of an international instrument;
3. Provision may also be made in the course of treaty implementation for a mechanism for on-site inspections, either at random, or in case of questionable activities. In this context, an international organization may, on occasion, intervene in order to establish the facts, as in the case of investigations into the alleged use of chemical or biological weapons;
4. The technical analysis of the data collected is usually the responsibility of each State party; it may be simplified by cooperation among the parties in an *ad hoc* or pre-established context, by international assistance, or by an autonomous international mechanism, although this latter eventuality continues to be an exception;
5. Possible publication and dissemination of the data continue to be at the discretion of the parties concerned;
6. The verdict on the data is, in principle, the responsibility of each of the parties concerned; however, it may involve an international dimension, in particular through the machinery of advisory commissions among the parties, or through a genuine collective procedure;
7. An assessment of the seriousness of a possible breach is made in the same way, although its nature is more directly political. What must be assessed are the implications of the breach for the security of the States concerned;
8. In any case, the powers of the UN Security Council - which may intervene on the basis of the Charter, independently of specific treaties assigning it a role in the verification process - must be held in reserve. The Council may carry out its own investigations, and make its own assessments, as it did, for example, when chemical weapons were used in the conflict between Iraq and Iran;
9. Issues relating to the Gulf War, and the disarmament measures adopted by the Security Council in resolution 687 (1991) which involve international control, raise problems of a different kind, namely, the consequences and settlement of an international conflict, rather than the verification of certain treaties. The obligations verified are those resulting from the resolution and not directly from the treaties to which it refers. Certain obligations - for example, those relating to the destruction of missiles - do not fall under the aegis of any specific treaty.

These components, and the tendency to provide verification mechanisms by subsequent instruments, are in fact not new. They were present, in a more-or-less apparent or developed form, in the conventional verification process. However, the current trend is towards a more precise identification and a more detailed and independent regulation of the various phases, using a more analytical approach. This aspect of the

fragmentation process has positive implications for the phases that are concerned with the collection and analysis of data. The stages concerning the evaluation and assessment of data are less developed and more vague; this means that they are largely left to the individual responsibility of each concerned party.

The verification process is also fragmented on account of the ***emergence of new kinds of obligations and prohibitions.***

The fragmentation process is not, then, a product of its own momentum, but of the requirements of new regulations, the development of which this momentum makes possible. The point at issue concerns not only efforts toward banning the testing, deployment or use of certain kinds of weapons or means of delivery, but also the destruction of certain kinds of weapons to achieve their reduction or even total elimination, and the limitation and control of their transfer. In addition, it concerns obligations to refrain from production, something particularly difficult to verify if the obligations overlap with civilian scientific and industrial activities, as in the case of chemical and biological weapons. It may even be possible to consider a number of constraints that would affect research and development.

These new kinds of obligations, and more precisely the complex objects to which they apply, raise new problems as far as their verification is concerned. It is interesting to note that some questions have been raised from various sectors as to the actual effectiveness of on-site inspection - which is sometimes presented as a panacea - despite the spectacular breakthroughs resulting from such inspection in recent years. The emphasis will henceforth be placed on greater reliance on confidence-building measures, and in particular on all such measures that make for increased transparency of sensitive activities. The purpose of such measures is primarily to give mere efficiency to the obligations, to make them more precise, and thus easier to verify. Such confidence-building measures, which may be autonomous, at the same time represent an initial phase in the provision of the data required for verification, and thus concern the fulfilment of commitments as much as their verification. Subsequently, they lead to the integration of the overall process into a more extensive and diffuse whole, which may entail a relative loss of identity for verification.

Broader Concept of Verification

There is a tendency for the verification process to become looser, in that its overall autonomy may well be dissolved in a broader concept, which could be called a ***confidence-building process***. This process obviously incorporates confidence-building measures, which nowadays receive considerable attention and are very popular with specialists. However, it also includes other components which fall, at least in part, within the sphere of verification in the conventional meaning of the word. The "Open Skies" negotiations are a good example. On the one hand, they qualify as confidence-building measures, while on the other hand, they also make it possible to simplify the verification of the various treaties on a multilateral basis without their being revised.

The overall characteristic of such a process is a pronounced tendency to extend cooperative measures leading, if not to common management, at least to continuing contacts and consultations in the implementation of treaties. It is no doubt premature to raise the issue of cooperative security, which would be integrated in a renewed, more comprehensive and broadly preventive collective security organization. However, such mechanisms involve, for example, implementation in anticipation of treaties (through unilateral reductions), reciprocal unilateral measures (trial inspections), partial agreements (*e.g.* the bilateral Agreement between the United States and the USSR for the destruction of chemical weapon stocks) occurring in the context of ongoing negotiations in order to facilitate their conclusion, the existence of conflict prevention centres, and so forth.

Another issue in this context is raised by the development of unilateral measures, which by nature do not imply a previously-agreed-upon process of verification. However, they can be included in the process of negotiation, or can be substituted for a formal negotiation, based on reciprocal expectations. Confidence-building measures can complement them and make way for improved cooperation, playing a role comparable to that of verification.

Might this extension not lead to a kind of ***dissolution of the identity and unity of the verification process***, resulting in a vague or loose definition? The advantage of enhancing security mechanisms by preventive and cooperative measures could then be offset by a lowering of the requirements, on behalf of more harmonious overall political cooperation and presumed confidence based on a number of prior demonstrations. An indication is provided by the doubts expressed in various quarters regarding the value of on-site verification, as noted earlier. Another indication is the scant importance attached to the unequal technical resources available to States in order to carry out their own data collection and analysis. This leads to verification having a deeply unequal dimension in the context of ostensibly egalitarian multilateral treaties. Would the "Open Skies" proposal be able to efficiently resolve such inequalities? Aerial means are in fact less discriminatory than, for instance, surveillance through satellites. This does not provide, of course, a complete solution. The only way of narrowing the gap, so to speak, would be to develop cooperation among parties - in the absence of genuine international verification - the results (if not means) of which should be accessible without discrimination. However, such cooperation also implies reciprocal arrangements and cannot be based merely on the transfer of technology.

In light of the current situation, and in anticipation of future developments, it is the whole armament cycle leading from research and development to testing, production, deployment, stockpiling, possible use, transfer, reduction and destruction of weapons which has to be considered in its entirety when examining the verification process and the collateral measures it requires.

The Armaments Lifecycle and Verification

Alan Crawford

The ability to collect relevant information concerning obligations under an arms limitation and disarmament agreement is indispensable to the verification process and underpins judgements about compliance. This ability may in large measure be a function of what can be observed from a distance about the armaments subject to limitation.

What can be observed may vary with the stage of the armaments "lifecycle" to which the agreement applies because different stages of this lifecycle will provide different "observables" for verification. This may have a profound effect on the degree to which different verification methodologies and strategies are applicable. For example, the observables associated with verifying limitations on the production of a certain weapon, such as a tank, may dictate the use of a certain range of verification methods involving relatively proximate monitoring of production facilities (eg. perimeter/portal monitoring, periodic on-site inspections, etc.). Verifying limitations on deployment of the same weapon may involve different observables making other verification methods more useful (eg. national technical means (NTM), aerial inspections, etc.).

This is not to suggest that different verification methods and strategies are necessarily exclusively linked to specific stages of the armaments lifecycle. On the contrary, many verification methods may have relevance to a variety of stages. However, the degree of usefulness of any verification method with respect to verifying arms limitations as well as the appropriate mix of methodologies will be in part a function of the stage in a weapon's lifecycle.

It is also likely that, for arms control verification purposes, the importance of various lifecycle stages will differ considerably between weapons. Explosive testing of nuclear weapons, for example, may be relatively more susceptible to monitoring than other stages in that weapon's lifecycle. In contrast, testing a tank may be less easily monitored than its production or deployment. It has been suggested that a thorough examination of a weapon's lifecycle may permit certain critical bottleneck's or "choke-points" to be identified upon which verification efforts could be most productively focused. "The result could be a more cost-effective verification system with a higher degree of reliability".[4]

An Armament's Lifecycle

The process of acquiring a weapon or military capability can be viewed as a sequence of events similar to many industrial processes. It is thus possible to conceive of

[4] Dr. Artur Knoth, "Implementing Treaty Requirements: Key Aspects of Verification", *International Defense Review*, No. 4, 1991, p. 340.

several generic stages in the life of any particular armament.[5] The genesis of this sequence or "lifecycle" is research into the basic principles associated with the weapon. The next step might be applied research in which these basic principles are translated into viable technical and engineering specifications for the weapon in question. This stage merges into the development of the weapon. Testing of components and the entire system are a major characteristic of this research and development phase in an armament's lifecycle.

Production of the weapon is the next step, followed by deployment into military units. Weapons may also be placed in storage or exported to other countries. Changes may be made to the weapon throughout its life to improve performance. Finally, it is possible to conceive of a weapon ending its lifecycle by being destroyed as obsolete.

Of course, this lifecycle model represents a simplification of reality. It may have little relevance to many countries which do not produce or conduct research into armaments, but instead merely purchase them from abroad. In addition, the end of a weapon's life may be much less clearcut than suggested above. Weapons can, for example, be destroyed in battle or, if they become obsolescent for one country's armed forces, they may simply be exported to another country. Moreover, the lifecycle model may have limited application to some arms control and disarmament measures, for example, reduction in manpower levels or military budgets.

Despite the limitations of the lifecycle model, however, it does seem to provide a useful vehicle for describing and analyzing the general verification requirements of the arms control process.

Research and Development (R&D)

The initial phase of the armament lifecycle may often occur in laboratories or similar R&D facilities. Because the observables in this stage may be limited to what happens inside those facilities, very intrusive verification methods may be required to monitor compliance with agreements limiting R&D. Moreover, because much research, especially basic research, may have a variety of general applications that are both civilian and military (as well as a multitude of different applications within each sphere), intrusive verification could easily involve the collection of collateral information unrelated to the verification of the agreement in question. Thus major concerns about how to protect non-verification related commercial and national secrets arise. Other verification methods, such as monitoring scientific literature, may also be less effective than more intrusive methods such as inspections of labs, because they are dependent on the publication of research results, which can be controlled.

It has been suggested that a complete ban on a particular weapon rather than partial controls could make verifying R&D easier. The reasoning is that a complete ban means that there is no longer any rationale for continuing R&D with respect to the

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[5] See for example J. Kruzel, "From Rush-Bagot to START: The Lessons of Arms Control", *Orbis*, Spring 1986, p. 197. Kruzel suggests that arms control agreements are most likely to focus on limitations just after completion of the research phase before major funding for production is approved, or when the system is fully deployed. It is arguable that facility of verification may be one reason for such a pattern.

proscribed weapon and, consequently, there should be no reason to withhold information concerning related R&D. Complete transparency should be achievable according to this line of thinking.

There are, however, other concerns which might inhibit such total openness. Countries might wish to continue research into defences against a banned weapon, which they may not wish to divulge for fear of encouraging illicit proliferation of the banned weapon or compromising their defence efforts. Biological weapons defensive R&D is a case in point. Another serious impediment is the fact that the results of R&D activities can often have multiple applications. While such results might be applicable to the proscribed weapons, they might also be applicable to non-proscribed weapons or to civilian (commercial) uses.

In sum, the nature of the verification task relating to R&D limitations poses substantial challenges. Because R&D may be conducted at sites that could be relatively easily hidden, effective verification may have to be very comprehensive, possibly with rights to look at a variety of locations on request and without refusal. In addition, it may prove necessary for effective verification to have the right to check regularly large numbers of facilities, with the resultant inconvenience to the inspected party and the attendant risk of divulging collateral information. For these and other reasons, it is sometimes suggested that R&D limits are for practical purposes unverifiable.

Because of the difficulties of verifying controls on R&D, considerable attention has focused on the use of a variety of confidence building measures (CBMs) to heighten transparency about military R&D activities. Such CBMs might include reciprocal visits to military laboratories, exchanges of scientific personnel, seminars and conferences, etc.

Among the potential observables for R&D verification are the following:

- laboratory equipment,
- prototypes, models, etc.,
- building/facility configurations, including special safety equipment,
- associated facilities,
- inputs/consumables (eg. electric power),
- environmental effects (eg. waste products, heat),
- personnel employed (eg. professional skills, records),
- scientific literature produced, and
- management information (budget, organization plan).

Testing

The aspect of the R&D process that is often most susceptible to monitoring especially from a distance, is testing, particularly field testing of armaments or their components. In this case, a variety of other verification methods and strategies, most notably NTM, can come into play to reduce the intrusiveness of the verification regime as well as make the task more manageable. As is the case with respect to many other

stages of an armament's lifecycle, the physical size or distinctiveness of the weapon and the way in which it is tested will have an important impact on its observability. Testing a new ICBM, for example, will likely be much more observable using NTM than testing a new cruise missile.

Of course, NTM are not all-powerful and, in particular, can not monitor all potentially interesting sites, at all times. Accordingly, additional cooperative procedures such as notifications which enhance the predictability of the testing will improve the effectiveness of verification, by allowing monitoring methods to be focused on the test. This point regarding enhancing the predictability of activities applies to other stages of an armament's lifecycle.

Many of the same potential observables that apply to R&D, may also apply to testing. Others include:

- special environmental effects such as destructive effects (eg. craters), transit of weapon through the atmosphere,
- telemetry,
- field organization for the test, and
- specialized facilities (eg. launch sites).

Production

The nature of the production requirements will vary substantially between types of weapons. What is needed to produce tanks differs considerably from that for chemical weapons and this in turn differs considerably from that for nuclear weapons.

Without production there can be no weapon. This is the one phase that is least easy to circumvent: testing may be curtailed and weapons may be clandestinely stored instead of deployed immediately, but production can not be bypassed.

Nevertheless, many production activities occur inside buildings which are less susceptible to direct observation by NTM or other non-intrusive methods. Production processes may also be disguised to further complicate monitoring.

Inputs into the production process as well as its outputs (ie. wastes, etc.) can provide clues as to what is being produced and in what quantities. The final product (ie. the weapons themselves) must be moved from the production facility and/or stored nearby. While this may be done under cover (eg. shrouds, darkness, etc.), any activity outside of buildings is theoretically more easily monitored from a distance. Even so, it is impossible to watch all the time, making the use of remote sensors to monitor production accurately somewhat problematical.

This limitation on the utility of remote sensors has lead the superpowers in the bilateral context (INF and START) to employ perimeter/portal monitoring systems (PPMS). These systems employ humans as well as relatively short-range sensors to monitor that no illicit armament leaves a known production facility. While effective, PPMS have tended to be costly to install and maintain; though simpler (and cheaper) versions may be feasible.

Among the observables that could be the focus of verification in the production stage are the following:

- nature and quantity of inputs into the facility (eg. raw materials, power),
- building/facility configurations,
- environmental effects (eg. emissions, wastes),
- associated facilities (eg. testing ranges, storage parks),
- number and types of employees, and
- outputs (ie. transport and storage of end products).

Deployment

Once weapons are deployed to field units they may be more susceptible to monitoring from a distance in the sense that the field units will train with them in the open. However, while it may be relatively easy to detect the deployment of a new type of weapon, it may be much more difficult to keep an accurate account of how many of them there are, especially when the weapons in question are small, similar to other permitted weapons and mobile. Moreover, deliberate concealment is likely: one of the traditional objectives of military units, even in peacetime, is to prevent disclosure of the exact locations and numbers of their weapons and troops. There are valid military reasons for this, which are difficult to overcome in the arms control verification context. For these reasons arms control agreements which limit numbers are often more difficult to verify then agreements which ban a weapon outright. In the latter case, detection of a single illicit weapon would constitute non-compliance.

One of the methods that has been suggested as a possible solution to this question of monitoring numbers of deployed armaments, though it has not so far been implemented, is the use of tags. Unique, tamper resistant tags would be affixed in an agreed manner to weapons, probably at the production facility. These tags would be regularly checked, either by inspectors or remotely in the case of "active" tags. The detection of any weapon of the proscribed category without a tag would constitute a violation. While tagging seems to offer a viable verification method, it is likely to be administratively complex to implement as well as costly.[6]

Another more traditional approach to verifying numbers of deployed weapons is through on-site inspection (OSI) of military units. This is a principal method that has been adopted by the CFE Treaty. There are a host of variations on the theme of OSI: regular inspections, challenge inspections, random inspections, etc. On-site inspectors can be located in a country on a temporary basis (ie. only during an inspection) or they

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[6] For further information concerning the arms control applications of tags, see: Donald Bauder, "Tagging: 'Fingerprints' and Electronic Labelling for Arms Control", *Physics Today*, Vol. 18, No. 4, October 1989; A. DeVolpi, "Status of Tags and Seals for Arms Control Verification", in *Verification Report 1991: Yearbook on Arms Control and Environmental Agreements*, edited by J.B. Poole, New York, Apex Press, 1991, pp. 131-138; and, Steve Fetter and Thomas Garwin, "Tags", in *Verification of Conventional Arms Control in Europe: Technological Constraints and Opportunities*, edited by Richard Kokoski and Sergey Koulik, Boulder, Colo., Westview Press, 1990, pp. 139-154.

might be stationed in a country on a more permanent basis. The Military Liaison Missions of the USA, UK, France and the USSR which operated in Germany following the Second World War could serve in some ways as a model for permanent OSI teams. OSI, of course, is a method that is applicable to the verification of other stages of the weapons lifecycle as well.

Among the observables in the deployment stage are the following:

- unique characteristics of the armaments themselves,
- activities in which they are used, especially training,
- the patterns in which they are regularly deployed,
- associated facilities (eg. maintenance depots, training facilities),
- unit organization,
- specialized support equipment or methods (eg. specialized fuelling or transport equipment), and
- unusual and unique environmental effects.

Storage

Certain types of weapons may be stored in quantity rather than deployed with active military units. The nature of the storage facility, especially whether the armaments are under cover, will greatly effect the utility of various verification methods. PPMS may have a role to play in verifying storage of weapons. Most of the observables associated with the production stage may also apply (*mutatis mutandis*) in the case of storage.

Transfers

The transfer of a weapon from one geographic point to another is an almost inevitable component of its lifecycle.

A variety of transfers can be envisaged. Internal transfers within a country between military facilities may be quite frequent. Because such internal transfers are subject to the control of the country being monitored, it may be difficult to verify such movements without complex and intrusive measures.

Another type of transfers are international ones. Such transfers, for example, could involve movements of armaments to a country's foreign bases on the territory of an ally. Because an international movement is involved, and possibly longer distances, verification might be somewhat easier, particularly if a limited and known number of transfer "chokepoints" are used.

A final type of transfer is the export of armaments to another country. This will be discussed below under the section dealing with "Withdrawal or Destruction".

Detecting and tracking transfers, especially if the movements occur within a single country and are stretched over an extended period of time, may be problematic using NTM. A potentially useful verification method to supplement NTM in monitoring movements is the entry/exit point (EEP). EEPs, like PPMS, might involve both human inspectors and sensors. EEPs would be positioned at transportation bottlenecks

(railroad junctions, key bridges, ports, etc.) or at other points to monitor the flow of military traffic. They might be permanent or temporary in nature. EEPs have not been employed in any strictly arms control verification effort to date, though the use of control posts in peacekeeping situations is very analogous. Among the observables for transfers are the following:

- specialized transport equipment,
- unusual activities associated with transport,
- special security arrangements,
- disruption of normal (civilian) transport patterns, and
- written records including contracts, bills of lading, financial records, etc.

Withdrawal or Destruction

A weapon can leave military service in one of several basic ways:

- It can be destroyed in combat or other military operations (eg. as training targets), by accident or under an arms control agreement;
- It can be abandoned, cannibalized or broken up for scrap;
- It can be mothballed in some sort of long-term storage facility;
- It can be transferred to non-military units (eg. internal security forces); or
- It can be exported.

Destruction pursuant to an arms control agreement is perhaps the easiest to verify in some ways. For example, under the CFE Treaty and the INF Treaty inspectors are permitted to witness the destruction of the weapons in question. Destruction under these agreements must be conducted according to explicit procedures that are designed, in part, to facilitate the inspectors' task. NTM can also play a role in verifying the destruction of larger weapons. OSI in these circumstances, however, is usually less resisted because the parties are often eager to demonstrate compliance with this aspect of arms control agreements. Nevertheless, there may remain some concerns about divulging technological secrets which may have to be addressed during negotiations on the procedures for verifying destruction.

Other types of destruction (eg. in combat and by accident) as well as abandonment and cannibalizing may be less susceptible to direct verification. Presumably such destruction would be notified and changes made to the inventory totals communicated regularly under an arms control agreement. Normal procedures for verifying these inventories would, if effective, confirm that the lower reported number of weapons are present.

Mothballing of weapons might be subject to similar verification procedures as discussed under "Storage" above, whereas exports might be amenable to the methods discussed under "Transfers", notably EEPs. Transfers to paramilitary units may pose special complications for verification, particularly if the weapons in question are similar to those operated by military forces that are subject to an arms control

agreement. One solution to this problem is to ensure that paramilitary forces are subject to the same arms limitation ceilings and the same verification arrangements as are regular military forces.

Summary and Conclusion

It is possible to conceptualize a typical "lifecycle" through which any weapon will progress from its conception to its destruction. A number of more or less distinct stages within this lifecycle can be suggested. This model may be useful in describing and analyzing verification requirements of arms control agreements.

Arms control agreements may apply to one or more stages of an armament's lifecycle. The utility of different verification methods for detecting violations may be significantly affected by the stage of the weapons' lifecycle that is subject to limitation. For example, limitations on certain types of R&D may be very difficult to verify using remote sensors because of the fact that such R&D can be relatively easily concealed. In contrast, the deployment of armaments is likely to be much more susceptible to monitoring from a distance.

In sum, the utility of a verification method will be in part a function of the stage in the armaments lifecycle with which the arms limitation and disarmament agreement is concerned.

For verification purposes, the importance of different lifecycle stages will likely differ between weapons. It is useful therefore to analyze the unique characteristics of each controlled armament's lifecycle in order to identify any "choke-points" upon which verification efforts can be concentrated for best effect.

The above analysis suggests that cooperative verification methods, such as OSI, while helpful in verifying agreements relevant to any stage of an armament's lifecycle, are probably most necessary for agreements dealing with R&D, production, some aspects of deployment, transfers and storage, and destruction. One form of cooperative measure - the prior notification of activities - enhances predictability and permits NTM to be focused of the event in question. This greatly improves the effectiveness of this method of verification.

Chapter 1
Nuclear Issues

Further Limitation and Prohitibion of Nuclear Test Explosions: The Problem of Verification

Jozef Goldblat

Introduction

The present international nuclear test limitation regime comprises the following treaties:

- The 1959 Antarctic Treaty prohibiting any nuclear explosions in Antarctica; in force since June 1961.
- The 1963 Partial Test Ban Treaty (PTBT) prohibiting nuclear explosions in the atmosphere, in outer space and under water; in force since October 1963.
- The 1967 Treaty of Tlatelolco prohibiting the testing of nuclear weapons by Latin American countries; in force since April 1968.
- The 1967 Outer Space Treaty, in force since October 1967, and the 1979 Moon Agreement, in force since July 1984, both prohibiting the testing of any type of weapon on the moon and other celestial bodies.
- The 1968 Non-Proliferation Treaty prohibiting the manufacture of nuclear weapons and, by implication, the testing of such weapons by non-nuclear weapon States; in force since March 1970.
- The 1971 Seabed Treaty prohibiting the placement on the seabed and the ocean floor and in the subsoil thereof, beyond the outer limit of a 12-mile seabed zone, of any facility designed for testing nuclear weapons; in force since May 1972.
- The US-Soviet 1974 Threshold Test Ban Treaty (TTBT) restricting the underground testing of nuclear weapons to yields not exceeding 150 kilotons[1]; in force since December 1990.
- The US-Soviet 1976 Peaceful Nuclear Explosions Treaty (PNET) restricting nuclear explosions conducted outside the nuclear weapon test sites (and therefore presumed to serve non-military purposes) to yields not exceeding 150 kilotons; in force since December 1990.
- The 1985 Treaty of Rarotonga prohibiting the testing of any nuclear explosive device in the South Pacific; in force since December 1986.

[1] Kiloton (kt) is a unit of energy used to measure the yield of a nuclear explosion; it is equivalent to the energy released by an explosion of 1000 tons of trinitrotoluene (TNT) high explosive. The explosion produced by the atomic bomb dropped on Hiroshima had a yield of about 14 kilotons.

The search for a permanent ban on all nuclear test explosions, which has been going on for over 30 years, has been hampered by a controversy over whether such a ban should be achieved through a single multilateral treaty or as a result of gradual, ever stricter limitations on testing by the nuclear weapon powers. Whichever course is eventually chosen, verification of compliance with the assumed obligations will be an important ingredient of the agreement reached.

Should the testing powers only decide to reduce the explosive force of their underground nuclear explosions, and should the new yield threshold not be lower than, say, several tens of kilotons, the existing verification procedures, those incorporated in the 1990 Protocol to the US-Soviet TTBT, could suffice.[2] If the yield threshold were drastically reduced, say, to the level of one kiloton or slightly higher, and if the number of underground explosions, permitted but notified in advance, were also set very low, important supplementary verification methods would have to be adopted by the nuclear weapon powers. For a comprehensive test ban (CTB), prohibiting all tests and valid for all States, a ramified, global verification system would have to be installed. This paper discusses the possibilities of verifying both a CTB as well as a very limited (in numbers) and very-low threshold test ban (VLTTB).

Under a VLTTB, the purpose of verification would be to check whether the parties have not conducted more nuclear explosions than agreed, and whether the yields of the permitted explosions have not exceeded the established limit. Under a CTB, any detonation of a nuclear device would appear to violate the ban, it being widely understood that so-called peaceful nuclear explosions are indistinguishable from weapon explosions[3] and should therefore not be permitted. Nevertheless, certain proposals for a nuclear test ban refer only to a prohibition of nuclear "weapon" tests, and the draft comprehensive nuclear test-ban treaty introduced by Sweden at the Conference on Disarmament on 25 July 1991[4] would explicitly allow detonations of nuclear explosive devices for peaceful purposes if the parties agreed on how to control them. Were this approach to be adopted, the procedures included in the PNET could be of some use, but such an eventuality is not discussed here.

Compliance with a VLTTB or a CTB can be monitored by seismic and non-seismic means, as well as through on-site inspections. It is assumed that certain very small nuclear experiments, those that cannot be detected by any means, would not be covered even by a comprehensive nuclear test ban.[5]

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[2] For a detailed review of these procedures, see J. Goldblat, "The Nuclear Test-Limitation Treaties" in S. Sur (ed.), *Verification of Current Disarmament and Arms Limitation Agreements: ways, means and practices*, Geneva, UNIDIR, 1991.

[3] *Effects of a Comprehensive Test Ban Treaty on US National Security Interests*, Hearing before the Committee on Armed Services, Intelligence and Military Application of Nuclear Energy Subcommittee, US House, 95th Congress (US Government Printing Office: Washington, DC, 1978).

[4] Conference on Disarmament document CD/1089.

[5] In the late 1980's, when the United States negotiated a test ban with the Soviet Union, the prevailing opinion within the US Administration was that nuclear experiments with a yield not exceeding 100 pounds should be permitted under a CTB. (R. N. Thorn and D. R. Westervelt, *Hydronuclear Experiments*, LA-10902-MS, UC-2, Los Alamos, New Mexico, February 1987.)

Seismic Monitoring

The most dependable way known to detect and identify the source of underground seismic events is by seismological means.

Detection

When a nuclear detonation takes place underground, ground vibrations or seismic waves are generated similar to those produced by an earthquake. Different seismic waves travel on different paths, at different speeds, have different frequencies and wavelengths, and are absorbed and scattered with different strengths. They can be detected by seismometers, instruments which respond to extremely small displacements of the Earth at their point of location.[6] "Body" waves that pass through the Earth's deep interior and "surface" waves that propagate close to the Earth's surface can be recorded at large distances - over 2,000 kilometres - and are usually referred to as "teleseismic waves". Those that travel within the Earth's crust and its outer layers can be recorded over shorter distances and are therefore called "regional waves". The geological structures modify the seismic signals produced by explosions and may complicate the process of detection. An even greater difficulty faced by seismologists is the ambient background of seismic "noise" - the vibrations in the earth resulting from winds, sea waves, industrial activity and even rush-hour traffic - from which the events of nuclear explosions and earthquakes must be picked out.

Nevertheless, with a network of properly distributed seismic stations equipped with sensitive instruments, earthquakes and explosions can be distinguished from other disturbances with a high degree of certainty. For example, in 1985, the seismic array in Norway, which consists of a large number of seismographs arranged in a special geometrical pattern, detected a 0.25 kiloton explosion conducted 3,800 km away in Eastern Kazakhstan.[7] High-quality seismic stations deployed within the testing countries could even further improve these capabilities. Detection would not constitute a problem in monitoring either a CTB or a VLTTB.

Identification

It is more difficult to determine whether a seismic signal was caused by a nuclear explosion. Natural earthquakes, many thousands of which are recorded each year, and chemical explosions, carried out in mines and quarries as well as at construction sites, generate seismic signals that may resemble those produced by underground nuclear

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[6] The way in which a seismometer works can be described as follows: a heavy mass is freely supported by a spring from a frame fixed to the Earth. When an earthquake or explosion occurs, the frame is shaken in response to the motion of the seismic waves traveling through the Earth. Although the the frame is displaced by the ground motion, the heavy mass remains stationary because of inertia. The displacement of the grounded frame relative to the stationary mass is a measure of the ground motion. This movement is then electronically magnified.

[7] R.W. Alewire III, "Seismic Sensing of Soviet Tests", *Defense 85*, Dec. 1985, pp. 11-21.

detonations. The threshold for identification is therefore always higher than the threshold for detection.

The simplest way to differentiate an earthquake from a nuclear explosion is to establish the depth of the underground event as well as the epicentre, that is, the area on the surface of the earth directly above the focus of the event. A seismic event can be unmistakably classified as an earthquake when it occurs at a depth exceeding the depth of any hole ever drilled by man (over 10 kilometres). A nuclear explosion can also be ruled out, if a seismic event occurs far out at sea but no drilling operations have been observed and no acoustic signals, which characterize an explosion, have been detected, On land, a seismic event occurring in an area with no evidence of human activity, or at a place which is obviously not suitable for nuclear testing, such as a population centre, must be assumed to be an earthquake. About 90 % of the world's earthquakes can be recognized by using the above indications.[8]

For the remaining events, those which cannot be identified by depth or location, other methods of discrimination are used; they are based on the physical characteristics of earthquakes and explosions. Seismically, an underground nuclear explosion is seen as a highly concentrated source of waves sent out instantly from one point with approximately the same strength in all directions; this is so because of the uniform pressure applied to the walls of the cavity created by the detonation. An earthquake, which occurs when two blocs of the Earth's crust slip past each other along a geological fault, generates waves over a much wider area - from all parts of the fault that rupture. The differences between these two types of waves, as reflected in seismic signals, permit to differentiate the sources of underground events. Identification becomes progressively more difficult for smaller events, because the quality of the signals generated by such events is lower, and because the number of earthquakes that can be confused with nuclear explosions rapidly increases when one considers events of decreasing size.

At low yields, nuclear explosions must be distinguished not only from earthquakes but also from other man-made explosions. The problem is that industrial explosions produce seismic signals which have physical characteristics similar to those of nuclear explosions. However, industrial explosions that are large enough to be confused with nuclear detonations are very rare. Moreover, in order to minimize ground vibration and to fracture rock more efficiently, these explosions are often conducted with bursts spaced over the duration of about a second. Such ripple-firing is apparent in the observed seismic signals and may facilitate identification. The use of high frequency seismic data may, in the opinion of some seismologists, further improve the capability not only to detect but also to identify low-yield nuclear explosions.[9] Nevertheless, with the existing seismological means, very small chemical explosions, those with yields considerably lower than one kiloton, cannot be identified as such. This circumstance

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[8] *Verification of a Global Comprehensive Test Ban*, VERTIC, London, January 1991.

[9] J. F. Evernden, C. B. Archambeau, and E. Cranswick, "An Evaluation of Seismic Decoupling and Underground Nuclear Test Monitoring Using High-Frequency Seismic Data" in *Reviews of Geophysics*, Vol. 24, May 1986, pp. 143-215.

may leave a loophole in a CTB. For a VLTTB, however, this would be of lesser consequence, because the yield threshold that might be agreed under such a ban would probably not be set that low.

Evasion

The effectiveness of a test ban monitoring system can be degraded through deliberately engineered measures, usually referred to as evasive measures. Several evasion scenarios have been contemplated.

It is known that the amplitude of the seismic waves generated by an underground nuclear explosion could be dampened and the seismic signals muffled, if the nuclear device were detonated in dry alluvium.[10] The geological formations which are suitable for such a technique are not widespread; their locations may be known and placed under special supervision.[11] However, formations in rock with significant gas-filled porosity - which are common - may pose a problem, in particular, in the verification of yield limitations.[12]

In a so-called multiple-explosion scenario, deception would be practised by firing a sequence of nuclear explosions with increasing yields in order to produce earthquake-like signals. However, in the opinion of some experts, the release of nuclear energy through this technique could not be confused with an earthquake. If suspicions were aroused, examination of seismic signals would reveal the origin of the events.[13]

A potential violator of a test ban could attempt to mask the signal from a nuclear explosion in the coda (taii) of a large earthquake signal. The difficulty to operate such a hide-in-the-earthquake technique would be substantial: the test would have to be held in constant readiness, probably for a lengthy period of time, awaiting an earthquake which would have a magnitude exceeding a certain limit, and which would occur sufficiently close to the test site. Even then, the fact that explosions generate more high-frequency energy than earthquakes might help expose the fraud.

It has been argued by some people that nuclear tests could be carried out secretly in deep space or behind the sun. The realization of such an exotic project would entail launching to the clandestine location one or more space vehicles that would carry the device to be exploded as well as the instrumentation needed to record the test and to transmit the data back to Earth. It would, of course, be impossible to detect such an event by seismic means; most probably, the use of monitoring satellites equipped with special detectors would be needed. However, the complex technical problems that would have to be overcome, the considerable costs involved, and the risk that the data

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[10] L. A. Glenn, "Verification Limits for a Test Ban Treaty" in *Nature*, Vol. 310 (1984), pp. 359-62.

[11] Certain studies have suggested that there are no such formations in the Soviet Union: L. R. Sykes, "Verification of nuclear test ban treaties", Testimony before the Committee on Foreign Affairs, Subcommittee on Arms Control, International Security, and Science, US House of Representatives (8 may 1985).

[12] Oral communication by D. R. Westervelt, Los Alamos National Laboratory, Los Alamos, USA.

[13] J. K. Leggett, "Techniques to Evade Detection of Nuclear Tests" (Chapter X) in J. Goldblat and D. Cox (eds.), *Nuclear Weapon Tests: Prohibition or Limitation?* (SIPRI, CIIPS, Oxford University Press, 1988.)

from the secret test might be intercepted by another power, would exceed the military value of the operation, and would make such an evasion highly improbable.[14]

The most likely way of eluding verification is by conducting a nuclear explosion in an underground cavity, preferably in a salt deposit. The explosive energy would then be "decoupled" from, that is, less well transferred to, its geological surroundings, and the seismic signals produced by the explosion would be muffled.[15]

To decouple a nuclear explosion, a stable cavity of suitable size and shape may be needed.[16] These conditions would be difficult to obtain, but they may exist in nature. The extrapolations so far made in the United States to determine the effectiveness of the decoupling technique have been based on data from chemical explosions with yields thousands of times less than that of a typical nuclear test, and only from one, very small (a few hundred tons) nuclear explosion.[17] In the event of a sizable nuclear explosion being decoupled, the reduced seismic signal may still be identifiable as a clandestine nuclear test. Should the cavity collapse, it could vent into the atmosphere radioactive substances open to detection by radiation monitoring, and/or cause a surface depression open to detection by photographic monitoring. In most cases it would be difficult to mask in conventional mining operations the lengthy and elaborate activities connected with decoupling a nuclear explosion. It might be possible, of course, to use the existing large natural cavities or those created by past nuclear explosions, but their locations are by and large known and could be monitored. Engineering a secret test explosion above 10 kilotons in a cavern, while guarding against the risk of detection, would be an extremely demanding, expensive and risky procedure.

The decoupling technique could, perhaps, be effective for a small nuclear explosion, up to a few kilotons. Such an explosion might be confused with a small earthquake and remain unidentified, especially if the muffled seismic signals could be attributed to a large chemical explosion simultaneously conducted for some legitimate peaceful purpose. As mentioned above, seismic means are not sufficient to make a distinction between nuclear and chemical detonations. This is of importance to both a CTB and a VLTTB. It will be noted, however, that industrial explosions in the 1-10 kiloton range occur less often than once a year.[18]

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[14] J. Horgan, "Underground Nuclear Weapons Testing" in *Spectrum*, Vol. 23, No. 4 (April 1986).

[15] "Decoupling" was introduced into test-ban negotiations as a problem for the verification of compliance as early as in 1959. G. T. Seaborg, *Kennedy, Khruschev, and the Test Ban* (University of California Press: Berkeley, 1981).

[16] To "fully decouple" a five-kiloton nuclear blast in salt, so as to reduce its seismic signal to a minimum, would require a cavity 86 metres across -higher than the Statue of Liberty; G. E. van der Vink, "Verifying a Comprehensive Test Ban" in *Arms Control Today*, November 1990.

[17] D. Springer, M. Denny, J. Healy and W. Mickey, "The Sterling Experiment: Decoupling of Seismic Waves by a Shot-Generated Cavity" in *Journal of Geophysical Research*, Vol. 73, No. 18 (Sep. 1968), pp. 5995-6011.

[18] "Seismic Verification of Nuclear Testing Treaties", Congress of the United States Office of Technology Assessment, Washington, DC: US Government Printing Office (May 1988), p. 13.

Many scientists claim that with the existing means reliable identification of fully-coupled nuclear explosions can now be obtained down to one kiloton of explosive yield. Others, less numerous, mention a figure as high as several tens of kilotons as the lowest verifiable yield. In between, some authoritative seismologists have concluded that the present level of seismic knowledge and the presumed effectiveness of cavity decoupling allow for near-certain detection of nuclear explosions with a yield in the 5-10 kiloton range.[19]

A CTB or a VLTTB, would have to include a formal undertaking by the parties not to complicate the detection of nuclear explosions or the assessment of their yields by interfering with each other's national technical means of verification.

Global Seismic Monitoring System

There is general consensus that the capability to detect and identify seismic events would be considerably improved if an international monitoring system were deployed. Such a system has been proposed by the Ad Hoc Group of Scientific Experts (GSE) set up within the framework of the Conference on Disarmament (CD) "to consider international co-operative measures to detect and identify seismic events". The system would consist of the following major components: a global network of modern seismograph stations; modern telecommunications channels for the exchange of recorded seismic data; and an international centre to collect and analyse these data and to distribute the results of the analyses. The data exchange would cover both level I and level II data. Level I data are basic parameters derived by the operators of each seismic station from the recordings of the detected events, whereas level II data - more voluminous - are waveform data, that is, the original recordings. National data centres (NDC) would be responsible for providing seismic data from the stations to the international data centre (IDC). The methods and procedures, which have been developed by the GSE, for transmitting data from stations to an IDC, for processing them there, and for transmitting the results back to the participants, have been successfully tested.

In its draft treaty banning "any nuclear weapon test explosion in any environment", of 1983[20], as well as in its draft CTB treaty of 1991, mentioned above, Sweden proposed that the basic equipment of seismological stations, the ways these stations should be operated, calibrated and maintained, the procedures for reporting seismological data (including the reporting format and the time schedule) on a regular basis, as well as the procedures for making requests for additional data from designated stations, and for responding to such requests, should be specified in an "operational manual". It also suggested that technical assistance in establishing, operating and maintaining new high-quality seismic stations be provided in those regions of the world where there are no such stations.

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[19] *Nuclear Testing Issues*, Hearings before the Committee on Foreign Relations, United States Senate, 99th Congress, 2nd session, May 8, June 19 and 26, 1986 (Government Printing Office: Washington, DC, 1986); Conference on Disarmament document CD/610/Corr.1.

[20] Conference on Disarmament document CD/381.

According to the GSE, a global seismic network would have to include at least 50 "primary" stations located in such a way as to ensure adequate world-wide coverage, preferably at sites where the background noise level is low. The stations would have to be able to record high-quality waveform data from seismic events at all distances. More array stations would not only help improve the detection capability but would also provide better location data for the detected events. Networks of "secondary" stations drawn from national earthquake-monitoring networks could increase the capability to detect lower-magnitude seismic events on the territories of the participating states.

At the January 1991 Conference, which was convened to amend the PTBT, a group of countries - Indonesia, Mexico, Peru, Sri Lanka, Venezuela and Yugoslavia - proposed that the global seismic monitoring network should have at least the capability to detect, locate and identify a tamped underground explosion[21] of 0.5 kiloton or more anywhere in the world and of 0.005 kiloton within the limits of national jurisdiction of any State "which has conducted more than one nuclear explosion".[22] This would mean that India, which has exploded a nuclear device only once (in 1974), as well as other nuclear threshold states, which possess the wherewithal to manufacture a nuclear bomb, but may have not yet done so, would be subject to less stringent monitoring than the existing nuclear weapon powers. Such an approach could not contribute to the tightening of the nuclear non-proliferation regime, which a CTB is expected to bring about.

A detailed scheme of a global seismic network was suggested at the PTBT Amendment Conference. One hundred and six non-nuclear weapon States parties to the PTBT would be monitored by one current, "off-the-shelf" high-technology seismic station, each. The remaining non-nuclear weapon States would require more than one station each, because of their size and the type of their geophysical terrain: Argentina-2, Australia-3, Brazil-4, Canada-4, India-2, Indonesia-2, Iran-2, Mexico-2. On the territories of the nuclear weapon States parties to the PTBT, higher quality, state-of-the-art stations would have to be installed: 38 in the Soviet Union, 20 in the United States, 1 (or perhaps one or two more) in the United Kingdom. (China and France have not signed the PTBT.) Thirty-three stations of the same quality would have to be placed in international territory, primarily to monitor ocean areas. Thus, approximately 219 stations would be needed; their total cost has been estimated at ca. 150 million US dollars.[23] In addition to the exchange of seismic data, each party would be under the obligation to provide detailed information regarding: every nuclear

[21] An underground explosion is tamped when it is detonated in close proximity to the surrounding rock.

[22] Conference on Disarmament document CD/1054.

[23] By comparison, the cost of a single nuclear weapon test explosion, as estimated by the drafters of the protocol to the PTBT, is 30-100 million US dollars. According to the *Defense Monitor* (Vol. XX, No. 3, 1991), the cost of an explosion varies depending on its complexity. Tests that require the use of vertical shafts, such as weapon-design and weapon-reliability tests, cost about 30 million US dollars each. Weapon-effects tests, which involve the use of horizontal tunnels and are more complicated, cost some 50-60 million US dollars per explosion.

explosion ever conducted by it; natural events occurring, or activities undertaken, within its territory that might give rise to ambiguity or uncertainty about compliance; large underground cavities created or discovered; vertical shafts and horizontal tunnels drilled in excess of certain agreed dimensions; and chemical explosions exceeding a specified yield. The accuracy of these national data would be subject to corroboration.

In-Country Seismic Stations

High-performance seismic stations specially designated to monitor underground events within the territories of individual countries would significantly complement the international seismic system described above. It is known that stations situated closer to the source of a seismic event register a fuller range of signals and make their interpretation easier. Additionally, seismic noise poses less of a problem and the evasion scenarios can be more effectively countered. Multiple nuclear detonations meant to simulate an earthquake, or a nuclear explosion detonated in the coda of an earthquake, would be highly unlikely to escape discovery, especially if the in-country seismic stations were linked to a network of stations situated outside the monitored countries. Such an arrangement would also permit the detection and identification of decoupled nuclear explosions, as well as the detection of certain chemical explosions conducted for civil engineering purposes.

It is noteworthy that in the course of their tripartite test-ban talks in the late 1970's, the Soviet Union, the United Kingdom and the United States agreed that the verification arrangements would include special, high-quality, so-called national seismic stations (NSS) on the territories of the three negotiating parties. The stations would be automatic and tamper-proof, so as not to require foreign personnel on constant attendance, and would transmit the recorded data continuously and directly outside the host country. The intention was to place the NSS in areas in which the geological structure might be considered suitable for conducting clandestine tests. There were, however, disagreements regarding the instrumentation of the NSS, their number in each of the negotiating states (the Soviet Union and the United States agreed on having 10 such stations installed in their territories, but the number for the United Kingdom was not settled), specific locations, procedures for their emplacement and maintenance, as well as for the transmission of data. It was not clear whether the treaty would be allowed to enter into force before the NSS became fully operative; at that time the stations were only at the stage of development. Nor was it known whether data from the NSS would be generally available or reserved solely for the three nuclear powers.[24]

The value of localized monitoring for obtaining supplementary data necessary to clarify ambiguous situations was recognized by the drafters of the amendment to the PTBT. The additional monitoring would be temporary, and the equipment utilized could be similar to that operated by the global network. Sites for the localized

[24] J. Goldblat and R. Ferm, "Nuclear Explosions" (Chapter 11) in *SIPRI Yearbook 1981*, Taylor & Francis, London 1981.

monitoring stations would have to be seismically quiet and, if possible, provide access to bed-rock. Data from the temporary stations would be duplicated on the site and a copy provided to the host country.

Non-Seismic Monitoring

Supplementary verification capabilities can be provided by techniques other than seismic.

Satellite Imagery

The most important method of non-seismological remote sensing is satellite photography. Not only military reconnaissance satellites, which have a resolution capability of a few tens of centimetres, but even civilian satellites, with a resolution of a few tens of metres, can produce clear pictures of surface craters which may be caused by underground explosions.[25] Areas with older crater formations could, however, present problems of identification. Explosions conducted in hard rock do not generally produce craters.

Satellite photographic reconnaissance may be also useful in detecting activities which are usually connected with preparations for a nuclear explosion. In 1977, after the Soviet and US satellites had observed such preparations in the Kalahari Desert, the South African Government was compelled to dismantle the suspected installations. In another instance, in 1979, a US satellite observed in the southern hemisphere a flash, which could have been produced by a low-yield atmospheric nuclear explosion, but American experts could not agree on the nature of the event. It is only because it happened in the vicinity of South Africa, which possessed the capability of producing weapon-usable nuclear material, but had not yet formally renounced the acquisition of nuclear weapons, that the South African Government was accused of having conducted a nuclear test.

Attempts to evade detection of an underground nuclear explosion by using the decoupling technique could be spotted by satellites, if large amounts of material were removed to excavate a cavity of the required dimensions. By using infra-red detectors, it may also be possible to detect underground releases of heat, especially from large nuclear explosions, because of an increase in surface temperature. Intelligence satellites may overhear communications related to a clandestine test programme.

Under a comprehensive test-ban treaty proposed by Sweden in 1991, each party operating an unclassified satellite system which provides images with a coverage and resolution relevant to the treaty, would undertake to make the image data available on terms to be agreed. A satellite image processing centre would store such data and process them at the request of any party.

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[25] The resolving power, or resolution, of an optical system may be defined as the minimum distance between two identical small objects when they can still be distinguished as two separate objects.

Radioactivity

Whatever the precautions taken by the testing state, it is impossible to ensure that the radioactive debris, which is produced by all nuclear explosions, would remain completely contained under the earth's surface. The possibility of accidental releases of radioactive material - and several such occurrences have been reported over the years[26] would constitute a serious dilemma for the potential evader.

In 1983, and again in 1991, Sweden proposed that an international surveillance of radionuclides in the atmosphere be established. A system for such surveillance, designed in the same way as the global seismological system, would consist of some 50-100 designated sampling stations properly distributed around the world; national or regional laboratories; a mechanism to exchange the measurements of the samples; and an international data centre. At each sampling station air would be continuously blown by a pump through a glass fiber filter. The filters would be regularly and often replaced and sent for analysis to the laboratories. The international centre would process the measurements reported through appropriate national authorities, in accordance with the procedures laid down in a special operational manual. The results would be rapidly distributed to all participants.[27]

National radiation monitoring networks already exist. Moreover, a world-wide network of air and rain sampling stations for monitoring levels of radioactivity in the atmosphere is operated by the Harwell Laboratory in the United Kingdom. The results of this monitoring are published annually.[28]

Additional non-seismic means of verification might include hydro-acoustic measurements in the sea. Yet another technique, that of monitoring the disturbances of the ionosphere, which are caused by the propagation of the sound wave generated by an underground nuclear explosion, is at the stage of development. Even if both ground and satellite-based sounding systems were used, it might still be difficult to identify nuclear explosions among many other sources of ionospheric disturbances.[29]

On-Site Inspection

A combination of seismic and non-seismic methods to monitor compliance with a test ban may render it unlikely for a violator to succeed in evading detection. However, unexplained events may occur, and the state suspecting a breach may wish to investigate the occurrence by inspecting its site.

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[26] US Congress, Office of Technology Assessment, *The Containment of Underground Nuclear Explosions*, OTA-ISC-414 (Washington, DC: US Government Printing Office, October 1989).

[27] Conference on Disarmament documents CD/403 and CD/1089.

[28] *Verification of a Global Comprehensive Test Ban Treaty*, VERTIC, London, January 1991.

[29] A. M. Din, "Means of Nuclear Test Ban Verification Other Than Seismological" (Chapter XI) in J. Goldblat and D. Cox (eds.), *Nuclear Weapon Tests: Prohibition or Limitation?* (SIPRI, CIIPS, Oxford University Press, 1988.)

Negotiating Record

On-site inspection has been a controversial issue since the early days of the test ban negotiations. In 1958, experts from East and West, meeting at a conference in Geneva, agreed on the following formula: "When the control posts detect an event which cannot be identified by the international control organ, and which could be suspected of being a nuclear explosion, the international control organ can send an inspection group to the site of this event in order to determine whether a nuclear explosion had taken place or not." The formula suggested that an inspection team could be dispatched to the site of an un-identified event only if the event were suspected of being a nuclear explosion. However, the experts did not spell out what constituted a basis for suspicion, except when an event that was not identified as an earthquake had occurred in an aseismic region. Their report stated that the number of on-site inspections would depend on the number of un-identified events, but no quantitative correlation was established.[30]

The position of the West, as put forward in the course of the test-ban negotiations in 1958-1961, was that *every* un-identified seismic event should be regarded as a potential underground nuclear explosion and that it must therefore be inspected. In other words, on-site inspection was to be mandatory. The Soviet Union was of the view that on-site inspection was to be voluntary, that is, that it should take place only if there was agreement between the parties.[31] The deadlock seemed to have been broken when the negotiating parties decided that there should be a guarantied quota of on-site inspections for each party. However, no agreement could be reached on the numerical value of the quota. The West insisted that this value should be related to the average annual number of un-identified events on the territory of a party to the treaty, whereas the Soviet Union argued that it must be determined by political considerations. Different figures were put forward by the negotiators.

The dispute over the number of annual inspections was particularly animated in the early 1960's, with the United States eventually proposing seven, and the Soviet Union - two to three on-site inspections. (The Soviet offer was subsequently withdrawn on the grounds that no such inspection was necessary.) The controversy symbolized the opposing views on the very concept of arms control verification and remained unresolved.[32] Even if either of the great powers had at that time accepted the other's figure, there would still have been important obstacles to overcome. The procedures and modalities for carrying out inspections were not even seriously considered, although they were far more controversial than the numbers.[33]

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[30] "Communiqué and Report of the Conference of Experts to Study the Possibility of Detecting Violations of a Possible Agreement on the Suspension of Nuclear Tests, August 21, 1958" in *Documents on Disarmament 1945-1959* (US Department of State: Washington, DC, 1960), Vol 2.

[31] Geneva Conference on the Discontinuance of Nuclear Weapon Tests, History and Analysis of Negotiations (US Department of State: Washington, DC, 1961).

[32] R. Neild and J. Ruina, "A Comprehensive Ban on Nuclear Testing" in *Science*, Vol. 175, January 1972.

[33] For the changing attitudes of the superpowers on the question of on-site inspection, see also J. Goldblat "Banning Nuclear Tests: Can a CTB Be Achieved?" in *The Council For Arms Control Bulletin*, No. 49, May 1990.

In the mid-1960's Sweden proposed so-called challenge inspections to verify a comprehensive test ban. If a seismic event occurred on the territory of one country and appeared suspicious to another country, the latter could request permission to inspect the region surrounding the event. The suspected country could either accept or reject the request. If one or several requests were rejected, the suspecting country could choose to withdraw from the treaty.[34] The proposal proved unacceptable to either of the two superpowers.

In the tripartite - UK-US-Soviet - test-ban talks of the late 1970's, the negotiators agreed that any party to a multilateral comprehensive treaty that had questions regarding an event on the territory of any other party could request an on-site inspection for the purpose of ascertaining whether or not the event was a nuclear explosion. The requesting party would have to give the reason for the request, including appropriate evidence. The party receiving the request would have to state whether or not it was prepared to agree to the inspection. If it was not prepared to accept the inspection, it would have to provide the reason for non-acceptance.[35] Agreement on this formula amounted to the adoption of the principle of voluntary on-site inspection, because refusal to accept inspection was not to be automatically qualified as a breach. It was thus a concession on the part of the United States which must have concluded that also non-mandatory on-site inspection could deter cheating.

The treaty envisaged in the tripartite talks would allow any two or more parties to take additional measures to facilitate verification. These measures would parallel the verification provisions of the treaty itself, but would specify in greater detail the procedures under which on-site inspections would be carried out, list the rights and functions of the inspectors, and describe the role to be played by the host country during an inspection. This two-tier verification arrangement was meant, in the first place, to reinforce confidence between the United States and the Soviet Union that the obligations they had assumed were being complied with, but it could also be usefully applied as between other States, especially in areas of international tension and mistrust.

The 1983 Swedish draft treaty provided for on-site inspection to be conducted by experts made available by the parties. The experts would be selected on the basis of equitable geographical and political representation. The purpose of the inspection would be limited to fact-finding, and no assessment of the nature of the inspected event would be made. The report by the inspection team could present a consensus view, but if consensus could not be achieved, the report would have to reflect the observations made by each of the participating experts.

In 1987, a group of Socialist countries drew up "Basic provisions of a treaty on the complete and general prohibition of nuclear weapon tests", in which it insisted on the right of each party to request on-site inspection in the territory of another party. The requesting State would have to cite appropriate grounds for the request, whereas

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[34] *Documents on Disarmament 1966* (US Arms Control and Disarmament Agency: Washington, DC, 1967).

[35] Conference on Disarmament document CD/130.

the requested State would be obligated to grant access to specified locations in order to clarify whether an event, the status of which was unclear, was related to a nuclear explosion carried out in circumvention of the provisions of the treaty.[36]

Also the 1991 draft Protocol of Amendment to the PTBT envisaged the possibility of on-site inspection at the request of a party, but the Secretariat of the Verification Organization, to be set up in accordance with this Protocol, could decide not to undertake the requested inspection and report its negative decision to all parties. It could also undertake an inspection at its own initiative, whenever data from the global permanent monitoring network or the temporary localized monitoring indicated the occurrence of an ambiguous event and suggested that the energy released was over one kiloton. The probability of inspection would be higher, if the event occurred on the territory of a State "that has conducted more than one nuclear explosion". If the Secretariat decided to carry out an on-site inspection, the host State might appeal the decision to the Assembly of the parties. The inspection could then proceed while the Assembly was considering the matter, but if the Assembly concluded by a two-thirds vote that on-site inspection was not warranted, the inspection would have to be promptly abandoned. The Secretariat would be empowered to order the host State to leave all, or only specified, vehicles, buildings, personnel, equipment and other items in place in the inspection area, and to refrain from undertaking any other changes in that area, pending the arrival of the inspection personnel. Before leaving the inspection area, the inspection team would be under the obligation to complete a written report summarizing its activities and the collected data. A copy of the report would be provided to the host State which might append to it a commentary.

According to the 1991 Swedish draft treaty, on-site inspection could be carried out either upon invitation by a party wishing to facilitate the identification of an event observed on its own territory, or upon request by a party wishing to investigate an event observed on the territory of another party. In the latter case, the requesting State would have to state the reasons for its request, including the available evidence. The requested State would be under the obligation to comply with the request, and a factual report prepared by the inspectors would have to be brought to the attention of all parties.

Modalities of Inspection

On-site inspection aimed at identifying a suspected event would be a complex operation. It would consist of surveys of the area of the presumed nuclear explosion in order to measure ambient radioactivity and temperature anomalies, and to discover fresh craters, traces of vehicles, metal artifacts and other signs of activities associated with a nuclear test or preparations for it. Having identified the site of the sought underground cavity or rubble-filled chimney - a principal "residue" of a nuclear

[36] Conference on Disarmament document CD/756*.

underground explosion - the inspection team would have to establish whether or not an explosion had actually taken place.[37]

The sponsors of the 1991 draft Protocol of Amendment to the PTBT have suggested that the host State should transport the inspectors to the location of the inspection within 24 hours after their arrival at the point of entry, provide them with immediate and uninhibited access to the entire inspection area, and give them all the necessary logistic support. Inspectors should use their own equipment which may, however, be examined by the host country at the start of the inspection. The inspectors should be entitled to take photographs, collect samples of air, soil, water, flora and fauna, survey the area via helicopter, fixed-wing aircraft and terrestrial vehicles, as well as dig holes. They must have the right to bring their own communications equipment or rely upon that provided by the host State. The latter may designate personnel to accompany the inspectors during the performance of their duties. Inspections could be open to public and journalistic observation.

The 1991 Swedish draft treaty stipulates that the inspection team should begin its duties in the specified area not later than seven days after the receipt of a request for inspection. An inspection may last no more than seven days following the arrival of the inspection personnel at the point of entry in the territory of the State to be inspected. Inspectors must be selected on the basis of their competence, and the inspection team must not include a national of the party requesting the inspection. Without prejudice to the privileges and immunities, which they should be granted in accordance with the 1961 Vienna Convention on Diplomatic Relations, the inspecting personnel would be obligated to respect the laws and regulations of the State in the territory of which the inspection was conducted, in so far as such laws and regulations did not impede the exercise of the inspectors' rights provided for by the treaty. Detailed rules and procedures for on-site inspection would be laid down in an operational manual.

Effectiveness

Although the right to on-site inspection has played an important role in the test-ban negotiations, inspection does not seem to be a particularly useful means of checking compliance with a CTB. A small and well-hidden nuclear explosion might leave no surface evidence, whereas visually detectable indications of a breach would best be detected by satellite photo-reconnaissance. The determination of the precise location of the suspicious event is crucial, because the relevant data can be found only in the immediate vicinity of the event, and the only way to prove that an underground nuclear explosion had been conducted would be to drill a hole and find radioactive samples. However, the geographical area to be covered by a search for evidence of violation may well be very extensive. The 1983 and the 1991 Swedish drafts suggest

[37] For a detailed description of the techniques for on-site inspection, see W. Heckrotte, "On-Site Inspection to Check Compliance" (Chapter XII) in J Goldblat and D. Cox (eds.), *Nuclear Weapon Tests: Prohibition or Limitation?* (SIPRI, CIIPS, Oxford University Press, 1988).

that the area subject to inspection upon request must be continuous and not exceed 1000 square kilometres or a length of 50 kilometres in any direction.

For reasons of expense, time and effort involved, it would be impractical to have more than very few on-site inspections per year, whereas the number of un-identified events may be large. Moreover, in most cases, the evidence of a test ban violation collected during an on-site inspection would, in all probability, be no better than circumstantial. The principal burden for identifying un-explained events would lie with the seismic monitoring system.

On the other hand, on-site observation by foreign personnel of notified large-size chemical explosions for industrial purposes would be useful, and perhaps even indispensable, to avoid suspicions of breaches. The 1991 Swedish draft treaty requires a notification of any non-nuclear explosion with a yield exceeding 100 tons TNT equivalent, or of a group of explosions with an aggregate yield exceeding the same limit. The notification, to be given 60 days prior to such an event, should specify the time, location, purpose and yield of the explosion, and include a description of the event. Both the preparations for the explosion as well as the actual detonation would be monitored on the spot. The monitoring personnel should be allowed to take pictures and to make measurements of radioactivity in the vicinity of the explosion. It should be entitled to the same privileges and immunities as the personnel conducting on-site investigations of suspicious events. Non-nuclear explosions with a yield between 10 and 100 tons TNT equivalent would be subject only to notification to be given within seven days after the explosion.

Deterrence

An actual violator would probably not run the risk of discovery of his clandestine test by permitting on-site inspection. However, he may fear the consequences of his refusal, which could be politically costly. He may therefore be deterred from undertaking an illicit act by the mere "threat" of inspection.

Whatever the nature of the inspection whether voluntary or mandatory - co-operation between the parties would be essential in resolving doubts regarding compliance. The inspection team must, of course, be scientifically and technically self-sufficient, but it would unavoidably be dependent on the inspected party for transportation to the site, housing, subsistence or communications. Lack of co-operation on the part of the alleged violator may not necessarily amount to an admission of guilt, but an outright rejection of a request to investigate a suspicious event, whatever the justification, would exacerbate the suspicion and might warrant political action.

Yield Estimation

There exist three main techniques for measuring the yield of nuclear explosions: radio-chemical, hydro-dynamic and seismic.

Radio-Chemical

This technique is based on the analysis of the nuclear by-products of the explosion. Since it requires data about the weapon design that could reveal sensitive information concerning the characteristics of the weapon, it is deemed to be excessively intrusive for an international treaty.

Hydro-Dynamic

This technique, the US version of which is called CORRTEX (continuous reflectometry for radius versus time experiments), is used to measure the explosive yield at the site of the explosion. An underground nuclear explosion produces a shock wave that propagates radially outwards. Cables placed in the emplacement hole containing the nuclear device, or in one or more separately drilled "satellite" holes adjacent to the emplacement hole, are crushed by over-pressure and shortened as the shock wave expands. (The shock wave causes the surrounding rock to behave like a fluid - hence the term "hydro-dynamic".) A measuring instrument connected to the cable registers the rate at which the cable is short-circuited during the milliseconds it takes for the wave to reach the surface. The larger the explosion, the faster the wave travels, and an analysis of the wave expansion allows an estimation of the yield.[38]

The use of the hydro-dynamic measurement technique is envisaged in the 1990 Protocol to the TTBT to check compliance with the 150 kiloton-yield threshold. Under this Protocol, the verifying party may ask for a "reference" test when the verified party conducts a test having a "non-standard" vertical or horizontal configuration, that is, when the emplacement hole has a non-standard dimension and does not satisfy certain other conditions specified in the Protocol. The reference test is a particular test of standard configuration, with respect to which the hydro-dynamic measurement is used for the purpose of establishing a basis of comparison for the seismic measurement of that test and of the planned test of non-standard configuration. The CORRTEX technique is very costly.[39] It is also known to be effective mainly when applied to large explosions.

Seismic

For the reasons explained above, a VLTTB would have to rely mainly on seismic measurements. To establish a correlation between the yields of explosions at specific test sites and the seismic signals produced, the parties would have to know the exact location of the site and its geology. An extensive exchange of information would therefore be required, and on-site visits might be needed to confirm the correctness of the transmitted data. Foreign personnel visiting the test site could also look at the conditions of the nuclear charge emplacement to ensure that techniques to muffle seismic signals from nuclear explosions were not being resorted to. "Calibration"

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[38] US Department of Energy, Nevada Operations Office, CORRTEX (Los Alamos National Laboratory: Los Alamos, N. Mex., April 1986.)

[39] See US Costs of Verification and Compliance under Pending Arms Treaties, The Congress of the United States, Congressional Budget Office, Washington, D. C., 1990.

explosions could establish a direct seismic magnitude-explosive yield relation for the estimation of the size of future tests, especially if each side were allowed to detonate its own nuclear charge at the other side's site, and if the yield of the charge were close to the agreed threshold.

The most important role in the measuring of yields of tests allowed under a VLTTB would have to be allotted to in-country seismic stations. Each nuclear weapon party would have to have the right to determine the conditions and technical requirements for the installation and operation of its seismic equipment at the designated seismic stations on the territory of another nuclear weapon party. The personnel of the verifying party could be present at the stations to carry out the measurements, while the testing party would be under the obligation to provide logistical support.[40]

Institutions

Swedish Proposal of 1983

In its draft treaty of 1983, Sweden proposed that a consultative committee be established to oversee the functioning of the treaty, including its verification arrangements. The committee would also serve as a forum to discuss and resolve disputes between the parties. It would be chaired by the depositary of the treaty, and each party would have the right to be its member. It would meet once a year, or more often, if an extraordinary meeting were requested by a party, and would work on the basis of consensus in reviewing the over-all operation of the treaty and its verification, as well as in making changes in the equipment and technical procedures used to verify compliance. Decisions on the annual budget of the secretariat and on the election of the director and the deputy director of the secretariat would be taken by a majority of the members present and voting.

The consultative committee would establish a technical expert group as a subsidiary body open to governmental experts from all parties. The group's duty would be to evaluate the technical performance of the international verification measures, including the techniques and procedures for on-site inspections, propose changes in the verification equipment and procedures, and undertake technical studies at the request of the consultative committee. In making its decisions, the group would try to achieve consensus. In case consensus could not be achieved, the group would report to the consultative committee the views of all the participating experts.

A permanent secretariat would support the work of the consultative committee and of the technical expert group. In particular, it would organize and conduct international on-site inspections and report the results to the consultative committee. Lists of experts available for conducting on-site inspections and of the equipment necessary for such

[40] For a detailed discussion of the explosive yield estimation, see C. B., Archambeau, "Verification of a Very-Low-Yield Nuclear Test Ban" (Chapter XIV) in J. Goldblat and D. Cox (eds.), *Nuclear Weapon Tests: Prohibition or Limitation?* (SIPRI, CIIPS, Oxford University Press, 1988).

inspections would be maintained by the secretariat in co-operation with the parties to the treaty. The cost would be borne by the parties in accordance with the UN assessment scale, calculated so as to take account of the difference between UN membership and the number of parties to the treaty.

Non-Aligned Countries' Proposal of 1991

In their draft Protocol of Amendment to the PTBT, a group of non-aligned states proposed the establishment of an organization for the purpose of assisting in the verification of compliance with a CTB treaty. The principal organs of the organization would be the assembly and the secretariat.

The assembly, to be composed of all parties, would meet at least once a year, and whenever so requested by the secretary-general or by one-tenth of its membership. It would approve or modify the budget of the organization, establish the policies and practices of the organization, elect the secretary-general and create a technical committee. All decisions of the assembly would be taken by a majority of those voting, unless the assembly adopted a different standard by a majority of two-thirds.

The technical committee, to which each member of the assembly would have the right to designate a representative, would meet at least four times a year to review the technical operations of the secretariat, assess the secretariat's reports and make recommendations regarding possible revisions of the verification measures with a view to enhancing their effectiveness or reducing their cost. The committee would be organized into sub-committees, each of which would be responsible for one branch of the verification technology. The committee's recommendations would be submitted to the assembly which might approve, modify or reject them.

The secretariat would compile and maintain data gathered and received by the organization, and would submit an annual report to the assembly as well as periodic reports to the technical committee. It would set up sections responsible for the implementation of verification measures pertinent to the prohibition of nuclear explosions in various environments: in the atmosphere; in outer space; under water; and under ground. Each section would develop working descriptions of the phenomena which are observable by global monitoring networks, localized monitoring, on-site inspections or other means, and which are associated with nuclear explosions in each of the above specified environments, as well as working descriptions of the phenomena which are associated with natural and legitimate events or activities that might create ambiguity or uncertainty regarding treaty compliance. Each party would designate a competent national body to serve as liaison with the secretariat. The costs of the international organization would be borne by the parties, and the ratio of their contributions would be the same as that established by the annual assessment of UN dues, unless the assembly adopted a different schedule by a majority of two-thirds.

Swedish Proposal of 1991

In its draft treaty of 1991, Sweden proposed the establishment of an organization responsible for ensuring the implementation of the treaty. Following the example set

by the draft chemical weapons convention under discussion, the organization would consist of a conference of the parties, an executive council and a technical secretariat.

The conference - the principal organ of the organization - would oversee compliance with the treaty provisions. It would meet once a year, and its decisions would be taken by a simple majority on questions of procedure and by consensus on matters of substance. Should consensus prove impossible to achieve, decisions of the conference would be taken by a two-thirds majority of those present and voting.

The executive council would be composed of 25 parties elected by the conference for a period of two years in accordance with the principle of equitable political and geographical representation. Its task would be to facilitate consultations among the parties and to help resolve issues related to the treaty, in particular to its verification. The council would meet annually, or more often if necessary, and its decisions (on questions to be specified) would be taken by a simple majority. An advisory board of international experts would provide scientific expertise on verification measures, and would assist the executive council in assessing the value of new methods which may be suggested for verification of compliance.

The technical secretariat would be headed by a director-general appointed by the executive council for a four-year term. It would co-ordinate the arrangements for the exchange of data as well as the operations of the global seismological network and the network for global surveillance of radionuclides in the atmosphere; assist parties in using satellite observations to clarify dubious events; and compile, analyse and report on hydro-acoustic signals in the ocean and other data that may facilitate verification. It would also compile any supplementary information that a party may provide to help interpret a suspicious event which had occurred on its own territory. Such information could include observations from sensitive in-country seismological networks. Moreover, to ascertain the nature of a seismic event, the technical secretariat could conduct on-site inspections on invitation or on request. In addition, it would monitor non-nuclear explosions of an agreed size, and its co-operation with the national authorities of the parties is envisaged to resolve the uncertainties that may arise.

Broadly speaking, the institutional arrangements for a multilateral CTB, as proposed above, are patterned after the existing international institutions. However, controversies may be expected. One of them regards the composition of the central management authority, such as the executive council. Quite naturally, each country would defend those formulas which could make its participation in the management authority possible, and there would certainly be an opposition to the idea - favoured by some - of establishing two classes of membership - permanent and non-permanent. Another controversy may develop over the voting procedures in the multilateral treaty organization. The choice is between decisions taken by a majority - simple or qualified - and decisions taken unanimously or by consensus. The latter procedure is desirable to the extent that it may guarantee general observance of the adopted resolutions, but its rigid application would be tantamount to introducing the right of veto which could paralyse the operation of the organization.

It should be noted that a VLTTB may require a different organization, because it would be applicable only to the nuclear weapon States. Indeed, under the 1968 Non-Proliferation Treaty, most non-nuclear weapon countries have renounced the possession of nuclear weapons and, consequently, also the testing of nuclear explosives. The VLTTB organization could be similar to the joint bodies set up to implement the US-Soviet nuclear arms control treaties.[41]

Non-Compliance

The 1991 Swedish draft treaty imposes on the parties an obligation to adopt legislative and administrative measures necessary to implement the treaty. The 1972 Biological Weapons Convention contains a similar clause, but during the 16 years since its entry into force only a small number of parties have taken the required measures. There is no penalty for the non-fulfilment of this obligation.

According to the same Swedish draft, failure to co-operate in good faith in the process of verification may become the subject of consideration in the executive council and at the conference of the parties. The latter organ could act to remedy the situation, but the kind of action which it would be entitled to take has not been defined. The threat that a party refusing to reform itself would see its treaty rights and privileges suspended cannot carry a veritable dissuasive force, because the threat would apply mainly to participation in the activities of the verification organization.

Recourse to UN Security Council, as suggested in the Swedish draft, would not necessarily solve the problem of enforcement. The Security Council has no statutory duty to oversee compliance with arms control treaties, unless there is a threat to international peace and security. This may not be the case with each and every complaint of non-compliance with a test-ban treaty. The Council may, upon request, initiate an investigation of an alleged breach, but it is not obliged to do so. The great power veto was used to block not only substantive decisions, but even proposals for enquiry, whenever the interests of the permanent members of the Council or those of their allies were at stake. Moreover, since non-parties should not be called upon to judge the conduct of a party, a complainant may be reluctant to resort to the Security Council if not all its members have subscribed to the treaty. In any event, it is the organization of the parties, rather than an external international body, that should perform the function of compliance evaluation.

As regards possible responses to established violations, it would seem evident that the threat of abrogation cannot be a means of enforcing a multilateral test-ban treaty, because the collapse of the treaty may be detrimental not only to the violator, but also to other States. To be effective, the treaty would have to spell out steps, other than the withdrawal, that the parties would pledge themselves to take, both unilaterally and

[41] See, J. Goldblat, "The Nuclear Test-Limitation Treaties" in S. Sur (ed.), *Verification of Current Disarmament and Arms Limitation Agreements*, UNIDIR, 1991.

collectively, to induce a defaulting State promptly to redress the situation. The severity of these measures would have to depend on the gravity of the committed offence.

Confidence-Building

As with most arms control agreements, the implementation of a nuclear test ban could be facilitated if its verification procedures were complemented with measures enhancing confidence in compliance.[42] With regard to a CTB, such measures might include the following:

Routine visits to former nuclear test explosion sites in order to ensure that they remain inactive.

Demonstrated dismantlement and possibly destruction of the specialized equipment used in nuclear testing operations, as well as cessation of the production of such equipment. This could provide a re-assurance that the parties to a CTB have definitively renounced testing.

Demonstrated relocation to other jobs of key personnel directly engaged in nuclear testing. This would further reduce the likelihood of an open or secret resumption of test explosions.

Establishment of an open register of mines in hard rock and of underground caverns of a determined size, both natural and man-made, including those created by nuclear explosions for peaceful purposes. This would assist in monitoring the potential sites for clandestine decoupling of underground nuclear weapon tests.

Summary and Conclusion

An effective seismic system to monitor a CTB would have to consist of a global network of adequately distributed high-quality seismic stations as well as properly located networks of in-country seismic stations. It would also have to provide for mandatory observation of large industrial chemical explosions. Such a system, complemented with non-seismic methods of verification including, if necessary, on-site inspection and with confidence-building measures - such as described above - would certainly be trustworthy. A CTB would exclude all modernization of nuclear weapons.

Were a VLTTB to be accepted, the nuclear powers' ability to ensure the continued effectiveness of the important components of nuclear weapons would not be affected.[43] Nor would a VLTTB present an obstacle to improving, if necessary, the

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[42] For a discussion of this approach, see J. Leggett, "Recent Developments and Outlook for the Verification of a Nuclear Test Ban" in J. Altmann and J. Rotblat (Eds.), *Verification of Arms Reductions* (Springer-Verlag, Berlin, Heidelberg, New York, 1989).

[43] This would be especially applicable to the fission "triggers" setting off the fusion reaction of thermonuclear weapons, the reliability of which appears to be of some concern. Reliability tests are rare: between 1970 and 1988 only some three per cent of all US nuclear explosions were conducted to test for weapons defects (*The Defense Monitor*, Vol. XX, No.3, 1991). Some leading US and Soviet scientists are of the opinion that

safety of the deployed or stockpiled nuclear weapons.[44] Micro-explosions could be used to test the resistance of weapons to effects of nuclear explosions. However, a newly designed strategic warhead requires at least one full- or near-full-yield test explosion to be certified.[45] And since such a warhead has an explosive force of at least several tens of kilotons, its explosion would be impossible to conceal under a VLTTB.

A yield threshold set by a VLTTB may be too low even for the development of some tactical nuclear weapons, whereas clandestine testing of devices with a yield somewhat higher would hardly be expedient. The would-be violator would have to go to extreme lengths to evade the terms of a test ban treaty because each nuclear explosive test is an undertaking of major engineering proportions. He would run a serious political risk for little military gain, as the utility of tactical nuclear weapons is rapidly diminishing.

A VLTTB would go a long way towards curtailing the development of directed-energy weapons, often referred to as third-generation nuclear weapons (the first-generation being that of fission arms, and the second-generation -that of fusion arms). The development of the X-ray laser (code-named Excalibur), which has given rise to sharp controversies in recent years, would be especially constrained. And since none of the new weapon concepts is likely to be developed without a series of tests covering a wide range of parameters, strict limitations on numbers of the permitted tests would have important consequences for the entire third-generation weapon programme.[46]

To the extent that the prevention of further qualitative improvement of nuclear weapons constitutes an important rationale for a nuclear test ban, the arms control value of a VLTTB would not be negligible.[47] A VLTTB might become a decisive transitional step towards a CTB.

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explosive testing is not needed to check the reliability of stockpiled nuclear weapons. (See, for example, *Defense News*, January 1991.

[44] So far, there has been no accident in which a warhead has gone off with a significant nuclear yield. According to some experts, further improvements can be made without resort to explosive testing. According to others, the lingering uncertainty regarding the safety of certain types of nuclear warheads, would justify some further experimental explosions. However, even the latter do not advocate an indefinite continuation of testing. See, *The Bulletin of the Atomic Scientists*, April 1991 and June 1991. It is also noteworthy that during the 1958-1961 US-Soviet moratorium on nuclear weapon test explosions, the United States conducted nuclear experiments intended to prevent a nuclear explosion in case of an accidental detonation of the high explosive component of the weapon (the so-called one-point safety experiments). Since the nuclear yields were below one pound of high explosive equivalent, the US Administration did not consider these experiments to be nuclear weapon tests under the terms of the moratorium. (R. N. Thorn and D. R. Westervelt, *Hydronuclear Experiments*, La-10902-MS, UC-2, Los Alamos, New Mex., February 1987.)

[45] J. C. Mark, "The Purpose of Nuclear Test Explosions" (Chapter I) in J. Goldblat and D. Cox (eds.), *Nuclear Weapon Tests: Prohibition or Limitation?* (SIPRI, CIIPS, Oxford University Press, 1988).

[46] D. Fenstermacher, "Arms Race: The Next Generation" in *The Bulletin of the Atomic Scientists*, March 1991.

[47] According to the Washington Center for Defense Information, 85 per cent of all nuclear explosions are for purposes of developing new weapons. (*The Defense Monitor*, Vol. XX, No. 3, 1991.)

Under a CTB and, for that matter, also under a VLTTB, some tests may remain undetected, for there will always be a limit to the capability of a monitoring system. This means that there will always be a threshold below which testing could be carried out clandestinely. It will be the judgement of each State contemplating adherence to a test ban whether such a risk is acceptable, and whether, taking into account the efficacy of the verification methods, the significance of undetected violations will be outweighed by the political benefits of the ban. These considerations apply to both treaties.

Cut-off on Production of Fissionable Material for Weapons Purposes

Sheel Kant Sharma

A cut-off on the production of fissionable material for weapons purposes has been envisaged as a measure independent or as a part of a nuclear freeze for a long time. In fact, the idea of restraints on the production of fissionable material for weapons purposes has been on the agenda for multilateral deliberations in the field of nuclear disarmament since the 1940s. The USA had proposed it as a part of the Baruch Plan in 1946 and later on during the 1950s as an independent measure, but until the early 1980s the Soviet Union was opposed to it. It was at the SSODII in 1982 that the USSR welcomed the idea of a cut-off for the first time but only in the context of an initial stage of a programme for nuclear disarmament and not so much as a separate measure.

The purpose of the present paper is to analyse the problem of verification in case the idea of a cut-off on weapons-grade fissionable material was to be adopted in some form as a measure for cessation of the nuclear arms race and nuclear disarmament. There can be two approaches to seeking a cut-off on 'the fissionable material for weapons purposes', namely, (a) a cut-off on production of fissionable material for weapons use limited to all the declared nuclear weapon states and (b) a cut-off on production of fissionable material, which can be used for weapons purposes, by all countries, *i.e.*, a universal cut-off.

In the evolution[48] of proposals for a cut-off on the production of fissionable

[48] Since 1978 the General Assembly has had on its annual agenda the consideration of "the question of adequately verified cessation and prohibition of the production of fissionable material for nuclear weapons and other nuclear explosives devices". A resolution has been adopted every year on the subject. The USA initially used to vote in favour of this resolution, albeit, stating in its explanation that adequate verification was an essential factor in any consideration of the question of a cut-off and that the USA believed that verification would pose considerable difficulties. The UK, which has always abstained, stated in the explanation of its vote in 1980 that two essential prerequisites for any negotiations on a cut-off were lacking in the resolution. These prerequisites were that there should be an agreement by all the parties directly concerned and that there should be an agreement on a proper method of verification. The UK believed that "verification of a cut-off would present formidable difficulties which were likely to remain insuperable for the foreseeable future and, therefore, a cut-off could not in existing circumstances be regarded as a verifiable measure." (See the *UN Disarmament Year Book*, Vol. 5, 1980, p. 114-115).

material essentially a two-fold problem appears to have persisted, that is, the question of an appropriate scope of a production cut-off on fissile material as a measure for curbing the nuclear arms race and the formidable difficulties of verification with such a cut-off. A limited and partial cut-off might appear to be less difficult to verify than a fuller comprehensive ban. It is also argued by the protagonists for a universal ban on production of fissionable material for weapons purposes that the rationale for a cut-off on fissile materials production for weapons use and the rationale for a cut-off on production of nuclear weapons themselves need not be mutually exclusive or contradictory.

Listed below are the main elements of scope among the various versions which can be formulated of the cut-off proposal[49]:

1. A cut-off in the production of fissionable material for weapons purposes by two (USA and the Soviet Union) or more nuclear weapon states;
2. A cut-off similar to (i) above applicable to all countries;
3. A complete prohibition on the production of fissionable material for weapons purposes (which will imply closure of the facilities for production of fissionable material); and
4. A simultaneous total stoppage of any further production of weapons and a cut-off in the production of fissionable material for weapons purposes, applicable to nuclear-weapon states.[50]

No agreement has so far been in sight about any of the versions mentioned above. However, there have been unilateral decisions by the USA (in 1964) and USSR (in 1989) announcing a partial reduction or a halt in production of weapons-grade fissile material. The Soviet Union has also offered proposals in October 1991 envisaging effective constraints on fissionable material production by the USA and USSR, also, by all the other nuclear weapon states.

In all cases of the cut-off enumerated above the essential problem of verification would remain a difficult one to tackle. The difficulties would stem from two factors, namely, the continued production and use of weapons-grade fissile material for

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China has generally maintained a position of abstention/non-participation without any explanation of its stand. France used to abstain but since 1985 it has changed position to a negative vote. The USSR initially voted against the resolution insisting that the cut-off could not be separated from cessation of production of nuclear weapons. However, since 1984 the USSR has been voting in favour.

India, Argentina and Brazil have been abstaining on this resolution since the beginning but in 1990 Brazil switched its vote to a positive one. The overall voting on the resolution between 1980 and 1990 has evolved from 125-11-8 to 146-1-6. While explaining its abstention India has maintained that a cut-off on the production of fissionable material could not be separated from the cessation of the production of nuclear weapons and that only the combination of the two measures would ensure that all nuclear facilities would become peaceful facilities amenable to a single system of universal international safeguards without discrimination.

[49] William Lanouette, *The Bulletin of Atomic Scientists*, p. 42-45, December 1989. This article gives a brief history of cut-off proposals.

[50] The nuclear-freeze resolution tabled by India, Sweden, and Mexico, among others, at the annual UNGA Sessions for nearly a decade. The proposal was also contained in the Action Plan tabled by India at SSOD-III.

peaceful purposes in nuclear power reactors in the world and the availability of such fissile material through recycling the retired nuclear warheads. In the case of a universal cut-off, verification problems may continue so long as the envisaged regime for an international control on fissile material production remains divided (*i.e.* one set of rules for nuclear weapon states and a different set for the rest). Countries which acquire or produce fissile material for peaceful uses in power reactors etc. may not accept a ban on production of such material in the absence of a similar ban on production applicable to all nuclear weapon states. Besides, the existing stockpiles of weapons-grade fissionable material and the availability of such material[51] through recycling of warheads will inherently introduce a discriminatory situation. The problems of keeping track of the total national inventories of fissile material even after the imposition of a cut-off will vary from nation to nation. At the same time transparency will be crucial to the security perceptions of various states,which in turn would require correct quantitative assessment of national stocks of weapons-grade fissile materials of all states.

Normally, the fissile material[52] for weapons purposes could be obtained from the following sources:

1. Enrichment plants which raise the percentage of the odd-numbered uranium isotope in natural uranium to above 90%;
2. Reprocessing plants which separate the fissile plutonium isotope Pu-239 from the spent fuel of power reactors or reactors specifically dedicated to production of plutonium.
3. Recycling of fissile material from disassembled, retired or obsolete nuclear warheads.

Verification of a cut-off would require monitoring these sources of fissile material to ensure that production has ceased for weapons purposes.

At present these plants and facilities remain outside the domain of international monitoring. Nations do not provide full figures and inspections are confined to a limited category of plants. As a result, the information about total quantity of fissile material under any of the above three categories is at best a rough estimate derived from plant capacities,Separation Work Units(swu's) etc., rather than hard statistics about production. Although there are safeguarded reactors in practically all significant users of nuclear power, it is difficult to estimate accurately the amount of fissile material produced and stockpiled by each and every country. Compliance with a cut-off

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[51] This question was addressed by India in a paper submitted before the SSOD-III devoted to disposal for peaceful purposes of the fissile material released from the nuclear warheads of the INF missiles.

[52] Frank Von Hippel and Barbara G. Levi, "Controlling Nuclear Weapons at the Source: Verification of a Cut-off in the Production of Plutonium and Highly Enriched Uranium for Nuclear Weapons" in *Arms Control Verification*, edited by Kosta Tsipis, David W. Hafemeister and Penny Janeway. Since 1964 and until the mid-eighties, the US did not add any highly enriched uranium to its nuclear weapon stockpiles and all weapons-grade uranium used in new US warheads came from the old stockpiles or recycling the retired weapons.

will require verification of the estimated stockpiles to ensure that there is no augmentation.

There is no existing international agreement at present which may cover any aspect of a production cut-off of weapons-grade fissionable material. The Non-Proliferation Treaty has perhaps a distant connection. Under article III, the NPT requires safeguards on production of fissionable material so as to prevent diversion for nuclear weapons or nuclear explosives devices. Strictly speaking, a non-nuclear weapon state which is party to the NPT could continue to produce and stockpile weapons-grade fissionable material provided that all of its facilities remain under the required safeguards. It would have to provide adequate explanation about the likelyhood of the peaceful use of such material. Acceptance of such explanations based on available facts will remain in the grey area of national judgement. What is provided for in the NPT is a measure of transparency and openness about the possession of fissionable material by the non-nuclear weapon states.

Such transparency, however, is not presently enforceable under the NPT in the case of nuclear weapon states. Going by the present international estimates of the total quantity of fissile material for weapons purposes, the amount possessed by nuclear weapon states is likely to be of a greater magnitude than what could be possessed by a non-nuclear weapon state. There is also the question of fissile material transfer for weapons purposes between two states, a subject which has been only partially addressed by the NPT. In some countries domestic federal legislation prohibits transfer of fissionable material from civilian facilities to weapons production.

For verifying a cut-off, a method will have to be devised for making a distinction between fissile material for weapons use and peaceful uses. For example, the level of Uranium enrichment below a certain percentage may not qualify for weapons use and Pu-239 with more than a certain percentage (6.6%) of the Pu-240 isotope might also not normally fulfil the conditions for explosive nuclear fission for weapons use. Verification requirements would consist of the ability and capacity of an international agency for the detection of the exact level of Uranium enrichment that a country is actually capable of, the inspection and analysis of the reprocessing plants to see the composition of plutonium separated from the spent fuel, monitoring the inventories of fissile material and assessing, through inspection or otherwise, the entire range of technology and special nuclear material like Tritium[53] and Beryllium at the disposal

[53] A recent report in the Washington Post of 25 February, 1991 refers to a study by the General Accounting Office of the US Congress which concludes that the US Energy Department has enough Tritium to service its nuclear weapons production requirements in the foreseeable future. This report comes after considerable internal debate on the proposed construction of a new reactor for Tritium production in the USA. The so-called cold-fusion experiment reported in the spring of 1989 by the University of Utah has been followed by many countries to confirm whether the electrolysis of heavy water did produce nuclear fusion. While the "fusion claim" has been denied by subsequent scientific opinion, doubts remain whether Tritium could be produced by that process. If so, production of Tritium would be virtually impossible to detect.

of a particular country to facilitate the weapons-usability[54] of the fissile material at its disposal.

In view of the above considerations it is preferable to situate the entire question of controls on fissionable material for weapons purposes in the context of the elimination of nuclear weapons themselves. The idea of the abolition of nuclear weapons has figured in disarmament proposals from time to time. For instance, proposals for the elimination of nuclear weapons in a time-bound framework have been made by the Soviet Union and India. There was reference to elimination of nuclear weapons at the Reykjavik Summit between the Soviet Union and the USA. The Final Document of the SSOD-I specified the stages of elimination of nuclear weapons in paragraph 50.

In the Action Plan tabled by India at the SSOD-III, there was a proposal about supervision and control by the IAEA on the fissionable material released from warheads of the medium range missiles in Europe eliminated by the INF Treaty. The Indian proposal also stressed in this context the significance of a nuclear weapons freeze and a simultaneous cut-off in the production of fissile material for weapons purposes. A number of commentators[55] have sought a focus on the fissionable material for weapons use in the overall context of the abolition of nuclear weapons. The requirement of adequate control on fissionable material arises in the context of the abolition because any undetected cheating by a country while eliminating nuclear weapons can cause a very serious security concern for all other states parties.

Guided by the present experience with the chemical weapons negotiations and the stupendous scale of the verification appurtenances of a global CW Convention, one can visualise the full dimension of the problem of verification if and when the elimination of nuclear weapons will be on the table. The process of nuclear weapons reduction and cessation of further production is not sufficient to guarantee enough confidence so long as fissionable material remains at the disposal of countries. It becomes evident that without a stage-by-stage and progressive restraint on the fissionable material useable for weapons purposes, there can be no realistic programme for the abolition of nuclear weapons; the reverse too would be a valid proposition.

The first and most crucial point about restraints on fissile material for weapons use is the imperative need for international cooperative measures as a means of verification. The very route to tackle the nuclear menace through restraints on fissile material ought to be visualised in an almost revolutionary perspective. By far, the best way to tackle the problem would be to place all weapons-grade fissile material under international control. The international authority to exercise this control will have to

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[54] David Albright and Mark Hibbs, *The Bulletin of the Atomic Scientists*, March 1991. The authors have quoted Theodore Taylor, former nuclear weapon designer, "The minimum amount of material necessary to make a militarily significant bomb is in principle unanswerable. But in practice, there are well-defined quantities of nuclear material that have been used in various devices, but these quantities are secret."

[55] E.g. Theodore B. Taylor, "Why not now" in *The Bulletin of the Atomic Scientists*, July-August 1989 and further discussion under the column, "counterpoint" with Sidney D. Drell in *The Bulletin of the Atomic Scientists*, December 1989.

be vested in a treaty-specific, specialised agency based on equitable, multilateral participation without discrimination, created under the UN system. The basic rationale for such global control flows from the dual-use potential of such fissile material and the principle that peaceful use options available to all nations should not be constrained.

On the practical side, the operation of such international control can be effected through as many international centres as could be feasible or advisable. Nations must place all their weapons-grade fissile material at the disposal of the specialised international agency at any centre; each nation shall have the unrestrained right to withdraw its fissile material for peaceful use. Further safeguards can be built into this system depending upon the restraints to be placed on the weapons-grade fissile material. In this setting, the fissile material released from disassembled warheads should also be brought under international control. As a parallel programme of nuclear disarmament progresses, the controls on fissile material can be made more intensive and wide ranging. Quite obviously a simultaneous process of systematic reduction and elimination of nuclear weapons should make the inescapable underpinnings of this arrangement.

The cut-off on fissile material has been revived during the past decade mainly in the context of the US-Soviet dialogue[56] on strategic arms reduction and other measures on nuclear disarmament (like SNF reduction or elimination). Moreover, acute concern has been mounting steadily about the environmental impact and safety of the nuclear reactors deployed or dedicated for production of weapons-grade fissile material. As authors Frank Von Hippel and Barbara G. Levy have stated in a comprehensive article on this subject[57],

> The recent resurgence of public concern about the nuclear arms race makes a fissile production cut-off especially timely; it could be part of a larger package of mutually reinforcing nuclear arms control and disarmament proposals. For example, because a "freeze" on the superpower nuclear weapons stockpiles would mean the end of requirements for new nuclear weapons materials, a cutoff on the production of fissile materials for nuclear weapons would be an ingredient of such a freeze and would increase its verifiability. Similarly, a fissile cutoff would be an essential part of any comprehensive agreement to reduce the superpower nuclear warhead stockpiles, since such an agreement, to be meaningful, would require assurances that new warheads were not being produced.

In the bilateral context of US-Soviet nuclear disarmament, a cut-off on production of fissionable material has been considered adequately verifiable by these authors if[58],

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[56] *Federation of American Scientists Public Interest Report*, November 1989, Chapter 1a. entitled, "Halting the Production of Plutonium and Highly Enriched Uranium".

[57] Tsipis, Hafemeister and Janeway, eds., *Arms Control Verification*, Pergamon-Brassey's, 1986, p. 369-388. Contains three articles respectively by Weinstock and Fainberg, Robert Keepin and Von Hippel and G. Levi discussing what the editors describe, "the technology and methodology of monitoring nuclear materials in civilian installations .....".

[58] Von Hippel and G. Levy, *op. cited.* These authors have discussed the bilateral cut-off in great detail providing solutions to specific problems. Their ideas can be useful in a larger context also.

"it were possible to detect with a reasonable probability the clandestine production or diversion of an amount of fissile material greater than 10% of the current US stockpiles over a period of 10 years." This figure amounts to roughly six metric tons per year of weapons grade uranium or one metric ton per year of plutonium. However, seen from a global perspective the absolute impact of these figures can be enormous; especially while envisaging multilateralisation of a bilateral US-Soviet cut-off.

A parallel to this situation can be drawn in the scenarios for multilateral nuclear arms reduction. Considering absolute numbers, as much as 90% reduction by the two leading nuclear weapon states has been advanced as a necessary prelude to the participation by others in the process. The problems in case of multilateralisation of a fissile material cut-off will be far more complex. The complexity stems from deep and extensive disparities in the national stockpiles of fissile material, the wide range of technical capacities for reprocessing and enrichment available with various countries for production of fissile material, the huge consumption of fissile material in the civilian nuclear fuel cycles of the developed countries in particular, and the very limited success so far in developing technical options to create two distinct categories of fissile materials for civilian and military use.

A number of ideas have also been suggested to cope with these issues. These ideas are discussed below.[59] It has to be borne in mind that generally it is difficult to regulate the operation and development of international nuclear power industry according to a priori stipulations.

The IAEA Safeguards

The IAEA is increasingly using safeguard instruments for non-destructive analysis and containment and surveillance devices. These devices keep track of the flow of nuclear material in plants by automatic cameras and video recorders that run for several months and take pictures at short intervals. The aim is to carry out material balance accountancy to detect diversion for weapons use. The IAEA Director General has stated that, "the Agency would have the ability to verify that no use is made for weapons purposes of any nuclear facility or fissionable material submitted to its safeguards" given adequate resources. It has been suggested that extending the IAEA safeguards to cover all fissile material production plants can verify restraints on this material against weapons use. However, IAEA has not indicated so far whether it would be able to cover even the weapons related facilities for fissile material production in the nuclear weapon states.

Reprocessing Plants

It has been suggested[60] that constraints be placed on the operation and materials of fuel cycles in power reactors (*e.g.* by prescribing low-enriched uranium, regulating

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[59] Gordon Thompson, "Treaty a Useful Relic", *The Bulletin of Atomic Scientists*, July/August 1990. The author suggested a set of elements of a programme, "addressing vertical, horizontal and latent proliferation." See also footnotes 9 and 10.

[60] See footnote 58.

the burn-up etc.)so that the plutonium in the spent fuel is mixed with other isotopes apart from Pu-239, rendering simple chemical reprocessing inadequate for weapons use. In this way the need to have control on spent fuel would appear to be minimised. Such a measure, in principle, can be taken unilaterally by the suppliers on the basis of technical feasibility without necessarily awaiting a formal treaty.

Enriched Uranium

There could be technical constraints on production of enriched uranium for civilian reactors to ensure that the percentage of U-235 is kept sufficiently low to rule out the incentive for diversion of fresh fuel for weapons purposes. This would require safeguards specially developed for monitoring enrichment facilities. Measures along this line can be contemplated without any treaty specificity.

The proposals based on the above ideas will also have to address the problems that flow from research reactors utilising highly enriched uranium, the gas-cooled graphite reactors and naval propulsion reactors which are fuelled by uranium enriched over 90%. As these would be considered legitimate uses, no nation can, in principle, be denied aspirations for possessing the appropriate technology and fissile material.

There is also the connected issue of breeder reactors which had been advanced as a permanent solution to the problem of nuclear fuel supply. These reactors use plutonium as fuel and also produce plutonium as waste which can be recycled as fuel. Research on breeder reactors has been carried out in a number of countries. Several research or demonstration reactors and one power reactor are operational although recent indications have tended to play down the utility of breeder reactors vis-a-vis the others. Breeder reactors would justify holding plutonium stocks and its continued production for peaceful uses. Nations that have devoted funds to a breeder programme may not accept a cut-off on plutonium production. While it is true that without the breeder option the problem of international controls on Plutonium might be simpler, this alone may not be sufficient to persuade countries that have launched a systematic R&D programme for breeder technology.

The cut-off on fissile material production would require inspections and monitoring of Uranium enrichment plants, fuel reprocessing plants and possibly eventually nuclear weapon factories where existing stockpiles were located. Enrichment units based on gaseous diffusion and gas centrifuge[61] are much larger in size, and are therefore difficult to conceal through monitoring Inspection will not be easy. But a bigger problem pertains to the laser separation of isotopes since laser enrichment units may accommodate miniaturisation to considerable extent, thus proving difficult to detect. According to the 1990 SIPRI Year Book[62], "laser enrichment plants need less Uranium for processing and can be smaller still, which would contribute to the

[61] Von Hippel and G. Levi reference cited above in (5), p. 358-382, for a discussion of possible measures.

[62] Richard Kokoski, "Laser Isotope Seaparation: Technological Developments and Political Implications", *SIPRI Year Book 1990*, p. 587-601.

difficulty in detecting and monitoring them" and that "a primary and increasing concern regarding the proliferation of nuclear weapons capabilities is the possible construction of clandestine laser enrichment facilities." Therefore, a system of safeguards would need to be devised to cope with the problem posed by laser enrichment. Such a system would have to address, inter alia, the question of guarantees against construction of small clandestine heavily enriched uranium (HEU) production facilities.

Conclusions

A treaty-specific approach to the problem of control on fissionable material for weapons purposes may require a very elaborate regime for verification coupled with ad hoc prescriptions to remove intractable problems like the breeder reactor or nuclear-powered vessels or spacecraft. If the objective of controls/restraints on fissionable material production are not clearly spelt out, nations may find it cumbersome to undertake obligations over and above the standard safeguards being applied by the IAEA. As it is difficult to envisage revolutionary changes in the prevelant nuclear fuel cycle, a complete prohibition on fissionable material production would appear to be unrealistic. (Because it would amount to closing down the enrichment and reprocessing plants). On the other hand, openness in the international transfer of sensitive nuclear materials and technology may, in turn, engender greater transparency about national fuel cycles and vice versa.

It may be pragmatic to work for progressively greater transparency about production and possession of fissile material for weapons use. Such a process can be helped by careful avoidance of ad hoc, discriminatory procedures so as to build adequate confidence among nations. It would be preferable to keep an open mind about the growth of civilian nuclear power industry as its evolution is likely to be guided by considerations entirely unrelated to disarmament; *e.g.*, search for sustained energy sources,environmental safety etc. It is not possible to prescribe regulations for civilian nuclear power production.

Exemplary impact could be made on the international situation by the adoption of reasonable and adequately verifiable restraints by the leading nuclear weapons states. In particular, acceptance of international control on fissiie material released from disassembled nuclear warheads would also make a far-reaching confidence building measure. Such a measure will not suffer from verification problems as the on-going process of nuclear disarmament has already shown unprecedented mutual accord for building up transparency.

The most important factor consists of the realisation that adequately verifiable controls on fissile material hold the key to the elimination of nuclear weapons. Therefore, the establishment of a link between progressive international controls on fissile material and a time-bound commitment to abolish nuclear weapons would seem unavoidable for putting a systematic regime into force. While the overall objectives of non-proliferation might be served by progressive controls on fissionable material, the

process may suffer from the same problems as the NPT, if pursued in isolation from a systematic programme for nuclear arms reduction.

Verification of a Ban on the Use of Nuclear Weapons

Sheel Kant Sharma

A ban on the use of nuclear weapons is essentially a preventive measure. Its verification requirements are directly related to existing nuclear weapons stockpiles, the targetting and deployment of these weapons, the strategic posture about their use and the C^3I system. So long as nuclear weapons remain with nation states, measures will have to be undertaken by those concerned to prevent their accidental use or to rule out the possibility of nuclear weapons going into unauthorised possession. The detailed procedures in force in the nuclear weapon states to achieve these aims would be equally applicable for preventing the use of nuclear weapons.

An agreement on non-use of nuclear weapons would comprise of, inter alia, an agreed set of such procedures which in turn can be verified internationally through a high level consultative machinery. The procedures already arrived at in the context of the US-Soviet bilateral agreements on INF, START, nuclear risk reduction etc., can provide guidelines in this regard. These agreements have also increased transparency among the nuclear weapon states about each other's strategic intentions inasmuch as nuclear force deployments go.To inspire further confidence in each other's intentions, there should be common commitment to rule out dangerous policies such as launch-on-warning.

The latest measures announced by the USA and the Soviet Union about lowering the state of alert of their nuclear forces would, in effect, rule out the launch- on-warning scenarios.There would be time available for mutual consultations if either side anticipated a threat.These measures contribute to reducing the advantage which could be gained by either side through a first strike, and to that extent, signify some progress towards a no-first-use of nuclear weapons.

In essence, the entire paraphernalia of the structures brought into being by carring out a strategy based on deterrence is practically indistinguishable from what would be required to put a ban on the use of nuclear weapons into effect. The only difference is in political intention (including the intention to cheat) which can only be resolved through CBMs and binding international agreements. In this sense the verifiability of a prohibition on the use of nuclear weapons would appear to be coterminous with the problem of political readiness to adopt such a measure.

A recent article in the Scientific American[63] makes a brief observation in this context,

[63] Bruce G. Blair and Henry W. Kendall, "Accidental Nuclear War", *Scientific American*, December 1990.

> Both US and Soviet nuclear commanders face an unavoidable dilemma: they must exert negative control for nuclear weapons to prevent unwanted use, but they must exert positive control to ensure that weapons are used when duly authorised. Measures that reduce the chance of unwanted launch may increase the chance that legitimate launch orders will not be carried out. Military commanders have thus resisted improved safeguards on the grounds that those safeguards would weaken nuclear deterrence.

It can be argued that the prohibition on the use of these weapons can help in removing such a dilemma and the negative controls which fortunately have held to date, can be continued forever, providing for compliance with a ban on use; it being realised that no verification procedures can provide 100% guarantee against the intention to cheat. But so long as nuclear weapons remain the risks involved in cheating may far outweigh the advantages.

One commentator has brought up the idea of international control on nuclear weapons which was discussed in the nineteen fifties.At that time a proposal was mooted of placing the control of nuclear weapons belonging to all the nuclear powers in the hands of the UN Security Council without a veto. Such ideas pertain to coping with the inherent dangers that flow from nuclear weapon stockpiles and can be applicable in a long term perspective to effectively prevent the use of these weapons.

It is important to realise that a prohibition on the use of nuclear weapons is a measure of extreme international sensitivity and will be a symbol of a very high level of international responsibility. It would provide the ideal setting for an increasing role for a body like Security Council to ward off unlawful behavior. It is possible to envisage complete international control on the entire nuclear fuel cycles of nations if all nuclear weapon states accept international legal obligations not to use nuclear weapons. The cost of the verification machinery for this whole set-up is likely to be a small fraction of the present expenditure on nuclear weapons. Over time this expenditure would also reduce considerably.

START Verification: A Step Towards Transparent Restraint

Serguei Kislyak

The recently-concluded Soviet-American Treaty on the reduction and limitation of strategic offensive armaments is bound to go down in history as one of the most significant achievements of the collective search for increased security. Leaving an in-depth analysis of the military/strategic core of the agreements and the envisaged reductions in offensive strategic capabilities of the USSR and the USA to other scholars, I will examine the set of provisions assumed by both countries, dealing with their very delicate part - namely, assuring compliance with the obligations. One would not exaggerate to say that the verification clauses of the agreement are part and parcel of what makes START a remarkable achievement. They deserve special consideration, particularly in light of the amount of traditional mistrust they will help to overcome,

as well as the important precedents they established for future arms control negotiations. The verification efforts to which the sides have agreed would have been viewed as unrealistic in the not-so-distant past. The degree of resultant transparency in their activities in the field of strategic arms would have been considered something hardly acceptable, due to the mistrust and secrecy that prevailed for years in the relations between the two superpowers.

Immediately after its signing, the START Treaty was hailed by a number of observers as a historic watershed, marking the end of the Cold War strategic arms race between the two Superpowers and the beginning of practical and daring - if not highly radical - reductions in their most potent capabilities to annihilate not only each other, but the rest of the world as well. Indeed, various types of weapons subject to the treaty limitations will be reduced by 25% to 50%, leading to a 42% reduction in the "attributable" number of warheads in their most sensitive area - the strategic realm. There are also those who criticize this treaty for being "short" of what had been expected in terms of potential reductions when negotiations started a little under a decade ago. The so-called "attribution" or "counting" rules (the number of warheads "attributed", for the purposes of this treaty, to various delivery systems) also come under critics' scrutiny - for instance, as physically allowing for the development of more nuclear charges on strategic systems than is fixed in terms of the counting rules of the treaty.

Admittedly, the START Treaty might look to some as something less than perfect. At the same time, the remarkable importance of the envisioned reductions in the context of assuring strategic stability can hardly be contested.

Verification provisions might also be subject to criticism for allegedly not being completely "airtight". In fact, there are already dissatisfactions expressed by experts and commentators, who have called the verification regime "something short of omnipresent", with "insufficiently high" quota limitations on the on-site inspection of mobile ICBMs, etc. Moreover, the two sides' inability to come up with mutually-acceptable verification solutions contributed to such an important issue as the Sea-Launched Cruise Missiles' being treated at the level of politically-binding statements, rather than in the form of specific limitations within the Treaty itself.

Meanwhile, one can safely argue that START, a sophisticated balance of various factors and considerations, is a reflection of what is technically feasible, militarily sound, and politically prudent and warranted. All of these seem to hold true for the verification side of the agreement as well, which is by far the most sophisticated, complex, and demanding in the history of arms control and disarmament.

At first glance, START does not seem revelatory, in terms of its basic verification approaches. The sides will rely on a variety of techniques available to them, "assembling the pieces of the puzzle", so to speak, in order to have a clear and stable picture of the compliance behaviour of the other contracting party. Both will obviously employ the so-called National Technical Means (NTM) at their disposal, as well as On-Site Inspections (OSI) and continuous "portal and perimeter" monitoring. They will also make use of a number of co-operative measures designed to make verification

easier, and, at times, simply feasible. In essence, we have seen the majority of them in the implementation of the INF Treaty. They worked then, and it may be expected that, with the new degree of sophistication and a number of added procedures, they will constitute a fairly solid basis for the verification of the reductions in strategic arms.

The monitoring and verification tasks presented by the agreement are manifold. They include checking compliance with quantitative reductions of several kinds of weapons, various deployment arrangements, the aggregate throw-weight of ballistic missiles, numbers of warheads on missiles, and numbers of heavy bombers that can carry air-launched cruise missiles or even those that are not equipped for that type of weapon. As opposed to the INF Treaty, the new agreement - on strategic weapons - has at least one major distinction that gives a whole new dimension to the associated verification efforts. Whereas in the INF specific weapons were subject to complete elimination, in START they are to be quantitatively reduced and constrained within some qualitative parameters. Accordingly, the sides will have to check *inter alia* the numbers and occasionally the qualitative limits of the weapons remaining after reductions - which is obviously a much more difficult task than would be their complete removal. The mobility factor particularly that of the ICBMs - only adds to the complexity of the verification tasks. These "mobiles" are specifically designed to be less traceable by the other side, and thus more survivable. It is clear that any agreement to limit their numbers would require a very delicate compromise to overcome the apparent and perhaps inherent contradiction between mobility and verifiability. The START verification formula for mobile ICBMs may represent one of the more innovative verification solutions we have yet seen.

Basically, according to the Treaty, the sides will reduce the aggregate number of deployed ICBMs, SLBMs and heavy bombers to 1,600, and will reduce to 6,000 the warheads attributed to these weapons. The latter number includes 4,900 for ICBMs and SLBMs, 1,100 for mobile ICBMs, and 1,540 for warheads attributed to deployed heavy ICBMs. Practically, that means that the Soviet Union will have to eliminate 900 of these vehicles, which constitutes a reduction of about 36% of what it has now. Among them, 154 heavy ICBMs they exist only in the Soviet arsenal - will be eliminated (50% of their current number). The US will get rid of 622 of their respective weapons (28% of their current arsenal). The aggregate number of warheads, according to the agreed attribution rules, will be reduced by 4,271 on the Soviet side and 4,371 by the Americans. The total throw-weight of the ICBMs and SLBMs will be limited to 3,600 tons for each side. Limitations on non-deployed ballistic missiles, including their storage, are introduced by the Treaty.

According to Soviet Ministry of Defense estimates, the reductions envisaged by either side (in practice, they would have some room to manoeuvre, since particular categories merely demand reductions to below the agreed ceilings) might look as follows:[64]

[64] "This Is A Balanced Treaty", *Izvestia* Newspaper, 8 January 1991.

	Existing number	*Number to be reduced*
	USSR	
ICBMs	1,398	≈400 (30%)
SLBMs	940	≈500 (50%)
Bombers	162	- -
Total	2,500	900 (36%)
Attributed warheads	10,271	4,271 (≈42%)
	US	
ICBMs	1,000	≈250 (25%)
SLBMs	648	≈200 (30%)
Bombers	574	≈200 (35%)
Total	2,222	622 (28%)
Attributed warheads	10,371	4,371 (42%)

These reductions will be accomplished in three stages during the first seven of the fifteen years the Treaty is, at minimum, intended to last.

Apart from numerical limitations, the Treaty includes a number of qualitative limits to repress a potential redirection of the strategic arms competition. In particular, a set of steps is envisioned that will curtail the introduction of new kinds of strategic offensive weapons, as evidenced by a provision for the resolution of related issues in a Joint Compliance and Inspection Commission, which is being created under the Treaty. Several kinds of "new" systems - or their flight tests and deployment - are specifically prohibited by the already-existent Treaty, which concerns air-based ballistic missiles, nuclear-tipped MIRVed ALCMs, and "heavy" mobile ICBMs or SLBMs. There is also a prohibition on the flight tests and the deployment of new kinds of heavy ICBMs (although it does not prohibit modernization of the existing ones). Ballistic missiles on any vessels other than submarines have been banned, and the number of warheads placed on ballistic missiles has been limited to 10.

This array of limitation measures, as well as the envisaged measures for eliminating or otherwise disposing of weapons systems, required, of course, a comprehensive set of verification arrangements, which resulted in a number of related provisions within the Treaty itself as well as a host of protocols attached to the Treaty. They cover the specific rights and obligations of both sides, as well as the extremely detailed agreement concerning the ways in which those rights are to be implemented. A comprehensive discussion of these provisions would extend far beyond the limits of this essay. Suffice it to say that those documents constitute a volume of over 500 pages and cover a great number of specific issues, ranging from the procedures for checking the numbers and types of missiles or their warheads to establishing the rights of inspectors and the kinds of compasses and rulers they are allowed to use.

Fundamentally, any verification regime, especially in the field of strategic armaments, must spring from the monitoring of the other side's weapon systems with the help of National Technical Means - which, naturally, are to be used according to the principles of international law.

Both sides have been using NTMs for years, both for monitoring military activities and for the verification of previous arms control agreements, like SALT and INF. The precise capabilities in this area have always been treated by each government as an extremely sensitive matter and were virtually never discussed by them in detail or in open sources. It is generally understood, however, that the sides rely primarily in this context on their space assets, which includes a wide range of imaging, signal intercept, early warning, and other satellites, as well as related ground-based and other systems. Given the extremely high resolution of the basic monitoring systems in the field of arms control like those based on the imaging technique, for instance it is generally assumed that they are adequate for detailed descriptions of major treaty-related items.

Constellations of the various types of satellites available to each side are believed to be able to meet the monitoring challenges posed by the Treaty.[65] That is not to say that NTMs can, for the purposes of the Treaty, do the verification job alone. Basically, they ensure the capability to see delivery systems - but there is no reliable guarantee of tracing them, especially if they are mobile or are concealed by the other side, let alone counting the numbers of warheads on missiles.

Based *inter alia* on the INF precedent, a comprehensive verification approach was developed for the purposes of START. The NTMs will be complemented by a variety of on-site inspections, continuous monitoring, notifications and other "co-operative" measures. The idea behind it is basically to afford each side a clear and continuous view of the state of the other's strategic offensive arsenal.

In the Memorandum of Understanding, the two sides indicate in particular data for the bases where treaty-limited systems are housed. All data concerning the implementation of the obligations, including all changes in the numbers of these weapons or their redeployments to other bases, will also be subject to notification of the other side.

There will be an early exchange of visits to confirm the technical characteristics of the respective strategic offensive systems of each side. These "exhibitions", utilizing both NTMs and OSIs, are expected to facilitate the verification process.

There will also be a host of inspections and "continuous monitoring activities", as provided for in the Treaty itself, in the Inspection Protocol, and in the Conversion or Elimination Protocol. The verification package includes various types of inspections and together with the information collected with the assistance of the NTMs - seems to cover every major phase of the "life cycle" of strategic offensive weapons during

[65] "Verification Technologies. Measures for Monitoring Compliance with the START Treaty", Summary-Congress of the United States, Office of Technology Assessment, December 1990.

the life-span of the Treaty itself. The inspection package - a number of these measures are to be conducted on a short (16 hours) notice basis - includes:

- baseline inspections to confirm the accuracy of data on the Treaty-limited items the sides agreed to exchange (short notice);
- data updating inspections (short notice);
- new facility inspections, to confirm data which is to be provided to the other side if new facilities are created in the future (short notice);
- suspect-site inspections should concerns develop over compliance by the other side (short notice);
- reentry vehicle inspections of deployed ICBMs and SLBMs (short notice);
- post-exercise dispersal inspections of deployed mobile launchers of ICBMs and associated missiles, to confirm that the numbers of these systems after the completion of dispersal do not exceed those specified for a particular ICBM base (short notice);
- inspections to confirm the conversion or elimination of strategic offensive arms;
- close-out inspections to confirm the elimination of facilities;
- formerly-declared facility inspections (to confirm that they are not being used for purposes inconsistent with the Treaty - also short notice inspections);
- in the course of exhibitions of heavy bombers conducted by each party, the other side will have the right to inspect the types and numbers of armaments for which the aircraft are equipped;
- each party will also have the right to conduct continuous monitoring at a number of facilities associated with the production of mobile ICBMs.

An important component of the verification package is a set of measures based on pronounced "co-operative" approaches. The Treaty language itself explicitly refers to co-operative measures primarily within the provisions stipulating the obligation to openly display - on the request of the other side - mobile ICBMs and aircraft. They are to be displayed (within bases, indicated by the other side) without any means of concealment that would allow their observation with the help of satellites. In the meantime, solutions, which are "co-operative" by their very nature, clearly extend far beyond this particular clause.

An agreement not to engage in any practice that denies full access to telemetric information broadcast during flight tests of ballistic missiles, including the use of encryption or jamming, would certainly be another case in point. That measure is particularly designed to help confirm compliance with the Treaty provisions related to the number of warheads on ballistic missiles and their throw-weight, as well as to define whether a missile being tested is or is not a new kind of ICBM or SLBM.

To help ensure compliance, the two sides also agreed to introduce a number of operational restrictions, which have been hotly contested over years of negotiations.

For example, the problem of the verification of mobile missiles was resolved by the introduction of the "restricted-deployment area" approach. As an illustration, suppose that ground-mobile ICBMs are to be deployed in restricted areas not exceeding five square kilometres each. Every such area, then, would contain no more than ten launchers and associated missiles and the same number of fixed structures for these systems. In turn, the restricted areas would be located in a deployment area not exceeding 125,000 square kilometres. This approach still provides both sides enough operational flexibility to assure required survivability for the mobile ICBMs, thereby also providing for the verification of the number of missiles which are supposed to be in those fixed areas only. Granted, there might be instances when missiles - for one reason or another - turn up outside those fixed areas (for example, when they are in transit). However, the envisaged procedures, which include an elaborate set of notifications that the two sides agreed to exchange, should ensure that all "legitimate" weapons systems are accounted for. Consequently, other mobile launchers and associated missiles - whether in excess of allowed numbers or found elsewhere, outside deployment areas - would most likely give rise to compliance concerns.

Similarly, the rail-mobile launchers of ICBMs will be based in rail garrisons, containing up to 20 kilometres of tracks each. No more than seven such garrisons are allowed for each country.

An important part of the verification measures provided for in the Treaty is the Joint Commission on Compliance and Inspections. Like preceding commissions of that type such as those created under the INF or other treaties - it is designed to provide a forum for the parties to resolve compliance-related questions and work out additional measures to ensure effective implementation of START. The Nuclear Risk Reduction Centers of both sides will continue to serve - as they do under the INF Treaty - as a major communication link for related data and notification exchanges.

In summation, then, one of the main features of the START verification package is its systematic approach. In other words, the verification process is based on multiple evidences of compliance behaviour that will be collected and analyzed by each side over a given span of time.

This would certainly seem to be the only feasible approach to monitory limitations on ballistic missiles. The whole infrastructure for their building, deployment, and maintenance that is necessary to enable their potential military use is widely regarded as difficult to conceal, at least over long periods of time. The verification package as it is designed in START - based on extensive use of National Technical Means, various On-Site Inspections, and Identifiers on individual missiles and other co-operative measures according to experts, discerns "traces of clandestine missiles at various stages of the ICBM life-cycle: design and development, test and evaluation, production, deployment, storage, maintenance and repair, exercise, reliability testing, and elimination".[66] This also holds true for submarine-launched ballistic missiles. The missile-carrying submarines, for all intents and purposes, cannot be concealed, due

[66] *Ibid.*

to their significant size and their large - and thus highly visible - production and support infrastructures. A combination of NTMs and OSIs, coupled with advance notification of missile tests, would provide possibilities for confirmation of the number of warheads with which MIRVed missiles are equipped. This takes on additional importance in light of the intention of both sides to deploy some of their ballistic missiles with fewer RVs than their tested maximum payload. In terms of strategic bombers, their size, geometry and distinct production, testing and support infrastructures make them traceable by the verification techniques to be used under the Treaty as well. Since under the Treaty there are different "counting" or "attribution" rules for nuclear warheads on board an aircraft, depending on whether or not they are equipped for nuclear air-launched cruise missiles (if not, all nuclear armaments of the airplane are counted as one warhead), some restrictions on aircraft-based weapons are stipulated. The proposed aircraft displays and on-site inspections of deployment bases would resolve the problem of verifying Treaty-limited airplane armaments.

Considering the kind of verification system delineated by the Treaty, any analyses of its assets and drawbacks should include a reliable estimate of its financial implications.

Unfortunately, at the time being there are few estimates on this score in the public domain. In terms of potential US expenses, an interesting study was published by the Congressional Budget Office, which could probably be referred to at least as a useful indication of the magnitude of the sums involved. According to the estimate, the on-site inspections alone would carry a price tag of 100 to 390 million dollars a year. An additional couple of hundred million dollars would be tacked onto the total treaty verification costs by the so-called "one-time procedures" (observation of the elimination of the related equipment, baseline inspections, etc.). The total "compliance cost" of the Treaty, which would obviously include the price of treaty-prescribed equipment eliminations, might be somewhat higher. An important conclusion the authors draw from their analyses is, however, rather encouraging. On balance, taking into account the money released for other purposes with the expected reductions in the strategic offensive weapons, the implementation of the Treaty might result in some tangible savings.[67] Similar studies of the Soviet costs are yet to be published. It is highly doubtful that one could reliably make use of any American estimates to "convert" dollar figures into rubles, especially at a time of significant economic change in the USSR, which might have a significant influence on the pricing patterns. Nevertheless, one conclusion the overall positive impact of the Treaty on the country's budget - should prove to be as valid for the USSR as it is estimated to be for the US.

Admittedly, the notable advancement towards peace made by the Treaty has more to do with a reduction of the nuclear threat, thereby bringing more stability and predictability to the strategic relationship between the USSR and the US. It may be assumed with some certainty that the verification regime developed within and

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[67] "US Costs of Verification and Compliance Under Pending Arms Treaties", *The Congress of the United States*, Congressional Budget Office, September 1990.

alongside this Treaty will also directly contribute to these goals. The measures provided for by the Treaty will introduce more openness into the field of strategic arms. The Treaty, including its verification regime, is a result of positive changes in Soviet-American relations in general, and, in turn, it could be an important causal factor contributing to the cementing of those positive overall changes. The Treaty might also be regarded as a very significant step away from traditional "deterrence" views of strategic stability assurance, in favor of one of mutual transparent restraint - and the Treaty verification package would certainly be a major contributor to that kind of development.

The START Treaty lays down many important precedents - and perhaps some lessons, as well. First of all, it undoubtedly provides a solid basis for future agreements between the nuclear superpowers on further reductions in strategic offensive arms, in addition to its simply giving a ready verification system for downsizing their respective stockpiles. It might also indicate that when the two sides have similar readiness to draw up mutually-acceptable formulas - limiting and reducing weapons, even introducing some operational restrictions for them - in the final analysis it is not the verification that would pose the major stumbling-block toward reaching an agreement. The dilemma of the mobile ICBMs is a vivid confirmation of that conclusion. It was not before both sides came to the political decision to limit them that any tangible progress on the verification side of the problem was made. On the contrary, the lack of agreement on the substance of the problems of limiting SLCMs resulted *inter alia* in greatly-hindered movement on the verification aspects of the agreement. In general, however, a verification regime sought by any contracting parties would undoubtedly be very much dependent on the state of their relations, the amount of mutual trust between them - or the lack thereof - and so on. One should not discard the possibility that in the future the two sides might opt for somewhat more relaxed verification procedures, if their relations became mature enough.

The Treaty is yet to pass important tests, beginning with its ratification by the signees' respective legislative bodies and its practical and effective implementation by the two sides. One would hope and expect that with the radical change in the relations between the two Superpowers, the end of their Cold War, and increased general trust between them, the Treaty will become not only a success of the negotiators, but a measure that will help bring about a safer, more open and predictable world.

START II: Evolution or Revolution?

Amy Smithson

Introduction

Long before signatures were laid to the Strategic Arms Reduction Treaty (START) on July 31, 1991, the agreement's shortcomings were being assessed. START had cut too little here, missed an important category of weapons there, or perhaps even gone too

far, too fast in these uncertain times.[68] All agreements endure similar criticisms that highlight differing views on the depth and nature of arms control, but critics can agree that arms control should create an enhanced security environment through lower levels of armament and controls on the use of weaponry. The broad framework for START II, given briefly in a joint statement during the June 1990 summit, adheres to these classic arms control objectives.[69] The statement by former Soviet President Mikhail Gorbachev and US President George Bush emphasized future reductions that would bring greater stability to the nuclear balance by removing first strike incentives, promoting highly survivable systems, and lowering the "concentration" of warheads on strategic missiles.

The framework for a second START agreement was further elaborated during a volley of proposals between the US and Soviet Presidents in the Fall of 1991. Aside from the sweeping unilateral cuts in tactical nuclear forces readily made by both countries, a series of strategic confidence-building measures (CBMs) and cuts were initiated. On September 27th, Bush ordered all US bomber aircraft and some intercontinental ballistic missiles (ICBMs) taken off alert status. He obviated a potentially major obstacle in START II negotiations by directing that all nuclear sea-launched cruise missiles (SLCMs), nuclear bombs for carrier-based aircraft, and nuclear depth charges be taken off US surface ships and submarines and stored on shore.[70] The latter category of weapons would be destroyed. Bush also cancelled the US rail- and road-mobile missile programs, noting that the single-warhead Midgetman would be deployed in silos only. In his speech, Bush re-emphasized the importance of moving toward lower levels of warheads per missile and proposed early negotiations on the elimination of multiple independently-targeted reentry vehicle (MIRV) ICBMs. Later, US officials indicated a willingness to include other strategic weapons in another set of initiatives that might decrease stockpiles even lower.[71]

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[68] One sharp criticism was that the treaty's provisions, namely its counting rules, would allow thousands more warheads than the 6,000 accountable for each side. See *Breakout, Verification and Force Structure: Dealing with the Full Implications of START*, House of Representatives Defense Policy Panel Report, One Hundredth Congress, Second Session, US GPO, Washington, 1988. Alexei G. Arbatov criticizes the START I Treaty in "We Could Have Done Better", *Bulletin of the Atomic Scientists*, Vol. 47, No. 9, November 1991, pp. 36-47. Other critics include Bill Gertz, "START Concessions Called Ill-advised", *Washington Times*, June 8, 1990, p. 3; Les AuCoin, "Start: Make It Better", *The Washington Post*, May 29, 1990, p. A23; Frank Gaffney, Jr., "Heralded Cut in Soviet ICBMs Illusory", *Defense News*, June 11, 1990, p. 19; and Stansfield Turner, "Scrap 15,000 Warheads, *The New York Times*, March 14, 1991, p. A17.

[69] US officials reportedly acknowledged that this early commitment to negotiate a second START accord was partly designed to fend off criticisms that the first agreement was deficient. R. Jeffrey Smith, "Negotiators Agree To Second Start on Strategic Arms, *The Washington Post*, June 2, 1990, p. 22. For a discussion of the objectives of arms control, which include arms race stability and crisis stability, and an overview of strategic arms control, see *Arms Control and National Security: An Introduction*, Arms Control Association, Washington, 1989.

[70] The issue of SLCMs was so contentious in START I negotiations that only a politically-binding declaration concerning long-range SLCMs was achieved.

[71] R. Jeffrey Smith, "Bush Administration Signals Flexibility on Additional Cuts in Nuclear Weapons," *The Washington Post*, October 1, 1991, p. A16.

While Gorbachev's October 5th response in many ways mirrored these initiatives, it also contained some interesting and important variations. The Soviets followed the US lead in CBMs and in taking nuclear weapons off of seagoing vessels, but blazed a new path by unilaterally committing to decrease to 5,000 its number of strategic warheads - 1,000 fewer than the agreed START I ceiling. As an additional CBM, Gorbachev froze the number of Soviet rail-mobile ICBMs and confined them to their garrisons. He cancelled some modernization programs for bombers and mobile ICBMs. Gorbachev also urged the United States to join the USSR in a one-year nuclear test ban and in a resumption of negotiations toward the goal of a permanent halt to testing. Gorbachev indicated an interest in cooperative development of non-nuclear ballistic missile defenses. This package of unilateral measures and negotiating proposals was created in consultation with the leaders of the former Soviet republics.

As indicated by this series of unilateral moves, profound changes are taking place in the politico-military relationship between the United States and for former Soviet empire. To begin with, a new Commonwealth of Independent States has emerged. Russia is an acknowledged leader in this union, but strategic nuclear weapons will be under centralized control. As other aspects of the political, military, and economic relationships between the Commonwealth states are settled, the US and Commonwealth leaders will continue to re-evaluate the objectives for another strategic nuclear treaty. What seemed ambitious in the Summer of 1990 could easily be outdated by the time START II negotiations begin. Unilateral reductions could continue to snowball, racing ahead of formal negotiations. Therefore, specific predictions about a START II treaty would be quite premature. However, some items likely to appear on the START II agenda can be anticipated.

The waning of the Cold War era opens up the possibility of deep cuts in the strategic arsenals of both nations. Suddenly, strategic arsenals that number one or two thousand no longer appear to be such unrealistic objectives, though such deep reductions would probably have to occur in phases.[72] The target most explicitly identified thus far for future control is the MIRVed missile. A ban on MIRVed mobile ICBMs, a structured builddown of the more vulnerable stationary MIRVed ICBMs, and a builddown that trades MIRVed ICBMs for single-warhead ones are all possibilities. The downloading of MIRVed missiles - the deployment of fewer reentry vehicles (RVs) on a MIRVed system - is already incorporated in START I. Some analysts have proposed alternative approaches, such as placing limits on warhead yields.[73] Reductions in MIRVed missiles on submarines (SLBMs) may also be sought as part of a deeper cut across the board in strategic weapons, though SLBMs are usually thought of as highly survivable, retaliatory systems.

The negotiations may also try to define stricter counting rules on weapon systems, an area that is often underappreciated for its true influence on the stringency of a

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[72] See Carl Kaysen, Robert S. McNamara, and George W. Rathjens, "Nuclear Weapons After the Cold War", *Foreign Affairs*, Vol. 70, No. 4, fall 1991.

[73] Roger D. Speed, *Strategic Forces: Future Requirements and Options*, Lawrence Livermore National Laboratory, UCRL-ID-105336, November 1990.

treaty. Counting rules are a generic term describing the rules that facilitate verification of treaty limitations. For example, counting rules might distinguish between deployed systems and those under construction, or assign the official number of RVs on a missile as the highest number flight-tested for that system.[74] In START II, more rigorous counting rules might be devised for nondeployed missiles, air-launched cruise missiles, ICBMs, and SLBMs. Yet another approach to the negotiations could broach the difficult task of limiting advanced technologies. Other issues will certainly be discussed, but even this concise START II agenda brings up a number of substantial verification challenges.

START II Verification Issues

A START II verification regime will undoubtedly employ national technical means (NTM) and various methods of human and technical on-site inspection (OSI). Different cooperative measures and on-site inspections will supplement NTM. Cooperative measures used in START I include the open display of road-mobile launchers, rail-mobile launchers, and heavy bombers upon request. Such cooperative measures assist NTM verification. The Intermediate-range Nuclear Forces (INF) Treaty proscribed five types of OSIs: 1) baseline inspections to verify the initial data exchanged; 2) short-notice inspections at declared sites, with a declining annual quota of OSIs during the treaty's 13-year duration; 3) elimination inspections for the observation of missile and launcher destruction at dedicated sites; 4) close-out inspections conducted when bases or missile support facilities are eliminated; and, 5) production monitoring, which is accomplished with permanent perimeter-portal monitoring systems at Magna, Utah, and Votkinsk, USSR. START I modified this approach by adding data update inspections, new facility inspections, technical characteristics and distinguishability exhibitions, and conversion inspections when retired equipment is converted to non-military uses. Heavy bomber baseline exhibitions and suspect site inspections to confirm the absence of illegal activities at undeclared locations were also added during START I, raising the types of OSIs to twelve.[75] The proliferation of OSI variants may continue in START II, perhaps adding ones dedicated to warhead dismantlement operations or other weapons, facilities, or procedures.

Of course, the movement toward extensive and intrusive OSIs could reverse. Already, both sides have proposed numerous CBMs that may relieve the burden borne

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[74] See Michael Krepon's "Counting Rules," in *Verification and Compliance: A Problem-Solving Approach*, Michael Krepon and Mary Umberger (eds.), Carnegie Endowment for International Peace, Macmillan Press, London, 1988, pp. 124-138 and "Verification of Limits on Air-launched Cruise Missiles," Thomas K. Longstreth and Richard A. Scribner in *Reversing the Arms Race*, Frank von Hippel and Roald Z. Sagdeev, (eds.) (Gordon and Breach Science Publishers, New York, 1990, pp. 181-236.

[75] Dunbar Lockwood describes START I verification in "Verifying START: From Satellites to Suspect Sites", *Arms Control Today*, Vol. 20, No. 8, October 1990, pp. 13-19. See also Sidney N. Graybeal and Patricia Bliss McFate discuss the various aspects of START I verification in "Getting Out of the STARTing Block", *Scientific American*, Vol. 251, No. 6, December 1989, pp. 61-67.

by the more costly and structured verification provisions of the first treaty. The line separating formal verification provisions and CBMs could become increasingly blurred. Deep cuts in strategic arsenals and control of warheads as well as delivery systems would, however, greatly increase the complexity of START II monitoring tasks. In general, the lower force levels are reduced, the more critical the ability to verify compliance becomes. Intensified monitoring of weapons production with portal-perimeter systems and inspection of suspect sites could become even more important in START II verification.

Two issues that may also come up in discussions of START II verification are ones that have already been broached: RV counting and tagging. The most simple and direct methods were chosen for RV verification in START I - brief visual observation. Covering individual RVs is optional. Interest in other RV monitoring techniques could revive for START II, especially for those that do not require dismantling the missile nosecone. For instance, gamma-ray or neutron imaging techniques can scan the nosecone with energy beams that selectively absorb the fissionable materials and reveal individual warheads as dark areas on the image. The fuzziness of the image is sufficient to count the RVs, but insufficient to compromise sophisticated design technologies.[76] RV inspections might be done as part of the perimeter-portal monitoring at designated production facilities,[77] as well as during routine short-notice OSIs, where portable sensors might be used.

Tags are intended to help monitor numerical limits on weaponry by applying unique identifiers to the items controlled by the treaty. For the relatively few instances where tags are being used in START I, negotiators settled upon a less complicated approach of simply painting identifiers on the missiles or relying on existing markings. However, lower overall levels of ballistic missiles in START II may rejuvenate efforts to use tagging. The criteria for tags are that they be reliable and precise, durable, unique, non-reproducible, and impossible to remove or transfer. Tagging technologies can be passive or active, ranging from reflective particles and holograms to barcoding and microchip devices with infrared transponders. Tags would be read, either up close or remotely, during OSIs to confirm that inventory levels do not exceed agreed ceilings. The United States and the Commonwealth states might build upon the experience gained in late 1989 joint verification exercises on tagging to further investigate the utility of this technology for START II monitoring.[78]

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[76] Other inspection techniques are described in Robert Mozley's "Verifying the Number of Warheads on Multiple-warhead Missiles," in *Reversing the Arms Race*, Frank von Hippel and Roald Z. Sagdeev, Gordon and Breach Science Publishers, New York, 1990, pp. 117-140. See also Allan Krass *The Verification Revolution*, Union of Concerned Scientists, Cambridge, Massachusetts, 1989.

[77] For a description of how pedestrian and vehicle portal monitors can detect nuclear materials, included shielded fissile material, see David Albright's "Portal Monitoring for Detecting Fissile Materials and Chemical Explosives," in *Reversing the Arms Race*, Frank von Hippel and Roald Z. Sagdeev, Gordon and Breach Science Publishers, New York, 1990, pp. 239-264.

[78] Conceptual information was exchanged that the United States demonstrated one tag, the reflective particle tag. "START: Tagging Demonstration," *Issues Brief*, US Arms Control and Disarmament Agency, Washington, January 29, 1990. Steven Fetter and Thomas Garwin give a more in-depth description of how tags might work

Arguments have been made that strategic arms control should come full circle by controlling the warheads, not just the delivery systems. Controlling the special nuclear material (SNM) from nuclear weapons is often proposed in tandem with a cutoff in the production of SNM for weapons. At the most basic level, verifying the control of warheads would entail accounting for all of the SNM salvaged from the dismantled warheads and verifying the chosen disposition technique to ensure that the SNM does not reenter the weapon cycle. For example, dismantling the approximately 6,000 warheads from START I would take approximately five years and result in a store of thirty tons of plutonium.[79] Schemes on how to accomplish warhead dismantlement have been devised, but the process could consume considerable manpower, time, and other resources. After initial dismantlement of the warheads in so-called black boxes, warhead components might be tagged and placed in tamperproof, sealed containers for further dismantlement, dilution, storage, destruction, or disposal. Any eventual process for dismantling warheads is bound to be elaborate because of the two competing interests - protecting sensitive warhead design technologies and providing adequate monitoring techniques to ensure compliance.

As for the final disposition of the salvaged SNM, three broad alternatives exist, each with its own controversies and more discrete options. First, SNM taken from warheads could be reprocessed for use in civilian power reactors. This alternative would involve tracking the SNM through the civilian power cycle to ensure that it is not diverted back to weapons production, an endeavor that would require a substantial technical and human monitoring effort. Some have proposed that the International Atomic Energy (IAEA), which safeguards nuclear materials in civilian power and research reactors, would be the appropriate mechanism for ensuring that this SNM does not leave the civilian cycle power cycle. Others have argued that this added responsibility could overwhelm the IAEA's resources. Some entity, whether the multilateral IAEA or a specialized bilateral organization, would have to assume this monitoring task. Second, salvaged SNM could be recycled into other weapons or adapted for use as fuel in military nuclear reactors onboard ships, satellites, or power plants at military bases. Recycling the SNM into other warheads would nullify the objective of controlling the fissionable material in the first place, and tracking the SNM throughout the military power cycle could be just as arduous as monitoring within the civilian nuclear power cycle.

A final category of options involves the mechanical deformation or contamination of the SNM, which is then disposed of or placed in supervised storage facilities. This

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in "Using Tags to Monitor Numerical Limits in Arms Control Agreements", in *Technology and the Limitation of International Conflict*, Barry M. Blechman (ed.), Washington: The Johns Hopkins Foreign Policy Institute, School of Advanced International Studies, 1989, pp. 33-54.

[79] For an overview of dismantlement, see "Megawaste: Junking Nuclear Bombs," Robert L. Park and Peter D. Zimmerman, *The Washington Post*, June 5, 1988, p. A32. See Theodore B. Taylor's "Verified Elimination of Nuclear Warheads", *Science and Global Security*, Vol. 1, 1989, pp. 1-26. See also a preliminary report of the Federation of the American Scientists in collaboration with the Committee of Soviet Scientists for Global Security and the Center for Program Studies of the USSR Academy of Sciences entitled "Ending the Production of Fissile Materials for Weapons, Verifying the Dismantlement of Nuclear Warheads", Washington, June 1991.

alternative has been criticized as a temporary solution because the SNM could be retrieved and reprocessed for use in weapons. International supervision of the storage facility might temper such criticism, but would add complications about control of the SNM.[80] Other less attractive disposal options elicit environmental concerns: jettison the SNM into deep space, bury it deep in the earth or the sea bed, or disperse it in the seas. The potential for an accidental release of contaminants into the environment detracts from these more exotic disposal options. Also, SNM placed in the earth or sea bed could, with a determined effort, be recovered for military use. Of these alternatives, the monitored storage of SNM would probably be the most amenable to verification because stored SNM would not require intricate procedures for tracking the materials throughout other uses.

Any proposals to constrain the research and development (R&D) and testing of advanced technologies considered in START II may present the treaty's most frustrating verification challenges. For example, maneuvering reentry vehicles (MARVs) and other advanced technologies may be discussed. Controls placed on selected technologies could have an undesirable side effect: sensitive R&D programs that are not restricted by the treaty, but are collocated with those chosen for limitation, might be exposed during the monitoring process. Moreover, defining where conceptual and scholarly research ends and R&D dedicated to weapons development begins - a matter that is compounded by the dual-use nature of some technologies - is a truly difficult task.[81] The United States and the former Soviet Union exchanged site visits at laboratory facilities and increased the interaction of scientists working in various types of research. Continuation and expansion of these types of exchanges, perhaps with an annual quota of visits and liberal use of shrouding and other safeguards, might build some confidence that any negotiated constraints on R&D are not exceeded.[82] More strenuous verification provisions may prove unpalatable for both parties.

Conclusions

The United States and the former Soviet Union spent a almost decade shaping the START I Treaty, producing a tome of some 750 pages. Through START II negotiations, the United States and the Commonwealth nations will determine whether the next round of strategic arms control will be evolutionary or revolutionary. An

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[80] Longstanding US policies mandate that SNM remain under the control of the US government. See the US Atomic Energy Act of 1946, as revised.

[81] A case in point is the dilemma encountered during the Comprehensive Test Ban (CTB) negotiations of the late 1970s. Negotiators balked at the task of *defining* a nuclear explosion, unable to pinpoint how far a "comprehensive" test ban should extend with regard to nuclear field and laboratory research. The subject was so difficult to contend with that no in-depth discussion ever took place. Personal communication to Amy Smithson, April 10, 1991, from General Edward B. Giller (USAF, ret.), Joint Chiefs of Staff Representative to the CTB negotiations.

[82] Sergei Kortunov also suggests data exchanges on the characteristics of new weapon systems, consultations about any concerns that arise as a result of these data exchanges, and visits to the involved laboratories and test ranges. See "START II and Beyond," *Bulletin of the Atomic Scientists*, Vol. 46, No. 8, October 1990, pp. 21-24.

agreement that mandates deeper across the board cuts and begins to de-MIRV strategic missile arsenals would fall in the former category. The exchange of unilateral measures and preliminary proposals that took place in the Fall of 1991 indicate that the evolutionary approach and the faster conclusion of follow-on negotiations may be preferred by both sides. The reductions achieved in this instance should equal or exceed the fifty percent cut initially advertised for START I. An advantage of this evolutionary approach is that negotiators would be building upon an established foundation, not starting from scratch. Appropriate adjustments would be made to the verification regime or CBMs could be substituted or added for some monitoring requirements.

A treaty that places controls on warheads and advanced technologies would, on the other hand, constitute a major break from established arms control trends. Crafting an agreement using this type of a revolutionary approach would be much more difficult, partly because major changes in the verification regime would be required. If negotiators attempted to address other large arms control subjects such as naval arms or nuclear testing within the framework of START II, progress toward a treaty is likely to be slower still. One way to relieve the burden in START II would be to handle such matters in separate negotiations, but even that approach does not preclude the linkage of the negotiations and the tactic of holding progress in one treaty hostage to desired concessions in other negotiations.

Depending upon the path chosen, START II might follow closely on the heels of START I or it might take yet another decade to accomplish. US and Commonwealth stockpiles will contain several thousand nuclear warheads after START I and tactical nuclear weapon reductions are completed, which means that a great deal of work remains for nuclear arms control. START II will constitute another step toward heightened stability and security at lower levels of strategic nuclear arms. Whatever the final form of START II, the early commitment of the parties to continue the START process is in and of itself an acknowledgement that arms control plays an important role in improving international security through mutually-agreed upon constraints on strategic nuclear weapons.

Ballistic Missile Defenses. A Dilemma yet to be Solved

Serguei Kislyak

The question of ballistic missile defenses has been one of the major components of Soviet-American negotiations on strategic weapons. It has long been a belief of both sides that there is no escape from the interrelationship - and in fact interdependence - between offensive and defensive aspects of the strategic balance. The renunciation of any system attempting to create a shield against ballistic missiles was first of all a recognition of the fact that such a system would hardly be feasible and, more importantly, that its absence in any case would better serve the goals of preventing an unbridled strategic offensive competition, and therefore of maintaining a strategic

balance with lower levels of armaments. As a result, the ABM Treaty, which resolutely limited the antiballistic strategic systems of both sides, was negotiated within the Soviet-American negotiations on the limitation of strategic armaments. The Treaty, prohibiting nation-wide missile defenses and allowing protection of only two areas within their respective territories (subsequently, still further limitation - a single area on each side - was agreed upon), came into force in 1972 and today remains the key factor determining the parameters of the related military efforts of the two sides.

A document of unlimited duration, the Treaty later became a subject of extensive debate and policy maneuvering, however. This was due largely to a substantive change in approach to the whole idea of ballistic missile defenses that took place in the early 1980s in Washington. Broad disputes on this score, often taking place in bilateral and multilateral fora, are well-known and well-documented in the pertinent literature. It would behoove the interested reader to address more fundamental sources concerning the basic rationales, arguments and counter-arguments behind this problem. Since our purposes are rather to assess what verification issues might be subject to discussion at the negotiation table in Geneva, it is sufficient to summarize, in general terms, where the two sides seem to be now and where they might be reasonably expected to move next.

The successful conclusion of two important treaties - one concerning the elimination of Intermediate Nuclear Forces (INF), and the other, the reduction of Strategic Offensive Arms (START) - seems to have further singled out the third area of the Geneva talks, which deals with "defense and space" weapons, as one still requiring much effort in order to reach even a conceptual mental juncture, let alone the drafting of an agreement text. Existing disagreements still appear to be fairly substantive in nature.

The US decided in 1983 to launch its Strategic Defense Initiative (SDI), a vigorous program designed to utilize what the "cutting edge" of scientific progress - particularly with respect to technology deployable in space - had to offer in terms of creating an antiballistic shield. With all the developments and refinements of the system taking place during arms negotiations, the American position increasingly appeared to be refocusing on the deployment - preferably on a mutually-agreed basis - of wide-scale Ballistic Missile Defenses (BMD), rather than reconfirming or reinforcing the previous agreement to radically limit them. They seemed to believe that the appearance of new technologies (various sensors, direct energy transmissions, onboard computers, new materials, miniaturization, etc.) would enhance the prospects of creating effective BMD systems. Such a system would make it difficult for the other side to plan and execute a nuclear first strike, which would lead in turn to a fundamental reassessment of the interrelationship between strategic defence and offensive arms, the very essence of the ABM Treaty.

The Soviet Union, on the contrary, has consistently insisted on this interrelationship, stressing, *inter alia*, that substantive reductions in offensive strategic arsenals are indeed possible if the ABM Treaty is in force and no weapons are deployed in space.

In the meantime, both sides are adhering to the Treaty. And the United States - despite its concerted efforts to develop the SDI program and its assertions that the Treaty allows for quite extensive research, development and testing of the system - is officially recognized not to be in violation of the Treaty in its rigorous, "traditional" interpretation.

The verification side of the situation, meanwhile, currently amounts more-or-less to what was provided for by the Treaty itself. It is notable that the ABM Treaty was the first agreement to explicitly recognize the two sides' right to employ so-called National Technical Means for verification purposes. Moreover, it was agreed (in one of the first co-operative verification measures) that obstacles to the complete use of these means should not be created. A Standing Consultative Commission (SCC) was created to deal with the concerns the sides might have with regard to the compliance behaviour of their partners. This SCC system seems to have afforded an adequate view of the other's side activities, especially in light of the relatively high visibility of the NTMs of the related systems. The Krasnoyarsk radar is one and perhaps the most vivid - example (this violation of the Treaty terms is currently being corrected through dismantlement of the system). Other cases have also given rise to compliance concerns, such as the "modernization" of American radars in Greenland and Great Britain, as well as some other issues which are known to have appeared on the SCC agenda.

One source of these difficult issues might be that they spring from a lack of complete mutual agreement between the sides as to what is banned and what is allowed by the Treaty in terms of ABM activities. The contested areas have to do with the development of systems, or the components thereof, that are based on new technologies, systems that were unknown or unforeseen at the time of the Treaty's negotiation. In response to this, the US has declared that the related prohibitions would not be applicable, while the USSR has vigorously refuted this assertion. There have been proposals and ideas forwarded by a myriad of means in a variety of venues - during the Geneva negotiations, as well as within an extensive dialogue between the two countries in an attempt to more clearly define what is in fact allowed by the Treaty (for example, by agreeing to constrain development and testing of new, "other" technologies to laboratories), among others. Were the two sides to look beyond their basic differences, which up to now have prevented progress toward such mutual understanding, the sort of blockade that has characterized negotiations up to now might be overcome.

In general, more mutual confidence and predictability seem to be the key ingredients to stability in the whole area of strategic defense and space issues. This takes on increasing relevance in light of the planned radical reductions of strategic offensive weapons and further technological developments. In this context, confidence-building measures - such as systematic exchange of related information, notifications, invitations to visit laboratories to observe testings, etc. - would also appear to be quite feasible from a technical standpoint. They would certainly be useful in terms of complementing the use of NTMs, as provided for in the Treaty.

It should be stressed that scientific literature and years of discussion in various fora have together produced a host of specific ideas and proposals for verification in this area. Technically, especially with the use of co-operative and confidence-building measures to help monitor compliance, they are prone to workable solutions. Among them are ideas to check space payloads at launching pads, to develop remote sensors measuring the power of lasers, to agree to ban tests on antisatellite systems, etc. One may safely say that adequate verification technology can be created, should both sides agree that it is in their best interests to do so. As of now, the main problem seems to lie elsewhere.

The crucial question remains as to what any verification, confidence-building or predictability measure is really designed to accomplish. Are the sides aiming to simply make transparent their process of introducing still more strategic weapons, which could very possibly result in new rounds of potentially destabilising action-counteraction competition? Or are they willing to contribute to the systematic confirmation that they are moving in the opposite direction? Further negotiations and the development of the general political and military climate will show what kind of answer is to be found to this dilemma - an answer with potentially extremely important implications for each of the two countries. One would hope that it is a constructive one, no less in terms of the verification aspects of the issues involved.

Short-Range Nuclear Forces Arms Control: A Nontraditional, but Effective Path

Amy Smithson

Introduction

A remarkable phenomenon preempted negotiations on short-range nuclear forces (SNF): the speed of unilateral reductions, withdrawals, and pledges outpaced negotiations. These withdrawals are an outcome of the political, military, and economic changes that have swept across Eastern Europe and the Soviet Union during the past few years. The Soviet Union began withdrawing conventional forces and SNFs from Eastern Europe as a result of the disbanding of the Warsaw Treaty Organization. In November of 1990, the Conventional Forces in Europe was signed, further cementing these withdrawals. Then, with two speeches in the Fall of 1991, US President George Bush and former Soviet President Mikhail Gorbachev came close to withdrawing and eliminating all deployed tactical nuclear artillery, missiles, and air-delivered systems with a range of less than 500 kilometers.

On September 27, 1991, Bush announced the worldwide unilateral withdrawal and elimination of all US nuclear artillery shells and short-range ground-launched missiles. Bush also ordered tactical naval nuclear weapons, including bombs, depth charges, and cruise missiles, taken off surface ships and submarines and placed in storage or destroyed. After a week of consultation with the leaders of the republics of the USSR,

Gorbachev responded to Bush's challenge for further cooperation with a similar statement. All Soviet SNF artillery, missile warheads, and nuclear mines would be destroyed and tactical nuclear weapons removed from ships. In addition, Gorbachev sought a reciprocal means to address air-delivered SNFs, proposing that nuclear bombs and aircraft missiles be placed in storage. Although this series of events made the convening of formal SNF negotiations superfluous, all is not said and done with respect to SNF.

Even as the foundations of the new Commonwealth of Independent States were being established during the collapse of the Soviet Union, officials from Russia, Ukraine, Belarus, and the other republics made statements of intent to abide by the arms control treaties signed by the Soviet Union. As new chains of command were being created for the 27,000 nuclear warheads scattered throughout the former Soviet empire, Commonwealth officials placed high priority on maintaining secure control of this vast arsenal. Plans to carry out the destruction of SNFs and some strategic weapons, were also being formulated. Western nations offered technical and financial assistance to the Commonwealth states for this task, including $400 million set aside by the US Congress for the purpose of dismantling and destroying Soviet nuclear weapons.

If SNF negotiations had taken place, they might well have foundered on difficult verification issues. This essay will first examine why this particular category of nuclear arms would have been so tough to verify. Second, contrary to popular perceptions, some unfinished business remains for SNF arms control. Measures for building confidence in the SNF unilateral withdrawals will be suggested, as will concepts for the verification of the lone category of remaining SNF, the air-delivered systems. This latter discussion will also broach the advantages and drawbacks of the use of unilateralism, as opposed to formal treaties, as a method of arms control.

Unilateral withdrawals have made the number of SNFs in Europe difficult to determine. The United States once deployed several thousand SNFs in Europe and approximately one hundred systems in South Korea. All of the remaining 850 Lance missiles and 1,300 8- and 6-inch artillery shells are being withdrawn and destroyed.[83] These reductions will leave approximately 1,400 SNF nuclear bombs for land-based aircraft in Europe and Korea.[84] This number is likely to sink even lower as the North Atlantic Treaty Organization (NATO) restructures its forces and decreases the number of aircraft wings. The Soviet Union had withdrawn all of its SNF from former East German territory under terms of German reunification and the Commonwealth is continuing to withdraw its other SNFs from the rest of the former Warsaw Pact members according to its unilateral pledge. The exact status of these other withdrawals

[83] Including the tactical naval systems, over 3,000 US nuclear weapons will be destroyed, while another 1,275 will be withdrawn and stored. "Impact of the Bush Nuclear Weapons Initiative," Fact Sheet, The Arms Control Association, October 1991.

[84] Updates on US and Commonwealth nuclear weapon deployments can be found in the *Nuclear Weapons Databook*, Natural Resources Defense Council, Ballinger Press, New York, 1990.

is not known, but in addition to nuclear artillery and dual-capable aircraft, the Soviets deployed SCUD-B, SS-23, FROG-7, and SS-21 SNF missiles in the theater.

SNF Verification Nightmares

At the height of Cold War tensions, thousands of short-range nuclear weapons were deployed in hundreds of munitions bunkers throughout Europe. To have negotiated an SNF arms control agreement under those political and military circumstances would have been an impressive achievement. To have been charged with creating a verification regime to monitor these numerous, small, very mobile, and multi-capable forces would have been a nightmare.

The difficulty of defining a negotiating mandate for SNF could in and of itself have been significant. A common perception of SNF arms control was that it would follow the precedent set by the 1987 Intermediate-Range Nuclear Forces (INF) Treaty, which placed a global ban on missiles with ranges between 500 and 5,500 kilometers.[85] SNF negotiations would probably have been conducted bilaterally in consultation with other parties that host US and Commonwealth SNFs, have nuclear arsenals of their own, and whose security would be effected by changes in the tactical nuclear balance. Aside from this fact, an SNF treaty was likely to have departed from the INF model in several critical ways.

First, the INF Treaty placed a global ban upon an entire category of weapon systems. SNF negotiations may not have been able to duplicate this feat, although talk of a Third Zero created expectations it might.[86] An SNF treaty could have fallen short of the INF double zero model both in the geographic range of the agreement and in an inability to include all categories of SNF. The fact that air-delivered systems are not included in the US unilateral withdrawals confirms this assumption. After consultation, NATO officials decided for the time being to retain some air-delivered systems,[87] which the Soviets sought to address in further unilateral steps or perhaps in negotiations. Reductions of SNF short of a ban would have required designers of

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[85] William D. Bajusz and Lisa D. Shaw describe various approaches to SNF reductions in "The Forthcoming SNF negotiations", *Survival*, Vol. 32, No. 4, July/August 1990, pp. 333-347; see also Olivier Debouzy, "The Debate on the American Presence and Role in Europe: A History", European Strategy Group Occasional Paper, January 1991, pp. 83-127.

[86] See Dennis M. Gormley's "Triple Zero - The Next Option," *Arms Control Today*, Vol. 18, No. 1, January 1988, pp. 17-20; and Sir Hugh Beach, "The Case for the Third Zero", *Bulletin of the Atomic Scientists*, Vol. 45, No. 10, December 1989, pp. 14-15.

[87] See Catherine M. Kelleher's "Short-Range Nuclear Weapons: What Future in Europe?", *Arms Control Today*, Vol. 21, No. 1, January/February 1991, pp. 17-21. Theresa Hitchens documents NATO's uncertain nuclear future in articles on the tactical air-to-surface (TASM) missile's apparently bright future and the possible cancellation of the short-range attack missile (SRAM-T). See, respectively, "Stand-off Capability to Key NATO Nuclear Plans", *Defense News*, Vol. 6, No. 11, March 18, 1991, p. 11 and "New Europe, Lack of Funds May Kill SRAM-T", with Barbara Opall, *Defense News*, Vol. 6, No. 7, February 18, 1991, p. 3. The follow-on-to-Lance missile and a new artillery shell that would have modernized NATO's ground-based forces have already been canceled. R. Jeffrey Smith, "US to Drop Plan for Missile in Europe", *The Washington Post*, April 19, 1990, p. A8.

a verification regime to devise methods of counting the numbers of manufactured, deployed, stored, and retired systems. In the INF Treaty's landmark verification regime, short-notice inspections at declared sites and perimeter-portal monitoring at central production facilities accomplish this function. Extension and adaptation of this approach might have fit the needs of SNF monitoring, but the job would have been more complicated because of the need to differentiate between warhead types and to tally nuclear warhead stocks. Therefore, warhead discrimination devices and a system of tags and seals for treaty-limited items might have been needed.

Second, the INF Treaty placed launchers, not their warheads, under control. INF inspectors monitored the scheduled withdrawal and destruction of INF delivery systems with routine and elimination OSIs. Unlike their INF counterparts, however, SNF delivery systems are capable of launching conventional and chemical rounds in addition to nuclear warheads. Possible constraints on conventional capabilities might have discouraged definition of launchers as the treaty-limited item.[88] Nor could the matter of missile reloads and their accountability have been ignored if launchers were controlled. These issues could have been quite contentious in an SNF agreement with delivery systems as the treaty-limited item.

The alternatives to control of delivery systems, namely controlling SNF warheads or some combination of the two, could have given rise to additional complications. Defining SNF warheads as the item of control would have forced the verification regime to cope with several factors simultaneously: small size, discrimination between nuclear and other warheads, mobility, and disposition of fissionable materials during and after withdrawal. US SNFs range in size from the 2900 pound Lance missile to the approximately 100 pound, man-portable rounds for the 155mm artillery gun.[89] The difficulty of monitoring small and mobile items suggests that tags and challenge inspections would have been part of an SNF verification regime. Tags are small, unique identifying markers that can be placed on individual missiles, warheads, or launchers to monitor deployments. Challenge inspections can be conducted at "suspect sites" to investigate suspicions about covert production, storage, deployment, or maintenance. Scientists have indicated that the technical challenge of discriminating nuclear rounds from conventional and chemical rounds during OSIs can probably be

[88] Dedicated conventional launchers that would not be covered in an SNF agreement might have been required. Jonathan Dean, *Meeting Gorbachev's Challenge: How to Build Down the NATO-Warsaw Pact Confrontation*, St. Martin's Press, New York, 1989, p. 266.

[89] Descriptions of US nuclear weapon systems can be found in the *Nuclear Weapons Databook, Volume I, op. cit.*

met.[90] However, the problems posed by placing the warheads' fissionable material under control during withdrawal and elimination could have been significant.

While the protection of sensitive warhead designs has not been an overriding concern in INF monitoring, accounting for the special nuclear materials (SNM) in the warheads while not compromising design information might have been a problem for SNF verification. Questions would have been raised about how to dispose of the SNM, whether through storage, re-use in military or civilian power cycles, or some other option.[91] Control of the SNM during and after dismantlement of the warheads would have opened up the possibility of having to build dedicated dismantlement and storage facilities. Furthermore, the entire lifecycle of reprocessed SNM as it moved through use in power plants or through a process of contamination and storage would have come under scrutiny. Implementation of such procedures would have required substantial resources.

Finally, determining the geographic scope of the treaty would have challenged the participants. INF set a global precedent, but other recent Euro-centric treaties cover continental territory only. The geographic boundaries of an SNF treaty would have influenced the number of sites to be inspected and the costs of the monitoring regime. In sum, issues that could have made SNF negotiations exceedingly difficult were what type of forces to include, whether to limit or ban these forces, what item(s) should be accountable, and what geographic scope the treaty should have. These variables could have produced any number of negotiating positions, resulting in a marathon negotiation.[92] Unilateral withdrawals fortunately spared the participants from this chore.

Conclusions: A Few Pieces of Unfinished Business

Unilateral steps were taken with SNFs because the European continent was in the midst of adjusting to an emerging security environment. Conventional forces were being reduced to parity, INFs had been eliminated, Germany had been reunited, dramatic political and institutional changes were taking place within the former Soviet Union, US and Soviet strategic nuclear arsenals were shrinking, and initial steps were being

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[90] See "Verifying Reductions of Nuclear-warhead and Fissile Material Stockpiles," in A Preliminary Report of the Federation of the American Scientists in Collaboration with the Committee of Soviet Scientists for Global Security and the Center for Program Studies of the USSR Academy of Sciences, entitled "Ending the Production of Fissile Materials for Weapons, Verifying the Dismantlement of Nuclear Warheads", Washington, June 1991, pp. 27-38. See also Robert Mozley's "Verifying the the Number of Warheads on Multiple-warhead Missiles", in Frank von Hippel and Roald Z. Sagdeev, *Reversing the Arms Race*, New York: Gordon and Breach Science Publishers, 1990, pp. 117-140.

[91] For more information on the complexities of warhead dismantlement and SNM disposal, see Theodore B. Taylor's "Verified Elimination of Nuclear Warheads", *Science and Global Security*, Vol. 1, 1989, pp. 1-26.

[92] For instance, Former Soviet Foreign Minister Eduard Schevardnadze proposed using the Atlantic-to-the-Urals (ATTU) boundaries of the Conventional Forces in Europe (CFE) Treaty as an intermediary step before moving on to a global SNF ban. For other formulas, see *Tactical Nuclear Weapons in Europe: The Problem of Reduction and Elimination*, Pavel Bayev, Vitali Zhurkin, Sergei Karaganov, and Viktor Shein, Institute of Europe, USSR Academy of Sciences, Novosti Press Agency Publishing House, Moscow, 1990.

taken toward closer economic and political ties for the entire continent. Threats to national security were obviously decreasing, but military balances were still in flux. While the involved parties could not have approached SNF negotiations with confidence under these circumstances, adjustments to SNF arsenals were perceived as desirable. Had a negotiation been assembled, the parties might have held unilateral withdrawals hostage as they jockeyed for position. The result could well have been a stalemate at the negotiating table and an artificially high level of SNFs kept in the European theater for bargaining chips.

The fact that unilateral measures, not formal negotiations were chosen, however, does not mean that the Commonwealth states and America should rest henceforth. A technical working group should be assembled to discuss confidence-building measures (CBMs) tied directly to the unilateral SNF withdrawals.[93] The implementation of dedicated CBMs would help fend off criticisms that unilateral withdrawals, even if reciprocated, are undesirable precisely because no verification accompanies them. Possible CBMs for these circumstances might include data exchanges throughout the unilateral reductions and voluntary visits to nuclear storage sites in Europe that are closed.[94] These visits could also take place at storage sites where the withdrawn weapons have been placed. Invitations to observe the destruction of some SNFs might also be extended. Such CBMs would enhance confidence that unilateral declarations are being upheld.

This technical working group could also be charged with the responsibility of exploring the complicated issues that will accompany the verification of dual-capable aircraft, which could eventually become the subject of a formal SNF treaty if additional unilateral measures are not forthcoming. This group could sponsor multilateral verification experiments and outline draft verification provisions. One verification concept regarding dual-capable aircraft that might be examined is the feasibility of declaring "nuclear capable" airfields and how to gear monitoring provisions to these sites while reserving use of challenge inspections for other airfields.[95] Strict counting rules for nondeployed and deployed nuclear bombs for dual capable aircraft might also be considered, along with a system of deployment cycle notifications for these weapons. If formal negotiations on dual-capable aircraft are slated, the parties could ensure that the previous unilateral withdrawals are not politically reversible by placing in the treaty the appropriate ceilings or a ban on categories of SNF that were

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[93] Talks in association with unilateral reductions could address "the rate of reductions, the qualitative and quantitative parameters of residual levels, verification procedures, and confidence- and security-building measures in the nuclear field." Pavel Bayev et al., *Tactical Nuclear Weapons in Europe: The Problem of Reduction and Elimination*, *op. cit.*, p. 42.

[94] US and Soviet officials began meeting shortly after the unilateral reductions were announced to discuss the possibility of data exchanges, but apparently the prospect of site visits has not been introduced.

[95] Evidence indicates that airfield activity can be monitored by automatic sensor networks that register acoustical and mechanical vibrations, supplemented by the use of short-range radar reflections. See *Automatic Sensor Networks for Verifying Disarmament of Aircraft*, Burkhard Rost, Institute for Theoretical Physics, University of Heidelberg, 1991.

unilaterally withdrawn. Therefore, any prohibited SNF found during the course of monitoring additionally agreed upon reductions would violate the treaty.

Prior to the extraordinary events of the Fall of 1991, unilateralism was rarely touted as a desirable approach to arms control.[96] Unilateralism, however, took SNFs off the front lines to storage and destruction much faster than traditional negotiations could ever have accomplished the task. Structuring CBMs to accompany unilateral withdrawals could improve the standing of unilateralism alongside the traditional arms control methods. The Fall of 1991 went a long way toward proving the viability and effectiveness of this method. Perhaps this season also marked the beginning of an arms control trend.

[96] For more extensive discussion of the merits of unilateral methods, see "The Race to Control Nuclear Arms," Paul Doty, Albert Carnesale, and Michael Nacht, *Foreign Affairs*, Vol. 55, No. 1, October 1976, pp. 119-132. Richard B. Foster discusses unilateralism in "Unilateral Arms Control Measures and Disarmament Negotiations", *Orbis*, Vol. 6, No. 2, Summer 1962, pp. 258-280. See also Herbert Scoville, Jr., "A Different Approach to Arms Control - Reciprocal Unilateral Restraint", in David Carlton and Carlo Schaerf (eds), *Arms Control and Technological Innovation*, London: Croom Helm Publishers, 1977, pp. 170-175.

Chapter 2
The Control and Disarmament of Chemical Weapons

Thomas Bernauer

Introduction

The 1925 Geneva Protocol, which is adhered to by 125 States[1], prohibits the *use* of chemical weapons, but not their development, production, stockpiling and transfer. Since 1968, negotiations at the Geneva-based Conference on Disarmament and its predecessors have sought to widen the scope of the Geneva Protocol and achieve a global and comprehensive ban on chemical weapons. It is widely believed that these negotiations may come to a successful conclusion in 1992.[2] In June 1990, the Soviet Union and the United States signed a bilateral agreement which is to lead to the elimination of the largest part of their chemical weapons stockpiles. Ratification of this agreement is still pending. Under the bilateral agreement, the objective of which is to facilitate the multilateral Convention, the two countries have also agreed to halt their production of chemical weapons.

This chapter analyzes the verification procedures that have been envisaged for the two mentioned international treaties and discusses the principal problems that remain to be addressed. It also examines the question of export controls on chemical weapons, relevant materials and the UN inspections in Iraq under Security Council Resolution 687, and relates them to the negotiations on the CW Convention.

What is commonly regarded as "verification" will be dealt with in terms of three components. The first component consists of criteria and definitions against which the compliance of the parties to the respective treaty can be checked, and procedures through which relevant information can be gathered with a view to assessing compliance. The second component is of a legal and political nature: the collected information is reviewed; problems of implementing the treaty are discussed against the background of a specific treaty interpretation and political considerations; and a

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[1] As of 1 January 1991 (Goldblat, Jozef and Thomas Bernauer, The Third Review of the Biological Weapons Convention: Issues and Proposals, New York 1991: United Nations (UNIDIR), p. 30).

[2] The negotiations have been accelerated as the result of a US initiative in May 1991. The text of the US initiative can be found in Conference on Disarmament document CD/1077 of 23 May 1991. The US president announced a change of the US position on two matters which had constituted a significant obstacle in the negotiations: (a) the US position that the right to use chemical weapons for retaliation in kind should be maintained during the envisaged 10 years period for the destruction of chemical weapons; and (b) the position that 2 % of the CW stockpiles should be maintained until all "CW capable" States had joined the Convention. Almost all other countries participating in the negotiations had opposed these proposals. The US president proposed a number of steps to conclude the Convention by 1992, namely, that the Conference on Disarmament's Ad Hoc Committee on Chemical Weapons stay in continuous session; that technical assistance be provided to the parties for the destruction of their chemical weapons; and that trade restrictions with regard to chemicals be imposed against non-parties to the Convention.

judgement or assessment is made. The third component consists of measures to be taken if a party is not complying with the treaty. Accordingly, the analysis will focus on international monitoring, decision-making on compliance issues, and enforcement mechanisms under the mentioned treaties.

The Projected Chemical Weapons Convention

Since 1984, negotiations in the Ad Hoc Committee on Chemical Weapons, a subsidiary body of the Conference on Disarmament, have concentrated on the elaboration of a draft Chemical Weapons Convention. At present, the so-called "rolling text" has grown to more than 150 pages (main body of the treaty and annexes).[3] The envisaged multilateral Convention is to ban the development, production, acquisition by other means, stockpiling, retention, direct or indirect transfer, and the use of chemical weapons. It would also prohibit the assistance, encouragement or inducement of anyone to engage in the prohibited activities. All chemical weapons and chemical weapons production and storage facilities are to be declared within 30 days after the entry into force of the Convention. They are to be sealed and subsequently destroyed during a ten-years period according to an agreed order.

The destruction process would take place under intensive international surveillance to ensure compliance with the disarmament obligation set forth by the treaty. The production, processing and consumption for peaceful purposes of certain chemicals in the civil chemical industry and other chemical plants is to be subject to declaration and international monitoring to ascertain that these facilities are not misused for purposes prohibited by the Convention. An "Organization for the Prohibition of Chemical Weapons" is be set up to ensure the implementation of the treaty provisions. It is to consist of a "Conference of the States Parties", an "Executive Council" with limited membership, and a "Technical Secretariat" which is to carry out the necessary inspections and other monitoring tasks and would provide administrative support.

Two basic approaches of collecting information relevant to compliance of the parties with the CW Convention have been tentatively agreed to: routine monitoring and inspections on request (challenge inspections).

Routine Monitoring

The basis for all routine monitoring activities, which are to be carried out by the Technical Secretariat on its own initiative, would be declarations by the parties. No later than 30 days after the entry into force of the Convention, the parties would have to declare whether they possess any chemical weapons or CW production facilities, and provide details on facilities which produce, process or consume chemicals that pose a risk to the objectives of the Convention (see below).

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[3] The latest version of the rolling text, which is updated at least twice a year, can be found in Conference on Disarmament document CD/1108 of 27 August 1991.

Promptly after the initial declarations have been made, the Technical Secretariat would check, through on-site inspection, the accuracy of the declarations of those countries which have declared their possession of chemical weapons or CW production facilities[4]. The Technical Secretariat would secure the weapons, the storage sites and the production facilities, and ensure that no undetected removal of declared items takes place except for destruction. Any transportation of weapons or equipment from storage to destruction facilities would be monitored to prevent illegal diversion. Technical instruments that may be used in this process include agreed seals, markers or other inventory control procedures.

The destruction of chemical weapons and the dismantling of CW production and (when destruction operations are terminated) CW destruction facilities would be subject to systematic on-site monitoring by the Technical Secretariat through on-site inspections and on-site monitoring with technical instruments. The purpose of such monitoring will be to ascertain that the destruction plans which are to be submitted in advance by each party concerned are properly implemented, this is, that the agreed quantities are destroyed within the defined time-frames. The monitoring of CW production facilities would serve to confirm that all activity has ceased at these facilities except for activities required for closure; that the declarations submitted by the parties concerned are accurate; that CW production is not resumed; that no undetected removal of declared items takes place; and that the facilities are properly dismantled.

Systematic monitoring of CW storage, production and destruction facilities will be carried out on the basis of "facility agreements". These agreements, which will be based on model agreements, have to be concluded between the Technical Secretariat and the party concerned within agreed time-frames. They will determine in advance the monitoring procedures for each facility. Some details of the monitoring systems to be installed at the declared facilities are also specified in a "Protocol on Inspection Procedures" which is attached to the rolling text.

The most difficult task under the Convention will probably be the monitoring of the civil chemical industry. Many chemicals and equipment that could be used for the production of chemical weapons are widely produced, processed and consumed[5] for peaceful purposes ("dual-use" problem[6]). Article I of the rolling text, which defines the general scope of the projected treaty, and Article II, which contains definitions and criteria, are rather imprecise as to what is to be allowed and what is to be prohibited under the Convention. The prohibitions are largely based on a "general purpose

[4] So far, the Soviet Union, the United States and Iraq are the only declared chemical weapons possessors. Around 10 to 15 other States are suspected of having chemical weapons, too.

[5] These three terms can, for the purpose of this paper, be defined as follows: producing means the formation of a chemical through chemical reaction; processing means a physical process such as formulation, extraction or purification in which a chemical is not converted into another chemical; consumption means the conversion of a chemical via a chemical reaction into another chemical.

[6] Single purpose items are items that have no other use than such prohibited by the Convention. Dual-use items can be used for permitted as well as for prohibited purposes.

criterion": activities and dual-use material are prohibited if they are to serve purposes prohibited by the treaty. Purposes, i.e. intentions, cannot be verified. The negotiators have therefore sought to establish a system of subsidiary criteria and thresholds which serve as a framework of reference against which relevant information can be collected and compliance can be assessed. This approach may be called "indirect verification".[7]

Chemicals which could be used for the production of chemical weapons have been divided into three lists according to the risk they pose to the objectives of the Convention. These chemicals, and the facilities producing, processing or consuming them, would be subject to international monitoring. The intrusiveness of the monitoring will vary according to the risk the chemicals pose, but will also depend on the feasibility of particular monitoring procedures with regard to the substances in question.[8] The three lists, or "Schedules", of chemicals are to be subject to review and updating under the Convention, according to defined procedures. A proposed Scientific Advisory Council may possibly play a role in this context.

Schedule one includes chemicals that pose the highest risk to the Convention, notably nerve agents, mustard gases, and some key precursors for binary nerve agents. These chemicals have only weapon applications with the exception of very small quantities that may be used for certain forms of medical research or treatment, or for (permitted) research aimed at developing protective measures against chemical weapons.[9] The Convention will impose strict limitations on the production, transfer and possession of such compounds. The limitations are to apply to the quantities produced or acquired (not more than one ton at any given time), the number and quality of the installations used, and the purpose of the activities. Facilities producing Schedule one chemicals have to provide regular and detailed declarations and will be subject to systematic monitoring through on-site inspection and on-site instruments. Schedule one chemicals may only be transferred for permitted purposes to other parties, and there must be no retransfer. Detailed declarations on each transfer will be required. Monitoring, which is to be based on a material accountancy system, is to focus on the following types of permitted facilities:

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[7] Indirect verification means that the provisions of the Convention are not directly verified (e.g. the non-development or non-production). A system of criteria are negotiated - for example thresholds for the production of certain substances or thresholds for declarations - and compliance with these criteria is verified. One of the only provisions in the case of the CW Convention, which is directly verifiable, is the obligation to destroy CW stockpiles and CW production facilities.

[8] The decision on whether to put a particular chemical in one of the three lists (Schedules) also depends on the extent to which the chemical is produced or consumed in the civil industry. It is possible that chemicals which pose a high risk but are produced, processed or consumed in very large quantities in thousands of facilities worldwide may be put into a lower risk category because systematic monitoring through on-site inspection would lead to excessive costs and hamper peaceful activities. The lists of chemicals are still being discussed.

[9] The rolling text uses the terms research, medical, pharmaceutical and protective purposes. In protective research, for example, Schedule one chemicals may be used in small quantities for the testing of gas mask, protective clothing, or detection or decontamination equipment.

1. A single small-scale facility that may be operated by each party. Such a facility may produce up to one metric ton of Schedule one chemicals for research, medical, pharmaceutical or protective purposes. The monitoring of this facility will ensure that the quantities of Schedule one chemicals produced are correctly declared and that their aggregate amount does not exceed one metric ton.
2. One production facility outside the single small-scale facility which may produce up to 10 kg of Schedule one chemicals per year for protective purposes; and other facilities that may produce between 100 g/year and 10 kg/year for research, medical or pharmaceutical purposes. Monitoring of such facilities is to ensure that they are not used to produce any Schedule one chemical, except for the declared chemical; that the quantities produced, processed or consumed are correctly declared and consistent with the needs for the declared purposes; and that the chemicals are not diverted or used for other purposes.

Schedule two contains chemicals that pose a somewhat lower but still substantial risk to the treaty. These compounds are mainly key precursors for chemicals listed in Schedule one and are produced in considerable quantities in the chemical industry for permitted purposes.[10] With a view to their civil use, there will be no limitation on the production of such compounds. However, facilities producing, processing or consuming Schedule two chemicals in quantities exceeding specific thresholds would have to provide regular declarations. They are to be subjected to an initial inspection, and subsequently to routine monitoring through on-site inspections and instruments.

As in the case of Schedule one facilities, monitoring might be based on a system of material balancing. If this were so, inputs and outputs and material inventories of a facility would be established through monitoring the book-keeping of the facility or through physical measurement of the inputs and outputs. The method used for a particular facility, as well as the number, intensity, duration, timing and mode of inspections would depend on the type of facility and a number of other factors.[11] However, the procedures for monitoring Schedule two facilities are still subject to intensive debate (see below). The monitoring of Schedule one and two facilities would start with an initial inspection and would be based on facility agreements which have to be negotiated for each facility in advance between the Technical Secretariat and the State concerned. These agreements, to be based on Model agreements[12], will specify detailed monitoring procedures for each facility.

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[10] Schedule 2 has been divided into Schedule two A and two B. The main characteristic of two A is that these chemicals are important precursors for a Schedule one or Schedule two B chemicals. Schedule two B includes substances that pose a risk for reasons of their lethal or incapacitating toxicity and other characteristics that make them suitable for chemical weapons (e.g. Amiton). Schedule two B is the least developed among the Schedules. A working paper on the issue was tabled by the United Kingdom (CD/CW/WP.358 of 13 August 1991).

[11] Some of these factors have been outlined in a document attached to the rolling text (CD/1108 of 27 August 1991, p.179).

[12] Model agreements for the single small-scale facility, Schedule two facilities and CW storage facilities are under discussion. Draft texts have been attached to the rolling text (CD/1108 of 27 August 1991, pp.185-201).

The monitoring of Schedule two facilities is to ensure that they do not produce any Schedule one chemical; that the declared quantities of Schedule two chemicals which are produced, processed or consumed are consistent with the needs for purposes not prohibited by the treaty; and that Schedule two chemicals are not diverted or used for purposes prohibited by the Convention (non-diversion).

Schedule three includes chemicals which are produced and consumed for permitted purposes in very large quantities in the civil chemical industry, but still pose a risk to the Convention. This Schedule contains some compounds which have, in the past, been used as chemical warfare agents (e.g. phosgene or hydrogen cyanide), as well as a number of precursors for Schedule one and two compounds. Each party would have to provide regular declarations on the aggregate production, processing and consumption of each listed chemical, and the purpose of such production. For facilities which produce, process or consume Schedule three chemicals in excess of a specific threshold, additional information would be required. With a view to the very large quantities that are produced and consumed in the chemical industry, systematic on-site monitoring to check these declarations was considered impracticable. Additional means of routine monitoring of Schedule 3 and other facilities are under discussion and will be examined below.

Inspection on Request

Routine monitoring, to be initiated and carried out by the Technical Secretariat on its own initiative, would take place only at declared facilities and would therefore leave an important gap: the parties could circumvent the prohibitions of the treaty in undeclared facilities which could not be inspected. This gap is to be closed by inspections on request, so-called "challenge inspections". These inspections, which would cover both declared and undeclared facilities, would provide a "safety net": they could be resorted to by the parties if other means, including bilateral consultations and clarification through routine procedures, had failed to remove doubts or suspicions.

In 1984, the United States proposed that any party to the CW Convention should have the right to request that a team of inspectors designated by the Technical Secretariat conduct an inspection, at any time and without delay, anywhere on the territory of another party. The requested party would have no right to refuse the inspection. The requesting State, on the other hand, would be obliged to keep the request within the scope of the Convention. The mandate of the inspection team would be the request put into operational terms. However, the question of challenge inspections remains almost completely unresolved and will be discussed below.[13] Special challenge inspection procedures are to be used for investigating allegations of the use of chemical weapons. It is likely that these procedures will supersede - among the parties to the Convention already existing procedures by which the UN Secretary-

[13] Documents reflecting the outcome of consultations on the subject include CD/1108 of 27 August 1991, pp.202-204, and CD/CW/WP.371 of 11 October 1991.

General can investigate allegations of the use of chemical or biological weapons.[14] It is possible, however, that the procedures established in the framework of the United Nations may be resorted to if the allegations relate to a non-party to the Convention.[15]

Details for the conduct of routine monitoring activities and inspections on request are spelled out in the "Protocol on Inspection Procedures" which forms part of the rolling text.[16]

The following table provides an overview of the basic obligations under the CW Convention and the envisaged procedures that could be used to monitor compliance with these obligations:

Obligation	*Declaration*	*Monitoring method*[17]
Declaration of CW stocks	Possession, size, inventory, location, destruction plans and their implementation	Systematic on-site inspection of declared sites
Non-removal of stocks except for destruction	Declarations in case of transportation from storage to destruction site, regular declarations on inventories	Systematic on-site inspection and monitoring with on-site instruments of declared facilities
Destruction of stocks	Plans for destruction and their implementation	Systematic on-site inspection and monitoring with on-site instruments of declared storage and destruction facilities

[14] The UN procedures were finalized in 1989 (see UN document A/44/561). See also Cottereau, Gilles, The Geneva Protocol on Chemical and Biological Methods of Warfare (1925) and Related Procedures, in: Sur, Serge, ed., Verification of Current Disarmament and Arms Limiation Agreements. Ways, Means and Practices, Aldershot 1991: Dartmouth (UNIDIR), pp.41-66. The procedures to verify the non-use of chemical weapons, as included in the Protocol on Inspection Procedures attached to the rolling text, have benefited from extensive research on the question carried out by Canada and Norway.

[15] The United States used to take the position, that the right to retaliate in-kind if it were attacked with chemical weapons should be retained at least during the 10 years destruction period. This position was dropped in May 1991. As a result, the unconditional non-use prohibition has made agreement on verification procedures for this obligation easier.

[16] The Protocol contains: (a) a general part covering definitions, the designation of inspectors, privileges and immunities, standing arrangements, pre-inspection activities, and the conduct of inspections; (b) a part covering routine inspections related to the destruction of chemical weapons and CW production facilities, and the verification of non-production. This part includes details on initial inspections and facility agreements, the size of the inspection team, standing arrangements, pre-inspection activities, and departure; (c) a part on challenge inspections. This part contains details on the designation and selection of inspectors, pre-inspection activities, the conduct of inspections, the departure, and reports; (d) a part on procedures to be applied in case of alleged use of chemical weapons. This part includes general provisions, provisions on pre-inspection activities, the conduct of inspections, reports, and measures to be applied with regard to States not parties to the Convention. (CD/1108 of 27 August 1991, pp.133-172)

[17] Inspections on request may be applied to check compliance with all obligations. They are only mentioned if no routine procedure is envisaged.

(continued)

Obligation	*Declaration*	*Monitoring method*[18]
Removal of CW belonging to non-parties from the territory of a party within 30 days after entry into force of the Convention	--	Inspection on request (challenge inspection)
Declaration of CW production facilities	Existence, location, plans for closure and dismantling, plans for temporary conversion into CW destruction facility and their implementation	Systematic on-site inspection of declared sites
Non-removal of equipment	(Declaration on conversion activities)	Systematic on-site inspection and monitoring with on-site instruments of declared sites
Non-resumption of production	--	Systematic on-site inspection and monitoring with on-site instruments of declared sites
Destruction of CW production facilities	Plans for dismantling and their implementation	Systematic on-site inspection and monitoring with on-site instruments of declared sites
Non-development	Data on Schedule one facilities: (a) single small-scale production facility for research, medical pharmaceutical or protective purposes (b) production facility for protective purposes (max. 10 kg/year) (c) production facility for research, medical, pharmaceutical purposes (max. 10 kg/year) (d) laboratories for research, medical or pharmaceutical purposes (< 100 g/year) Data on Schedule two facilities Data on Schedule three facilities	(a) systematic on-site inspection and monitoring with on-site instruments of declared sites (b) " (c) " (d) inspection on-request (challenge inspections) Systematic on-site inspections and monitoring with on-site instruments of declared sites Monitoring of data by the Technical Secretariat; inspection on request (challenge inspection)

[18] Inspections on request may be applied to check compliance with all obligations. They are only mentioned if no routine procedure is envisaged.

(continued)

Obligation	*Declaration*	*Monitoring method*[19]
Non-production	(a) schedule one facilities (a) - (c) above (b) schedule one facilies (d) above (c) facilities producing, processing, or consuming Schedule two chemicals (d) facilities producing, processing or consuming Schedule three chemicals	(a) systematic on-site inspection and monitoring with on-site instruments of declared sites (b) inspection on request (challenge inspection) (c) systematic on-site inspection and monitoring with on-site instruments of declared sites (d) monitoring of data by the Technical Secretariat; inspection on request (challenge inspection)
Non-acquisition	Past transfer or acquisition of CW or CW relevant equipment (since 1.1.1946); Declarations concerning CW and CW storage facilities (see above)	Systematic on-site inspection and monitoring with on-site instruments; after destruction and dismantling inspection on request (challenge inspection)
Non-stockpiling Non-retention	Declarations concerning CW and CW storage sites (see above)	Systematic on-site inspection and monitoring with on-site instruments; after destruction and dismantling inspection on request (challenge inspection)
Non-transfer	Past transfer or acquisition of CW or CW relevant equipment (since 1.1.1946); Declaration of transfers of Schedule one chemicals	Inspection on request (challenge inspection)
Non-assitance, non-encouragement, non-inducement	--	(Inspection on request?)
Non-use	--	Inspection on request (challenge inspection)

Problems to Be Solved

As a result of the East-West conflict, negotiations related to the question of monitoring compliance with the CW Convention had for a long time been dominated by an ideological and abstract approach. During the past few years, however, they have gradually moved to the stage of technical discussion and practical experimentation. Trial or experimental inspections, conducted by a large number of countries of all

[19] Inspections on request may be applied to check compliance with all obligations. They are only mentioned if no routine procedure is envisaged.

political groups, have provided valuable insights into the questions that remain to be addressed, and the approaches that could be used therefore. These experiments were initially designed to inquire on the national level the feasibility of the procedures drawn up for Schedule two facilities.[20] Multilateral trial inspections for Schedule two facilities were envisaged, but never materialized. Nevertheless, several States have conducted experimental inspections at various types of facilities (including the civil chemical industry, military installations, or single small-scale facilities) with different inspection formats (routine inspections, challenge inspections, ad hoc inspections; see below).[21] Despite this practical approach, a number of important problems remain to be addressed. They include the prevention of the abuse of monitoring procedures, the question of whether to expand the coverage of the presently envisaged routine monitoring procedures, resources necessary for the monitoring (including costs), and the question of how to assure the non-transfer of chemical weapons.

Preventing the Abuse of Monitoring Procedures and Challenge Inspections

Many delegations to the Conference on Disarmament have expressed concerns that intrusive monitoring procedures, such as the ones outlined above, may lend themselves to abuse in at least two forms: the gathering of military, industrial or other intelligence unrelated to the CW Convention during routine or challenge inspections; and the abuse of the right, for political or other purposes (e.g. to embarrass a country), to request inspections (challenge inspections). Several approaches have been proposed to solve these problems:

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[20] These national trial inspections were carried out on the basis of guidelines worked out in the Ad Hoc Committee on Chemical Weapons in 1988 (CD/CW/WP.213 of 12 September 1988). Evaluations of these trial inspections can be found in CD/CW/WP.236 of 7 April 1989 and CD/CW/WP.237 of 10 April 1989.

[21] In 1990 and 1991, reports on trial inspections were submitted by Egypt (CD/958 of 23.1.1990), France (CD/960 of 1.2.1990), USSR (CD/966 of 14.2.1990, experimental challenge inspection at a military installation), FRG (CD/975 of 9.3.1990), Yugoslavia (CD/982 of 30.3.1990), FRG (CD/983 of 5.4.1990, trial challenge inspection), Canada (CD/987 of 19.4.1990, trial inspection at a single small-scale facility), India (CD/988 of 20.4.1990), GDR (CD/996 of 12.6.1990, trial challenge inspection in a chemical industry plant), Austria (CD/999 of 12.6.1990), United Kingdom (CD/1012 of 11.7.1990, practice challenge inspections of government facilities), Netherlands (CD/1018 of 19.7.1990, trial challenge inspection), GDR (CD/1020 of 26.7.1990, trial challenge inspection), Czechoslovakia (CD/1021 of 26.7.1990, trial challenge inspection at a chemical facility), Czechoslovakia (CD/1022 of 26.7.1990, trial challenge inspection at a military facility), France (CD/1029 of 8.8.1990, trial challenge inspection), Canada (CD/1030 of 8.8.1990), Iran (CD/1040 of 31.8.1990), Canada and Netherlands (CD/1052 of 28.1.1991, trial challenge inspection), Germany and United Kingdom (CD/1056 of 8.2.1991, joint practice challenge inspection), New Zealand (CD/1057 of 13.2.91), France (CD/1063 of 21.2.1991, trial challenge inspection), United Kingdom (CD/1080 of 5.6.1991; trial challenge inspection), Spain (CD/1082 of 12.6.1991), France (CD/CW/WP.351 of 15.7.1991), Poland and the USSR (CD/1093 of 6.8.1991; trial challenge inspection), United States (CD/1100 of 14.8.1991), Germany (CD/1101 of 15.8.1991; trial challenge inspection), Germany (CD/1102 of 15.8.1991; international trial challenge inspection), the United StatesCD/1107/Rev.1 of 23.8.1991; trial challenge inspection), Switzerland (CD/CW/WP.372 of 11.10.1991; trial challenge inspection). For a discussion of the question of national trial inspections see Pugwash Newsletter, July 1991, pp.28-34. See also Trapp, Ralf, Evaluation of Experiences from National Trial Inspections in Chemical Industry, Working Paper submitted at the 16th Workshop of the Pugwash Study Group on Chemical Warfare, held in Geneva on 26-27 January 1991.

Procedures to Protect Confidential Information

Especially the civil chemical industry, and with it the respective governments, have been highly concerned over the possibility of unauthorized release of commercial proprietary information obtained during routine or challenge inspections. In the chemical industry, the pharmaceutical in particular, large-scale investments are made in research and development (for peaceful civilian purposes) and competition is high. Unauthorized transfer of even small pieces of information to competitors, e.g. on customers or on production processes, may cause grave financial losses. Consequently, procedures have been drawn up to prevent the unauthorized release of sensitive proprietary information through members of the Technical Secretariat (including the inspectors) or through other channels. The Annex on the Protection of Confidential Information[22], which resulted from this effort, defines what is to be considered confidential information. It also contains rules on the employment and conduct of personnel from the Technical Secretariat, measures to protect sensitive installations in the course of on-site monitoring, and procedures to be applied in case of breaches of the confidentiality rules. Some details are still being discussed but most delegations tend to believe that the drafted measures are adequate. In June 1991, representatives of the major chemical industries in Western countries declared that they were willing to provide the international inspectors with full access to all commercial facilities at any time, including sampling with standardized analytical methods, to check whether a chemical warfare agent or precursor is present. The only condition that they posed was, to protect commercial proprietary information, that the samples taken by the inspectors must be analyzed on-site.[23]

"Managed Access"

Procedures to protect sensitive information or installations unrelated to the CW Convention are being built into the monitoring procedures. An important means in this respect, which is still under discussion, would be to restrict, during inspections, access by the international inspectors to certain parts of a facility. This approach has been called *"managed access"*.[24] Initially, it has been envisaged for the protection of sensitive governmental facilities (e.g. nuclear weapon storage sites) during challenge inspections, but may in the end also be applied for certain inspections in the civil chemical industry.[25] The United Kingdom, which conducted perhaps the most

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[22] CD/1108 of 27 August 1991, pp.76-81.

[23] CMA News Release 8059 of 25 June 1991. Neue Zürcher Zeitung, 10 July 1991.

[24] Additional measures which are likely to be embodied in the Protocol on Inspection Procedures include, inter alia, provisions which would permit the checking, by the inspected facility or State, of equipment which is used by the international inspectors; limitations on the technical equipment to be used during the inspections; or limitations on what can be taken out of an inspected facility (e.g. for sample analysis off-site), etc. These measures cannot be discussed in detail here.

[25] The idea was introduced (CD/715 of 15 July 1986) and then developed by the United Kingdom to cope with inspections at highly secret military installations (e.g. nuclear weapon storage sites). Other States such as Germany, the Netherlands, Canada or France have participated actively in the further development of the approach.

extensive inspection experiments in this regard, argued that the problems involved in challenge inspections can be resolved through the appropriate techniques of managed access. This view seems to be supported by many Western and Eastern European countries.

Managed access procedures could employ a variety of techniques, including a negotiating process (on-site) between the inspection team and the inspected State or facility management on access to particular rooms or installations within a site. A number of routine and exceptional techniques were outlined by the United Kingdom.[26] Routine measures could be: the implementation of a previously formulated and tested plan for the removal of notice charts and displays; the logging off of computers which might disclose sensitive information; the locking away of all papers or of sensitive equipment; the use of shrouding techniques; the use, by the inspectors, of instruments such as x-ray or gamma ray spectrometry equipment, gravity meters, etc; and the use of sampling. Exceptional measures might include the shrouding of defensive positions, alarms, sensors, or deliberately changing normal security practices; and/or a system of *random selective access* under which only a defined percentage of zones, buildings, rooms or items within a site is available for inspection at the inspectors choice (several methods are possible). The random selective access procedure, which would prevent the inspectors from acquiring an overall picture of an installation, may avoid lengthy and sometimes frustrating negotiations between the Secretariat or inspection team and the inspected State or facility management on access to particular locations.[27] If, however, a procedure involving a negotiating process is used, the application of managed access techniques requires that the parties or facilities establish, in advance, plans for handling inspections at facilities which they consider sensitive. Fall-back positions and bottom lines for the negotiations would have to be defined in this respect. Also, the role of the observer of the requesting States during an inspection on request, including his role in negotiations on managed access, would need to be clarified; for example whether he/she could propose or even request access to certain sites. China and some non-aligned States hold that the role of the observer should be minimal, some Western States would like the observer to play a more important role.

The "Perimeter Approach"

On 15 July 1991, the United States submitted a comprehensive proposal on challenge inspections at undeclared facilities. The proposal was co-sponsored by Australia, Japan and the United Kingdom.[28] At the time when this chapter was

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[26] See in particular CD/1012 of 11 July 1990.

[27] See Cooper, Graham, Inspection on Request: Coming to Terms with their Scope, in: Chemical Weapons Convention Bulletin, Issue No.10, December 1990, pp.1-3.

[28] CD/CW/WP.352 of 15 July 1991. The United States also submitted a working paper on challenge inspections at declared facilities (CD/CW/WP.356 of 6 August 1991). Access to places within a declared facility would be governed by techniques of managed access (see above) if there is no facility attachment. If there is a facility attachment, the inspection would be governed by this attachment. Inspections at declared CW development facilities would be conducted on the basis of managed access. Since inspections at undeclared facilities are the most problematic, we will focus on them.

finalized, the US proposal was under intensive consideration and it seemed possible that it could be accepted in a modified form. The proposal contains provisions on managed access mechanisms but goes much further in restricting access by international inspectors to sensitive facilities. As a matter of fact, it seeks to establish a (somewhat limited) right of refusal by the requested State. The main reason for this radical departure by the United States from its position on challenge inspection held since 1984 was concern over the protection of US military technology. The US proposal is less intrusive than most Western States - except for the United States - would have liked, but apparently still not acceptable to a number of developing countries such as China or Pakistan.

According to the US proposal, an inspection could be conducted anywhere, but the requested State would have the right to protect sensitive installations and prevent disclosure of confidential information not related to the Convention, in accordance with a Protocol on Inspection Procedures. Requests must be within the scope of the Convention. The mandate for an inspection would be the request put into operational terms by the Director-General of the Technical Secretariat. Notification to the requested State must be given 12 hours prior to the arrival of the inspectors at the point of entry. The precise site to be inspected would only be indicated to the inspectors and the challenged State within 24 hours after the inspectors have arrived at the point of entry into the territory of the challenged State ("requested perimeter")[29].

The requested State would have the right to propose an "alternative perimeter" to the inspection site perimeter specified in the request.[30] The requirements in this regard are that, as a rule, the alternative perimeter shall include the challenged site and should bear a close relationship to the requested perimeter. It is not clear, however, how close

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[29] The perimeter of the site to be inspected must be specified in the request, either through geographic coordinates or by description on a map. The proposal also contains some guidelines as to how the site must be specified. The requested perimeter shall run a reasonable distance outside any structures, not cut through existing security enclosures, and run a reasonable distance outside any existing security enclosures that are included in the requested perimeter. During a presentation in the Ad Hoc Committee on Chemical Weapons on 4 October 1991, the United States suggested that commercially available satellite imagery, maps, and photo-interpretation may be used by the requesting State in determining the perimeter of the site.

[30] The perimeter approach relates to the question of "alternative measures", an approach that had been under discussion for several years already. To protect the parties against abusive requests for inspections (challenge inspections), it had been suggested that the requested party may propose alternatives to full access to a facility (*"alternative measures"*) to prove its compliance with the Convention. No agreement was reached on what precisely such alternative measures could be. The feasibility of the concept was therefore questioned. Alternative measures may include partial access, external observation, photography, remote sensing, sampling at the surroundings of a facility, automatic sampling inside a plant, etc. The most difficult point, however, was the question of what would happen if the proposal(s) by the requested State were not accepted by the requesting party ("last word problem"). Most Western and Eastern European States held that, if the proposals were not accepted, the inspection should be carried out as planned (full access). Some non-aligned countries wanted the matter to be transferred to the Executive Council for consideration and decision. A few countries suggested that the inspection team should decide. Agreement on such a solution was unlikely since few countries are willing to leave such an important decision to the inspectors. The question of whether the requesting, the requested State, or the inspection team or Executive Council should have the last word can be traced throughout all proposed formula for challenge inspections.

the relationship between the requested and alternative perimeter must be.[31] The challenged party will make "every reasonable effort" to reach agreement with the inspectors on the modalities for the inspection. If the requested perimeter is accepted by the challenged State, it becomes the "final perimeter". The designation must be made within 60 hours after the specification of the location of the challenged site. The inspectors must be able to reach the site not later than 12 hours after the agreement. If the challenged State does not accept the requested perimeter, it shall propose an alternative perimeter not later than 60 hours after notification of the location of the challenged site. If the alternative perimeter is accepted by the challenged State, it becomes the final perimeter and the inspectors must be enabled to arrive at the site within 12 hours. If there is no agreement on the proposed alternative perimeter, the challenged and the challenging State should agree on a "provisional perimeter". The perimeter negotiations must be concluded within 60 hours after specification of the challenged site. If there is no agreement at the point of entry, the challenged State shall designate the alternative perimeter as the provisional perimeter and ensure the arrival of the inspectors at this perimeter within 12 hours. Prompt access must be given to the provisional perimeter. If no agreement is reached after 96 hours after the inspection team's arrival at the provisional perimeter, the latter shall be designated as the final perimeter. This means that the inspected State has the last word. As a general rule, access within the requested perimeter shall be provided as soon as possible, but no later than 168 hours after specification of the location of the requested site. Within the perimeter that is inspected, managed access techniques may be applied. This means that access to any place within the requested and final perimeters and the particular inspection activities are negotiable and that alternative means to satisfy the concerns could be used (e.g. sampling around a facility or letting only one member of the inspection team look into a building from the door). In addition, the challenged party may take measures to protect sensitive installation or data (e.g. removal of certain items, shrouding, restrictions on sample analysis, logging off of computers, random selective access, exclusion of certain inspectors; see above).

Within the requested perimeter, the challenged State must grant to the challenging State at least one of the following: access on the ground by one or more members of the inspection team to portions within the requested perimeter (some sort of managed access); aerial access, for example in line with the proposed Open Skies regime[32]; observation into the perimeter from an elevated platform; use of tamper-evident sensor suites specifically designed to detect relevant chemicals as developed and approved by

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[31] The proposal contains suggestions such as the following: an alternative perimeter is a short, uniform distance from the requested perimeter; or, at least part of the requested perimeter is visible from the alternative perimeter.

[32] The question of aerial inspections cannot be discussed in detail here. It may be noted, however, that aerial inspections may be employed to render routine or challenge inspections more effective. They may be used, for example, for site orientation and familiarization, or as a less intrusive inspection measure in the context of managed access. See Smithson, Amy and Michael Krepon, Strengthening the Chemical Weapons Convention Through Aerial Inspections, Occasional Paper 4, The Henry L. Stimson Center, Washington D.C., April 1991.

the parties in accordance with the Convention and as the aerial or surface access permitted by the challenged party. This means that, in the worst case, the requesting party might, after one week of negotiations, be allowed to look at a facility from an elevated platform located outside the perimeter, or might be allowed to observe the facility from an airplane, possibly without any sensors.

The requesting State has the right to send an observer, but his/her role will be limited. He/she will have the right to make recommendations to the inspection team, but it is up to the inspection team to accept these recommendations. The challenged party has the right to bar the observer from entering specific places. The observer will, however, be informed by the inspection team about the conduct and the findings of the inspection.

The report on the inspection will be transmitted to the challenging State, the challenged State, the Executive Council, and all other parties. It will contain the factual findings and an assessment by the inspectors of the degree and nature of access and cooperation granted by the challenged State. It will also describe the extent to which the inspection team could fulfill its mandate. If requested by any party, the Executive Council will meet to review the situation and consider "any appropriate further action" to redress the situation and ensure compliance with the Convention. The challenged and challenging parties will have the right to participate in this meeting.[33]

"Political Filter"

A few countries hold the view that abusive requests for challenge inspections should be prevented through a "political filter". Requests for a challenge inspection would have to pass through this filter - i.e. they would have to be approved by an international body - in order to be carried out. This would create an opportunity to stop abusive requests. The United States (in 1984[34]), China (in 1990[35]) and Peru (in 1991[36]) made proposals to this effect.

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[33] The results of a US trial inspection on the basis of the perimeter approach are described in CD/1107 of 23 August 1991 and CD/1100 of 14 August 1991. A detailed criticism of the perimeter approach can be found in Smithson, Amy E., "Chemical Inspectors: On the Outside Looking In?", in: Bulletin of the Atomic Scientist, October 1991, pp.23-25.

[34] CD/500 of 18 April 1984. The United States proposed a Fact-Finding Panel. For a description of the US Proposal see Bernauer, Thomas, The Projected Chemical Weapons Convention: A Guide to the Negotiations in the Conference on Disarmament, New York 1990: United Nations (UNIDIR), pp.177-178). The US proposal has been overtaken by the "perimeter approach" proposal.

[35] CD/1031 of 10 August 1990. China proposed that the Executive Council serve as a political filter. In addition, China proposed that the right to request an inspection any time, anywhere and with no right of refusal should be limited to "any facility, location or installation relevant to the compliance with and implementation of the Convention". Whether the site in question is "relevant" would supposedly be decided by the Executive Council.

[36] CD/1075 of 14 May 1991. Peru proposed a two-step process. Any request for an on-site inspection would be communicated to the Technical Secretariat which would notify the requested State and the Executive Council within 24 hours. An inspection team would be quickly dispatched. The inspectors would have access to any facility relevant to the request, but not yet anywhere. If the problem could not be clarified, the Executive Council would meet within 48 hours to consider the extension of the mandate for the inspectors to "anywhere" within the scope of the request to enable it to make an assessment about compliance with the treaty.

The proposals for a political filter are deemed unacceptable by many States participating in the negotiations. The reasons are as follows. Such a procedure would delay the launching of inspections on request or may prevent them altogether. It would therefore fail to restore confidence in the treaty in moments when there are suspicions and doubts over compliance. The decision (possibly by the Executive Council) of whether a request is justified or whether a site is relevant to compliance with the Convention would be an extremely difficult undertaking. In any event, the procedure is likely to be discriminatory: requesting States which do not have the national technical means to gather detailed intelligence on the case in question may be less capable of justifying their request during the decision-making process. In addition, some States are less "popular" than others in international fora, and popularity is constantly changing. It is therefore likely that requests would not be treated in an objective and impartial manner.[37]

National Legal or Constitutional Problems

A question of national constitutional nature, which becomes important in the context of challenge inspections, is whether a request for inspection could be turned down by a judge or court of the requested party. National law in many Western States, for example, requires a search warrant for the search of private dwellings, and sometimes also for the search of commercial facilities (depending on other regulations). Some countries, for example the United States, have therefore hesitated to pursue the idea of the "anytime, anywhere, without the right of refusal" approach because this might necessitate a (difficult) amendment of the constitution. How the problem will be solved is not yet clear. Providing for exemptions in the text of the Convention, covering the mentioned case, would weaken the whole challenge inspection procedure. (Courts and judges do not enjoy the same degree of independence from their government in all countries.) Reservations to the Convention, providing for such exemptions, would also be unacceptable to many States. It may be noted, however, that many facilities which could be subject to inspections under the Convention are already subject to extensive national regulations and must grant access to national inspectors even without a search warrant.[38]

Expanding the Coverage of the Routine Verification System

Many negotiators agree that there is a gap in the routine monitoring procedures so far included in the rolling text which are to ensure that dual-use capabilities in the civil chemical industry are not misused: a number of facilities which are capable of

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[37] A good example for the problems involved is the UN Human Rights Commission which may launch investigations into human rights violations.

[38] On the question of verification and U.S. constitutional law, see Hamburg, Eric, Arms Control Verification and the U.S. Constitution, Working Paper of the Center for International Security and Arms Control, Stanford University, August 1989. See also, Tanzman, Edward A., and Barry Kellman, Legal implementation of the Multilateral Chemical Weapons Convention: Integrating international security with the Constitution, in: New York University Journal of International Law and Politics, Vol.22, No.3, Spring 1990, pp.475-518.

producing chemical warfare agents, but would not be subjected to routine monitoring by either data reporting or on-site inspection[39]; and Schedule three facilities would not be subject to any on-site inspection.

To close this gap, Australia, the Federal Republic of Germany and the United Kingdom proposed to expand the coverage of routine on-site inspections beyond Schedule two facilities. They submitted that this should be done in the form of non-systematic inspections which would supplement the routine procedures so far envisaged.[40]

The proposed "ad hoc inspection" or "ad hoc check" or "ad hoc visit" procedures were supported chiefly by Western and Eastern European countries, including the United States and the Soviet Union. According to the prevailing view among these countries, the ad hoc procedures could be triggered on the basis of National Registers of the chemical industry, to be established by each party according to agreed criteria. Facilities to be covered by these inspections would include so-called "CW capable" facilities. These are facilities capable of producing chemical warfare agents but not subject to declaration under Schedule two or three because their current consumption, processing or production of chemicals does not require such declaration. Detailed proposals on how to establish the registers were made by the Federal Republic of Germany.[41]

Agreement on what constitutes a "CW capable" facility has not yet been reached. Criteria such as the production of certain organic chemicals in excess of specific thresholds, facilities with a certain production capacity for such chemicals, raw material consumption, plant equipment, safety features, plant location, special security regimes, preparations for handling accidents, etc. have been mentioned. It was suggested that only a minimum of information should be required on the listed facilities.[42] Since a agreed definition of CW capable facilities does not exist, it has remained unclear how many facilities could possibly be covered under such an inspection mechanism. States

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[39] Facilities which produce listed chemicals or have the capability to do so may remain completely outside the monitoring system because they do not produce such chemicals (at present) or produce them in quantities smaller than the thresholds for declaration and monitoring. The more developed industrial economies are increasingly shifting their production from dedicated to multi-purpose plants. Such plants are convertible to the production of various products within a short time. (See Lohs, Karlheinz, Perry-Robinson, Julian, Smidovich, Nikita P., Verification and Chemical-Warfare Weapons, in: Verification: Monitoring Disarmament, ed. by Calogero, Francesco, Goldberger, Marvin L., Kapitza, Sergei P., Westview Press 1990, p.142.)

[40] CD/698 of 4 June 1986 (Australia), CD/627 of 1 August 1985 (FRG), CD/791 of 25 January 1988 (FRG), CD/869 of 6 September 1988 (FRG), CD/909 of 30 March 1989 (United Kingdom). In April 1990, Australia tabled a paper on so-called "ad hoc visits" (WP.286). It contained ideas which had emerged from consultations in the Western Group and tried to reconcile the German and British proposals. The scope of the inspections would correspond to those proposed by Germany, and the inspections could be triggered by the parties and the Technical Secretariat based on a quota system. See also the working paper on ad hoc visits, submitted by the United States in 1990 (CD/CW/WP.300), which contained proposed amendments of the rolling text. Ad hoc inspection procedures were tested in trial inspections by several countries, including the FRG (CD/950), the Netherlands (CD/925) and France (CD/CW/WP.351).

[41] CD/984 of 10 April 1990.

[42] E.g. Pugwash Newsletter, July 1991, p.28. A number of criteria are also mentioned in a working paper attached to the rolling text (CD/1108 of 27 August 1991, p.184).

advocating ad hoc inspections seemed to agree that the latter should be conducted in a comparatively less intrusive manner: they should only be used to check the absence of undeclared chemicals listed in the three Schedules.[43] It is likely that more mobile or even portable equipment would be very useful for such inspections. The prevailing view was that there should be no facility agreements for the inspection of CW capable facilities. Therefore, the Protocol on Inspection Procedures would have to be carefully devised so as not to compromise confidential business and other sensitive information unrelated to the CW Convention.

The advocates of ad hoc procedures were able to agree on a precise format for such inspections. Problems to be solved include finding the appropriate criteria to select the industrial facilities so as to cover the relevant ones and not to overburden the Technical Secretariat by widening the basis of monitoring too much. It also remains to be discussed whether to check the absence of all listed chemicals, or only of Schedule one chemicals.[44] Another moot point is who would trigger the inspections by selecting the facilities from the register: the parties or the Technical Secretariat, or both.

The main opposition to the ad hoc concept, however, came from China and some non-aligned countries. They argued that there was no need for ad hoc inspections because the envisaged routine monitoring and challenge inspections were sufficient. Another reason for their opposition is the following: Presently envisaged routine monitoring of the industry would cover facilities producing or consuming Schedule two chemicals in excess of specific quantities. Very few if any facilities in developing countries would therefore be subject to routine inspection. Ad hoc inspections would probably increase the range of facilities to be inspected and might therefore affect facilities in developing countries to a larger extent.

Continuing concerns over the possibility of excessive costs of the routine monitoring system, and the inability to arrive at an agreement on ad hoc inspections or another arrangement to close the perceived monitoring gap, have led to further proposals on how the routine monitoring system could be improved.

In this context, Sweden proposed a "unified system of verification in the chemical industry based on a qualitative approach": this is a non-systematic monitoring procedure that would replace the monitoring system envisaged for Schedule two and three.[45] The "qualitative approach" would be designed to reduce the actual inspection

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[43] The ad hoc inspection approach may be considered as a shift to a more qualitatively oriented routine verification scheme. The mechanisms based on the three Schedules would essentially produce statistical answers on compliance by the parties. Ad hoc inspections or the "unified" monitoring system proposed by Sweden (see below) could generate more qualitative evidence in terms of making technological assessments about facilities, their equipment and their activities.

[44] Checking the non-presence of all listed chemicals may create many false alarms. Even if, for example, undeclared Schedule two production were detected, it would have to be established whether this activity did exceed the annual production, processing or consumption threshold required for declaration. This would require additional inspections. Gross violations could certainly be detected, but facilities operating close to the threshold set for declaration and inspection, especially multi-purpose facilities, would pose considerable problems.

[45] CD/1053 of 4.2.1991. The idea, which was announced already in December 1990, draws on earlier proposals by Australia and the Netherlands.

effort (the presently envisaged procedures were considered to be unmanageable) while at the same time the scope of the inspection effort could be widened to more facilities. Elements of the existing Schedule two and three system would therefore be combined with elements of the proposed ad hoc inspection scheme. The proposed system would be based on declarations, free access and selective inspections.

The parties would have to declare facilities planning to produce Schedule two or three chemicals in excess of a given threshold. In addition, they would declare facilities planning to produce other discrete chemicals above a given threshold using one or more defined chemical conversion processes. Relevant chemical conversion processes would be listed in a new Schedule four.[46] Annual declarations on aggregate quantities of past production, export or import of each Schedule two or three chemical would be required.

All declared facilities would be liable to receive on-site inspections on short notice. These inspections would be based on a limited mandate; they would be used to check whether the declarations are correct and whether any Schedule one or any undeclared production of Schedule two or three compounds is taking place. The inspection format would therefore not be based on the material balance approach so far proposed for Schedule two. The initial inspection currently envisaged for Schedule two facilities would be used for Schedule two and three facilities, but there would be no facility agreements.[47] Each facility would thus receive at least one inspection but the time-frame presently envisaged for Schedule two could be stretched. Furthermore, each party could propose, at declared facilities on the territory of other parties, a maximum of 10 inspections annually, and would be obliged to propose at least one inspection. The proposals for the facilities to be inspected would be treated so that the Technical Secretariat would not reveal the proposing party. The Technical Secretariat would select randomly the facilities to be inspected from the pool of proposed ones. No facility could receive more than two inspections within 12 months. If the actual number

[46] Sweden defined chemical conversion processes in the following way: "Chemical industrial processes by which reactants are transformed into products can be classified in terms of 'chemical conversion processes'. Each such process embraces a number of individual reactions or chemical conversions, utilizing the same main types of process equipment under similar reaction conditions." (CD/1053, p.8) A proposal on the contents of Schedule four was submitted with the Swedish working paper. It listed the key chemical conversion processes that could be used in the production of Schedule one, two and three chemicals. Using the criterion of chemical conversion processes to identify relevant facilities is based on the following considerations. Some types of chemical processes involving unlisted chemicals could be used to convert specific chemicals into listed chemicals, notably Schedule one chemicals. The speed with which this could be done depends on the design of a facility, i.e. on whether there would be a need for altering the facility. The possibility that a relevant conversion process could take place at a specific facility could be evaluated on the following bases: One could examine the chemicals which are currently produced or consumed and examine any theoretical possibility of converting the chemicals involved into a chemical listed under the CW Convention. If this were theoretically possible, one may have to check the practical feasibility in terms of the design of the facility and classify the facility accordingly. Another possibility would be to start with currently applied production processes and examine whether they could be switched to any of the listed conversion processes.

[47] Trial inspections have shown that the negotiation of facility agreements may be a very complicated, time-consuming, and therefore costly process, and could possibly overburden the Technical Secretariat during the initial phase after the entry into force of the Convention.

of inspections proposed by the parties fell short of an agreed level, the Technical Secretariat could select facilities at random from the lists of declared Schedule two or three facilities.

The reaction to the Swedish proposal was mixed. Some delegations noted that the proposed system might be more cost-effective; that it would cover Schedule three facilities and facilities "capable" of producing listed chemicals but not declared and monitored under the presently planned procedures; and than no facility agreements would be required. Others pointed to important weaknesses in the Swedish proposal: Firstly, the monitoring would focus only on production, but not on processing and consumption. The non-diversion of Schedule two and three compounds would therefore not be subject to monitoring: the purpose for which the substances are produced and the destination of these chemicals would not be established. It will be noted, however, that national trial inspections have shown that non-diversion is very difficult to check also under the presently envisaged Schedule two procedures.[48] Secondly, the extension of inspections to facilities that use certain conversion processes may affect many facilities which have so far not been considered chemical (e.g. the petroleum refining industry). The number of inspections might therefore increase dramatically and lead to higher costs. In this context, some developing countries expressed criticism because the proposed new measures might apply to some of their facilities which would not be affected under the routine measures so far envisaged in the rolling text. (The same problem exists for ad hoc inspections.) Thirdly, checking the non-presence of undeclared Schedule two and three chemicals, in addition to Schedule one chemicals, may be time consuming and more complicated than just checking the non-presence of Schedule one chemicals. Such monitoring may often not produce relevant results, because the purpose of the chemicals and their use would remain unclear. (The same problem exists for ad hoc inspections).

In July 1991, some members of the Group of 21[49] submitted a proposal which advocated the maintaining of systematic inspections for Schedule two facilities, including initial inspections and facility agreements. Depending on a risk assement made by the Technical Secretariat during the initial inspection according to a number of criteria, a Schedule two facility could be subjected to "systematic routine inspection" (SRI) or "random selective inspection" (RSI). The facilities subject to RSI would, according to the risk assessment by the Technical Secretariat, be classified in three baskets. The ratio of inspections would be 3:6 for high-risk facilities, 2:6 for medium-

[48] The measures envisaged so far focus mainly on the consistency of declarations and material balances at a facility, and not so much on non-diversion. To know where material unaccounted for went would require intrusive monitoring of marked links, exports and imports, material flows between facilities, etc. This is, for practical reasons, impossible. The system envisaged under the CW Convention does, in this respect, not match nuclear safeguards as performed by the IAEA under the Nuclear Non-Proliferation Treaty. According to most experts, full-fledged monitoring of non-diversion under the CW Convention is not feasible. For a comparison of the nuclear safeguards and monitoring under the CW Convention see: Schiefer, Bruno H., Keeley, James F., eds., International Atomic Energy Agency Safeguards as a Model for Verification of a Chemical Weapons Convention, Ottawa 1989: External Affairs Canada.

[49] CD/CW/WP.348 of 27 June 1991 (Egypt, Ethiopia, Indonesia, Iran, Kenya, Nigeria, Pakistan, Yugoslavia).

risk facilities, and 1:6 for low-risk facilities. The Conference of the States Parties or the Executive Council would determine the annual number of inspections in each category for the coming year. In case of changes in a facility, the assessment and classification by the Technical Secretariat could be repeated.

For the first time, the sponsors of the proposal also subscribed to the principle of on-site inspections in Schedule three and "CW capable facilities". To this end, they proposed a mechanism of general surveillance of data and random selective visits (RSV). The facilities to be inspected would be selected by the Technical Secretariat on a purely random basis. The same classification as for random selective inspections in Schedule two facilities was suggested.[50] A facility agreement would not be required. CW capable facilities were defined as: capable of producing organic chemicals containing the elements of phosphorous, fluorine, and sulfur or those involving the processes of phosphorylation, fluorination or sulfurilation identical to those chemicals included in Schedule one as well as Schedule two chemicals; having the same process equipment and machineries as for Schedule two chemicals; and having the same process equipment layout as for the production of Schedule two chemicals.

The definition of CW capable facilities and the selection of facilities to be inspected seem to constitute the most difficult problems with regard to the discussion on whether to expand the coverage of the routine monitoring system. Many countries of the Group of 21 seem to favour a restrictive definition of CW capable facilities and a purely random selection of facilities to be inspected. Western and some European Neutral countries, supported by their chemical industry, on the other hand, tend to regard a broader definition and random selection combined with national nomination as the better approach.

Resource Requirements for Operating the CW Convention

The intrusiveness and extent of routine monitoring, which will result from the negotiations, depends also on available resources, or rather the resources which governments and national constituencies are willing to make available for the purpose of the Convention. In recent years, there has been increasing concern that the measures provided for in the rolling text, especially the envisaged routine monitoring system, may lead to excessive direct and indirect costs[51]. Several attempts have been made to evaluate the requirements in this regard[52], but precise costs estimates are difficult

[50] The proposal remained very vague on this point.

[51] Indirect costs include, for example, costs to be met by the civil chemical industry (e.g. personnel to negotiate the facility agreements with the Technical Secretariat, organize the inspections and accompany the inspectors).

[52] E.g. Congress of the United States, U.S. Costs of Verification and Compliance under Pending Arms Treaties, September 1990: Congressional Budget Office. Canada, The Chemical Weapons Convention and the International Inspectorate: A Quantitative Study, August 1990. Beck, Herbert, Verifying the Projected Chemical Weapons Convention. A Cost Analysis, AFES-PRESS Report No.13, Mosbach 1989. CD/CW/WP.364 of 21 August 1991 (United States: "A Chemical Weapons Convention. Staffing and Cost Estimates for a Technical Secretariat").

if not impossible to produce.[53] Predictions on the annual costs of the Technical Secretariat (not including costs for destroying CW) vary from 100 million to 500 million US Dollars.[54] The formula for cost sharing is under consideration. Some countries advocate the UN cost sharing system, others want other criteria to be considered as well (e.g. the inspections required as a result of a country's CW stocks and/or the size and quality of its chemical industry).

In any event, it seems clear that costs will be considerable. It has therefore been questioned whether the extent of routine monitoring so far envisaged in the rolling text makes sense. First of all, it is rather unlikely that violations of the treaty would occur in declared facilities which are subject to routine monitoring. So why spend most of the resources on checking these facilities? Partly as a result of such criticism, the confidence-building effect rather than the deterrence effect of routine measures has been stressed. Secondly, there may be procedures which cost less but are just as effective. Proposals for such procedures are intensively discussed at present (see above).

The operation of the Convention will require extensive preparation. To this end, a Preparatory Commission will be established. The Commission will begin its work after a certain number of States (probably around 50) have signed the Convention.[55] Its tasks will be enormous. Among other things, the headquarters of the Organization,

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[53] National trial inspections may provide some ideas as to how expensive the monitoring would be. However, there is no agreement on how many facilities should be inspected and what the inspection format should be. (Example: Sweden noted that around 1000 facilities would be subjected to the Schedule two regime, Canada mentioned around 200 facilities for Schedule two and around 100 for Schedule three. A working paper by a group of non-aligned countries mentions a minimum of 10.000 Schedule three facilities that exist now and an increase by 15.000 by the turn of the century. It seems that the latter figures do not relate to the facilities that will actually have to be reported and/or inspected because most of them produce, process or consume quantities below a specific threshold. Additional information as regards the verification burden can be obtained through the voluntary data exchange that has been under way in the framework of the CD for several years already. However, the case of thiodiglycol demonstrates the difficulties in obtaining reliable data on even the most common chemical weapon precursors (see Lundin, S.J., Verification of Dual-use Chemicals under the Chemical Weapons Convention: The Case of Thiodiglycol. Sipri Chemical and Biological Warfare Studies 13. Oxford 1991: Oxford University Press.

[54] The study, published by the Canadian Government, arrives at annual costs for the Technical Secretariat of around 120 million dollars, and one-time costs of up to 30 million dollars to electronically secure all sites. The study by the US Congress predicts much higher costs (partly for political reasons, as some observers have noted). For the bilateral US-Soviet CW Agreement, concluded in June 1990, it estimates 45 - 220 million dollars in one-time costs and 15 to 70 million dollars in annual recurring costs. These figures do not include elimination costs. The estimates draw on experience with the INF agreement and mutual visits to CW facilities under the bilateral Memorandum of Understanding signed in Wyoming in June 1989. It is clear that the multilateral Convention would cost more than the bilateral agreement. The study estimates that one-time costs would probably not exceed 1 billion dollars, and that recurring annual costs would not exceed 0.5 billion dollars. A working paper, issued by the United States in August 1991, estimates around 163 million US$ per year to run the Technical Secretariat. This sum does not include capital costs. The United State estimates that around 50 million US$ would have to be added to the start-costs. This estimate is based on the costs to construct, finish and furnish a facility for 1.225 people (the US estimate for the number of staff of the Technical Secretariat).

[55] A table attached to the rolling text (CD/1108 of 27 August 1991, pp.217ff) provides an idea as to the tasks that lie ahead.

including the administrative services, need to be set up[56], the staffing pattern of the Technical Secretariat has to be established, a pool of highly qualified inspectors and other personnel needs to be recruited[57], the inspectors and other personnel have to be trained, technical instruments have to be standardized and acquired[58], the staff rules have to be drawn up, guidelines for initial inspections and facility attachments have to be devised, etc. Most of the duties of the Organization will commence very shortly (around 30 days) or even immediately after the entry into force of the Convention. The tasks include the processing of declarations, the negotiation of facility agreements, initial inspections, the verification of declarations, the securing of sites where chemical weapons are located, the securing of CW production facilities, the designation of inspectors, the conduct of challenge inspections, etc.

National Implementation

It is evident that the implementation of the envisaged international monitoring measures requires a high degree of cooperation between the Organization and the national authorities. The latter would have to collect regularly the necessary data to submit the declarations. They would also be responsible for hosting all on-site monitoring activities. National legislation[59] and organizational arrangements on the national level are therefore required. Article VII of the rolling text contains a few guidelines to this end. Several studies on the subject have been carried out.[60] Some countries, for example Australia[61], Canada, Germany, the Netherlands, Peru and the United Kingdom, are working on the necessary measures including legislation. Some

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[56] Several countries including Austria, Belgium and the Netherlands have offered to host the Organization.

[57] Some negotiators and other experts have noted that finding a sufficient number of highly qualified inspectors may be very difficult. Working conditions and salaries of inspectors will certainly have to be made sufficiently attractive to compete with well paid jobs in the civil chemical industry. Experience of the IAEA should be carefully studied in this regard.

[58] The question of technical resources (including technical instruments) necessary to implement the monitoring procedures will not be discussed in this paper. Instruments such as seals, markers, mobile equipment for identifying listed chemicals, or data bases to be used by the inspectors have been examined in a series of national projects and national or bilateral trial inspections. Canada, Finland, Germany, Norway, the United States, Sweden and a few other countries have been particularly active in this regard and have submitted many reports to the Conference on Disarmament. The Ad Hoc Committee on Chemical Weapons established a Technical Group on Instrumentation. This Group submitted two reports (CD/CW/WP.272 and CD/CW/WP.306). In 1991, the Ad Hoc Committee set up a Technical Group on Analytical Data Base and Laboratories. This Group submitted a report in July 1991 (CD/CW/WP.349 of 12 July 1991).

[59] It must, for example, be assured that international inspectors have access to facilities that are on the territory of a party but under the control of a third party or non-party to the Convention; or, that the inspectors have access to facilities where access is limited as a result of license agreements. A study of the US case can be found in Hamburg, Eric, Arms Control Verification and the U.S. Constitution, Working Paper of the Center for International Security and Arms Control, Stanford University, August 1989.

[60] E.g. Stock, Thomas, and Ronald Sutherland, National Implementation of the Future Chemical Weapons Convention, SIPRI Chemical and Biological Warfare Studies 11, Oxford 1990: Oxford University Press. Canada, Role and Function of a National Authority in the Implementation of a Chemical Weapons Convention (CD/994 of 30 April 1990).

[61] Australia submitted a working paper outlining its strategy for preparing the implementation of the Convention (CD/1055 of 5 February 1991).

experts have pointed out that activities which are relevant to the CW Convention are already extensively regulated in many States, especially industrialized countries, in terms of environmental, transportation, import/export and customs regulations, work place regulations or product registration. As a result of such existing national legislation, national inspectors often have considerable powers to check the relevant facilities. The gathering of the necessary information on the national level for the declarations which are to form the basis for international routine monitoring may therefore not require large-scale additional efforts.[62]

Preventing the Transfer of Chemical Weapons

In connection with increasing allegations of chemical weapons proliferation since the beginning of the 1980s and the use of these weapons in the Iran-Iraq war, Western and Eastern European countries began to install export controls on chemical weapons relevant materials and, later on, also technology. While global efforts to coordinate these non-proliferation measures have so far failed, international coordination in smaller groups has been more successful.[63]

Western and some European Neutral countries coordinate their national efforts in the framework of the so-called Australia Group, which consists of 22 countries[64]. This group meets semi-annually and maintains a list of chemicals (precursors) that could be used for the production of chemical weapons. The participating countries have entered into a politically binding obligation - in the form of a gentlemen's agreement - to control the export of these substances through national measures. In May 1991, the Group agreed to expand its core list to 50 chemicals. By the end of 1991, the 22 members of the Group will subject these 50 precursors to export-licencing requirements.[65] A list for dual-use equipment and technology is under consideration. For political reasons, the Australia Group does not maintain a list of countries with regard to which the export countrols are applied. The way in which exports are controlled, as well as the target countries, are determined by each participating State. The most elaborate, stringent, and publicly highlighted export controls are currently being implemented in the Federal Republic of Germany and the United States.[66] Efforts to harmonize national export control policies are also under way in the

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[62] The author is grateful to Prof. Ronald Sutherland for information on the situation in Canada. Exchanges of data relevant to the CW Convention, which have taken place voluntary in the framework of the Conference on Disarmament, may have provided the States concerned with valuable insights into their national situation.

[63] A most comprehensive analysis of the question of chemical weapons proliferation can be found in: Burck, Gordon M, Charles C. Flowerree, International Handbook on Chemical Weapons Proliferation, Westport, CT 1991: Greenwood Press.

[64] Australia, Austria, Canada, the 12 member States of the European Communities, Japan, New Zealand, Norway, Switzerland, the United States, Sweden and Finland.

[65] Australia, Ministry of Foreign Affairs and Trade, News Release, 24 May 1991. Daily Bulletin of the US Mission to the UN in Geneva, 3 June 1991.

[66] In the case of the United States, these efforts are based on Executive Order 12735 of 16 November 1990. On 13 December 1990, the United States lauched the Enhanced Proliferation Control Initiative (EPCI). On 7 March 1991, the publication of regulations intended to implement the Executive Order and the EPCI was announced. The implementing regulations, which are very complex, were issued by the US Department of Commerce on 13 March 1991. Information on these measures is contained in CD/1086 of 28 June 1991.

framework of the European Communities. Eastern European countries used to coordinate their measures in the "Leipzig Group", but this Group has become inactive.[67] Most of its members are seeking to join the Australia Group and have adjusted their export controls to the guidelines of the Australia Group.[68]

In 1991, France and the United States launched an effort to arrive at an agreement between the five permanent members of the UN Security Council to control conventional arms transfers and the spread of weapons of mass destruction, particularly in the Middle East.[69] However, maily due to opposition by China, the initiative has so far not succeeded.

Since at least 1989, these measures to stem the spread of chemical weapons are widely regarded not as an alternative to a Chemical Weapons Convention, but as a complementary measure to prevent the worst until the Convention enters into force. But, it is not yet clear how export controls such as the ones by the Australia Group will be brought in line with the envisaged Convention.

One of the fundamental obligations under the Convention will be not to transfer chemical weapons or to assist or encourage anyone in their acquisition. This obligation must, of course, be subject to international verification. And yet, there are no specific verification provisions for this obligation in the rolling text. It appears that verification of compliance with the non-transfer obligation will have to be ensured through routine and challenge inspections and data reporting - in the case of parties to the treaty - and through other measures, especially if non-parties are concerned.

Western and some Eastern European countries would like to maintain their export controls under the Convention, probably in a revised form. Moreover, some Western countries, led by the United States, have proposed to ban exports of Schedule one, two, two B and three chemicals, and listed[70] equipment and technology to produce them, to non-parties to the Convention. Transition periods would facilitate the implementation of this trade restriction. The transition period for Schedule three chemicals, technology and equipment would be the longest, namely 5 years. During the transition periods, the parties would have to make arrangements with the non-parties for international inspections equivalent to those applicable to parties. These measures are to prevent the transfer of chemical weapons relevant material to non-parties, but also to make life for non-parties harder and provide them with an incentive to join the Convention.[71] Countries from the Group of 21, on the other hand, have proposed to lift all "discriminatory restrictions" in the chemical field with regard to the parties to the CW Convention as soon as the Convention enters into force. They contend that export

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[67] SIPRI Yearbook 1991, pp.106-108. Bernauer, Thomas, The Projected Chemical Weapons Convention, pp.45-48.

[68] See, for example, CD/CW/WP.365 of 23 August 1991 (Romania).

[69] CD/1103 of 19 August 1991, CD/1079 of 3 June 1991. See also Office of the Press Secretary, Fact Sheet on Middle East Arms Control Initiative, 29 May 1991.

[70] The United States proposed that this list be drawn up by the Preparatory Commission for the Convention.

[71] CD/CW/WP.357 of 8 August 1991 (USA). The compatibility of such clause with other international agreements, including the GATT agreement, would require some further examination.

controls are discriminatory restrictions and are detrimental to the transfer of chemicals and related technology for peaceful purposes.[72]

It is likely that the export controls and trade restrictions described would strengthen the non-transfer provision of the Convention. Strict measures with regard to non-parties could close a substantial loophole. Nevertheless, the verification of non-transfer would be most effective in the case of parties to the Convention. Although material balances and the non-diversion of chemicals or technology are hard to monitor, the parties would be subject to a variety of controls, including routine and challenge inspections. National export controls with regard to parties and non-parties could constitute another means to check the transfer of CW relevant chemicals and technology. All these controls are likely to amount to a degree of transparancy which would make any transfer of relevant substances or technology by any party to the Convention, or any subnational actor, a very risky undertaking.

Lessons to be Drawn from the Chemical Weapons Inspections in Iraq

Under UN Security Council Resolution 687 of 3 April 1991, Iraq is obliged, in exchange for a permanent cease-fire and a gradual easing of the UN trade embargo, to eliminate all its weapons of mass destruction and never to acquire them. By 18 April 1991, Iraq had to declare, among other things, to the United Nations all locations, amounts and types of its chemical weapons, all stocks of agents and all related subsystems and components, and all research, development, support and manufacturing facilities for its CW programme. Under the same resolution, the UN Secretary General had to draw up, by 18 May, a plan under which a Special Commission would undertake the following: inspect the sites of declared weapons, agents, components and facilities, and conduct on-site inspections at further locations which it has itself designated for inspection; and take possession from Iraq of all the declared items and further items that it may find, for the destruction, removal or rendering harmless under international supervision. The UN Special Commission (UNSCOM) was to assist the UN Secretary-General in developing a plan, until 1 August, for monitoring and verifying Iraq's compliance with the obligation not to use, develop, construct or acquire chemical weapons and relevant components and facilities.

The Iraqi government submitted its first declaration on 18 April 1991. Additional information was given on 28 April and 4 May. After several complaints about incomplete information and consultations between the Commission and Iraq, the quantity of declared items seems to have increased considerably. The UNSCOM working group for chemical weapons started its work on 7 May 1991.

On 17 May 1991, the UN Secretary-General presented to the Security Council a plan for inspecting Iraq's chemical weapons items.[73] The plan provides for a three-stage process. The first stage includes the gathering and assessment of information. In this

[72] E.g. Argentina (PV.596) or Pakistan (PV.600).

[73] S/22614.

phase, the information provided by Iraq is to be checked. The task of destroying Iraq's chemical weapons and relevant facilities and the requirements and modalities for carrying it out is to be assessed as well. During the second stage, the disposal of weapons and facilities and all other items specified in Resolution 687 is to be undertaken under the supervision of the UNSCOM inspectors. Munititions and relevant facilities are, to the extent possible, to be marked with tamper-indicating devices to prevent diversion. Monitoring between the time of initial inspections and disposal are foreseen. During the third stage, Iraq's compliance in the future is to be monitored. The plan gives the inspectors the right of immediate access to any site they chose within Iraq. For the purpose of implementing the disarmament provisions of Resolution 687, a Field Operations Office is to be set up in Bahrain and a Support Office in Bagdad.

The inspection activities in Iraq commenced on 10 June 1991. Five series of inspections, which have been conducted so far, have concentrated on the examination of the declared sites, the identification of munitions, agents, relevant equipment and their condition, the inventory of the agents and munitions, possible undeclared locations, and ways of destroying the relevant items. The inspection teams have usually assembled in Bahrain for a period of briefings and acclimatization. Subsequently, they have been flown to Bagdad by military aircraft. From Bagdad, the 20 to 30 men teams have traveled to the relevant sites on a daily basis, with a few tons of equipment accompanying them. Helicopters have been used during the latest inspection rounds as a means of transportation and aerial reconnaissance. Inspections have been conducted at declared and undeclared sites. The relevant items discovered at undeclared sites seem to have been of minor importance. In contrast to the inspections of its nuclear activities, Iraq has reportedly been cooperative with regard to investigations into its chemical weapons program. The inspection teams have discovered that many of the chemical weapons storage, research and production facilities are damaged by the intense bombardement by the allied forces and (natural) corrosion. The chemical weapons found are, according to some inspectors, more of a liability than a military asset to Iraq. Many munitions are leaking and the working conditions for the inspectors have, at some sites, therefore been extremely hazardous. A large portion of the equipment brought along by the inspectors has been protection and decontamination equipment. It has become apparent during the inspections that much of the production infrastructure, empty munitions and precursor chemicals were supplied by foreign sources. One of the politically more delicate parts of the inspection effort, namely the detailed investigation of supply routes for the Iraqi chemical weapons programme, has not been undertaken so far.[74]

The detailed inventory of the inspected sites started during the fifth inspection round, which began on 7 October 1991. There has, so far, not been any permanent monitoring of the relevant sites to ensure that no chemical warfare items are illegaly removed.

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[74] Chemical Weapons Convention Bulletin, No.13, September 1991, pp.21-22. S/23165 of 25 October 1991 (UNSCOM report on the first five months of operations).

Reasons for the lack of measures to secure the sites may be the following. Iraq does not have much to hide anymore as far as its chemical warfare programme is concerned. The Iraqi chemical weapons arsenal is, as mentioned above, of little military value in its present condition. And finally, important items could have been removed before the inspections started, if Iraq had decided to do so.

Iraq has proposed to destroy its chemical weapons items on its own.[75] This proposal is still being considered. Several countries hesitate to accept such a solution; there are serious doubts about whether Iraq could guarantee sufficient safety standards during the destruction process. As of December 1991, Iraq has only destroyed a number of empty munitions.

On 1 August 1991, the UN Secretary-General submitted a plan for ongoing future monitoring and verification of Iraq's compliance with its unconditional obligation not to use, retain, possess, develop, construct or otherwise acquire any weapons or related items prohibited by Resolution 687.[76] The monitoring with respect to chemical weapons is to be carried out by a compliance unit under the Special Commission in cooperation with the Security Council's Sanctions Committee and with support from the UN Department for Disarmament Affairs. An international mechanism to control the transfer to Iraq of chemical weapons relevant material and technology is to be set up, not later than before the trade sanctions against Iraq are lifted. The UN plan contains a list of items relevant to monitoring and verification. The international export control arrangements and the monitoring and verification are to be based on this list. Iraq must declare the production, processing, consumption, storage, import and export of the listed chemicals and the facilities involved, if they exceed a specific threshold. Facilities where organophosporus chemicals are produced or processed, or where organic chemicals are produced by chlorination, must be declared. Iraq must also declare the import or acquisition of equipment or technologies for the production or processing of the listed chemicals. It must notify the Special Commission in advance if it wishes to produce, process, consume, store, import or export the listed substances. The plan contains a special list of chemicals which have little use except as chemical warfare agents, including precursors for such agents. If Iraq requires any such chemicals, the Special Commission will examine and decide on the request and establish special arrangements to this end.

The monitoring regime is based on on-site inspections, aerial overflights and the provision of information by Iraq. The rights of the inspectors are unprecedented in the history or arms control. The inspectors have the right to request any additional information or clarification from Iraq. They may designate any activity, site, facility or other items for the provision of information on a regular basis. They have access, at any time and without hindrance, to any site or facility declared by Iraq or designated by the Commission, and they have the right to overfly any area in Iraq. Advance notification must be given to Iraq at a time the Commission considers appropriate. The

[75] S/22682 of 10 June 1991.
[76] S/22871/Rev.1.

inspectors and their equipment enjoy unrestricted freedom of movement within Iraq and the inspectors can use their own means of transport. There are practically no limits as to the access within facilities (sampling, taking of photographs, videotaping, interviewing, copying or records, removing of any material, use of equipment, etc.). The Commission has the right to confiscate any undeclared but prohibited items and arrange for their disposal. It may establish special modes of monitoring and inspection, including prolonged or continuous presence of inspectors or use of instruments. The Commission will report, through the Secretary-General, to the Security Council every six months, and at any other time the Council requests, on the implementation of the plan. The plan may be revised in consultation with the Security Council. The UN plan was formally adopted by the Security Council on 11 October 1991.[77] Iraq must inform the Security Council by mid-November 1991 on legislative or administrative measures it has taken to implement the provisions of Resolution 687 and the related monitoring plan. Iraq has voiced strong opposition against the monitoring measures, adopted under Chapter VII of the UN Charter, but it seems likely that it will eventually comply.

The lessons that could be drawn for the Chemical Weapons Convention are still very tentative. The following three areas may be of particular relevance for the multilateral negotiations on a CW Convention and require in-depth study.

Firstly, the inspections in Iraq are far more intrusive than the ones under a CW Convention will ever be. It is therefore difficult to draw conclusions as regards the effectiveness of the procedures envisaged for the Convention. It would seem, however, that a State subject to challenge inspection may find all types of allowed and prohibited means to prevent access by inspectors to certain sites or facilities. Very intrusive challenge inspection procedures for the CW Convention are therefore indispensible. The Iraq experience has shown that, from a technical point of view, the time-span between advance notification of the requested State and access to the site to be inspected could be considerably shortened in many cases. However, the multilateral negotiations are presently moving in the opposite direction (see the "perimeter" approach above). This may raise doubts about the deterrent value of the verification system envisaged for the Convention. In any event, it raises the question of why there should be so many costly routine inspections in declared facilities if an important loophole in the challenge procedure, such as the one left by the perimeter approach, would allow violators to escape undetected. If a less intrusive challenge inspection approach were to be adopted, questions such as how to cope with obstructive behavior by an inspected State during a challenge inspection would become crucial. Issues which require careful evaluation in this respect include decision-making procedures in bodies under the Convention which are to consider the result of a challenge inspection, and other follow-up procedures, including sanctions.

Secondly, some limited lessons may be drawn concerning technical equipment and inspection procedures to be used for the CW Convention. In addition, the inspections

[77] UN Security Council Resolution 715.

in Iraq provide a good training ground for future inspectors under the CW Convention.[78] A comprehensive evaluation of the experience of individual inspectors should be undertaken and be fed into the multilateral negotiating process. A seminar of the Ad Hoc Committee on Chemical Weapons on the problem of CW destruction, in which a few UN inspectors participated, is a first step in this direction.[79] Nevertheless, it must be noted that the inspection conditions and the nature of the sites to be inspected in Iraq were very different from what will be the "normal" case under a CW Convention (except perhaps for inspections related to destruction activities or some challenge inspections). This means that the equipment used in Iraq is likely to be very different from what will normally be used in routine inspections under the CW Convention.

Thirdly, intelligence information fed into the inspection process by individual States is essential for pin-pointing inspections to the relevant sites. The UN inspectors in Iraq were, to a large extent, dependent on information supplied by a few countries, especially the United States, when it came to picking undeclared facilities for inspections. This dependence on nationally produced intelligence will certainly introduce an element of inequality into the CW Convention, which is, however, a fact of life and cannot be changed through a disarmament treaty. States with more sophisticated national technical or human means to collect intelligence on relevant activities in other countries will have an advantage as regards the identification of suspected sites. The only remedy would be to oblige all parties to make available the relevant intelligence information, which is unrealistic, or to conduct only routine inspections at declared sites, which is of little effect and could be very expensive. The increasing availability of commercially produced satellite imagery and photo-interpretation services may to some extent remedy this inequality, but cannot eliminate it. The quality of satellite images produced by only few countries for (secret) military purposes is likely to remain much higher than that of commercially available imagery. In addition, access to commercial satellite imagery cannot be ensured under all circumstances (e.g trade embargoes) and the private companies selling such information are concentrated in very few countries.

Decision-Making on Compliance Issues

Verification of compliance with the CW Convention would often necessitate an assessment of political and legal nature. Example: The inspectors of the Technical Secretariat find that one ton of a Schedule two chemical at a facility remains unaccounted for or has been produced without declaration. This would not necessarily mean that the State concerned is producing chemical weapons. To clarify the case, further investigations and an assessment of the situation by the parties would be

[78] Krepon, Michael, Amy Smithson, Iraq Provides CW Ban Training Ground, in: Defense News 23, May 27, 1991.

[79] The seminar took place in Geneva from 7 to 11 October 1991.

required. The final assessment of the behaviour of the country concerned would be guided by political considerations and by a specific treaty interpretation.

It is agreed that under the routine inspection scheme, the Director-General of the Technical Secretariat would inform the Executive Council if uncertainties or problems arising during routine monitoring activities could not be resolved. The Conference of the States Parties or the Executive Council could then discuss the matter: they would both be authorized to consider questions of compliance. It would finally be up to the Conference of the States Parties, the supreme body under the Convention, to make recommendations and take decisions on any matter related to the treaty. For the proposed challenge inspection scheme, it is proposed that the inspection report be transmitted to the requesting and the requested party, to the Executive Council and to all other parties. The Executive Council could then meet upon request by any party to review the situation and consider further action to ensure compliance with the treaty. It could make recommendations to the Conference of the States Parties. It has also been proposed that the Executive Council may bring a compliance problem directly to the attention of the UN Security Council or the UN General Assembly.

There is disagreement, however, whether these two bodies could, for example, vote on the report of a challenge inspection, or take a decision on whether a State is complying with the CW Convention. There are two schools of thought in this respect. Countries of the Western group and the group of Eastern European and other States tend to hold the view that it would be up to the individual country to pass the final judgement. Their justification for this unilateral approach is that questions of compliance with the CW Convention touch upon the security interests of each individual country and could not be decided by an international body. Decisions by such a body would be guided by political considerations and would rarely be impartial. The Organization should, therefore, not play the role of a court. Non-aligned countries and China[80], on the other hand, have argued that decisions concerning compliance with the Convention should be taken by a body of the Organization. They hold that questions of compliance concern all parties to the treaty and should therefore be dealt with by all parties collectively.

The rolling text contains an Article on the settlement of disputes among the parties. The relevant provisions apply to cases where the application or interpretation of the Convention is disputed. In such cases, the parties concerned should consult or refer the issue to an organ of the Convention or the International Court of Justice. The Conference of States Parties or the Executive Council could also consider the matter. The former may also establish or entrust organs with tasks related to the settlement of a dispute. There are, however, no mandatory procedures for settling a dispute. But the Conference of States Parties or the Executive Council may, if authorized by the UN General Assembly, request the International Court of Justice to give an advisory opinion on any legal question arising within the scope of the activities of the

[80] E.g. CD/1031 of 10.8.1990.

Organization.[81] Practice will have to show how far these provisions could be employed in the verification process.

Enforcement Measures

During the 1990 session of the Conference on Disarmament, the question of steps to be taken in the event of non-compliance was, for the first time, addressed in detail. The discussion resulted in a draft document, attached to the rolling text, on "Measures to redress a situation and ensure compliance, including sanctions".[82] In 1991, this document was included in the main body of the draft Convention.[83] The measures outlined in this text include the suspension or restriction of a party's rights and privileges under the Convention, but not withdrawal of membership in the Organization. The Conference of the States Parties may recommend (undefined) collective measures in accordance with international law. And finally, cases of particular gravity may be brought to the attention of the UN General Assembly or the Security Council. These measures appear rather vague. Questions that remain to be addressed include whether a formal judgement by the parties about compliance would be needed to proceed to the enforcement stage; which measures could be used for which offense; how unilateral or Security Council measures would relate to the treaty specific measures; and how the competences of the bodies of the Convention could be defined. However, further elaboration seems to be extremely difficult as the existing text is based on a fragile consensus which resulted from hard negotiations.[84]

The Bilateral US-Soviet Chemical Weapons Agreement

On 1 June 1990, the United States and the Soviet Union signed an agreement providing for the destruction and non-production of chemical weapons.[85] Under this Agreement, which is to facilitate the conclusion of a multilateral CW Convention, the two countries will halt their production of chemical weapons. (In fact, they have already done so, even though the Agreement is not yet in force.) They will reduce their stocks to 5000

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[81] CD/1108 of 27 August 1991, p.54.

[82] One type of response to non-compliance - namely, in case of use or threat of use of chemical weapons - is the provision of assistance to the victim of the threat of CW use or actual use. Article X of the draft Convention contains provisions to this end. Another type of response to non-compliance would be withdrawal from the Convention by the party(ies) affected by a violation. Since we focus on enforcement measures against the violator, we do not deal with these two types of responses.

[83] CD/1108 of 27 August 1991, p.49.

[84] For an interesting study on the question of sanctions and assurances, see Dunn, Lewis A., and James A. Schear, Combatting chemical weapons proliferation: the role of sanctions and assurances, Henry L. Stimson Center Occasional Paper No.3, Washington D.C., April 1991.

[85] CD/1001 of 12.6.1990. For an analysis of the Agreement, see Goldblat, Jozef, and Thomas Bernauer, The US-Soviet Chemical Weapons Agreement of June 1990: Its Advantages and Shortcomings, in: Bulletin of Peace Proposals, Vol.21, No.4, December 1990, pp.355-362.

metric tons of chemical warfare agents.[86] The destruction operations are to begin no later than 31 December 1992. By the end of 1999, each party shall have destroyed at least 50 % of its aggregate stocks, and until the end of 2002, all stocks subject to reduction must be destroyed. By then, each party must not have more than eight chemical weapons storage facilities. The United States and the Soviet Union have agreed to cooperate in the destruction of chemical weapons - a programme remains to be negotiated - but it is not yet clear whether the mentioned time-table is realistic. Especially the Soviet Union has no destruction capability at the moment and it will be noted that the costs for the destruction of the totality of the stocks to be eliminated may exceed 10 billion US$. However, the implementation of the agreement may simply be delayed since the party which has no difficulties with destruction would not have to destroy its stocks more rapidly than the party which has difficulties.

Detailed provisions for the inspections under the bilateral agreement were to be negotiated by 31 December 1990. By the end of 1991 these negotiations were not yet concluded. The Agreement has therefore not yet been submitted to the respective Parliaments for approval. The main reason for the delay is the unability of the Soviet Union to meet the destruction time-table provided for in the Agreement.[87] Also the United States seems to be facing delays in its "chemdemil" programme. It would seem that the verification procedures as such could be drawn up relatively easily: similar procedures for the multilateral Convention have already been negotiated and are tentatively agreed. The Soviet Union and the United States have declared that the envisaged multilateral Convention will have precedence over the bilateral Agreement. However, it is possible that some verification measures of the Agreement could be maintained by the two countries concerned under the Chemical Weapons Convention, if they do not contradict the provisions of the Convention.

Monitoring of Compliance

The scope of the bilateral Agreement is much narrower than the scope of the projected multilateral Convention. The bilateral Agreement does not prohibit the development, transfer, acquisition and use of chemical weapons, and does not provide for the complete elimination of these weapons. Only non-production and destruction will be subject to international monitoring. Moreover, monitoring of non-production would be confined to declared chemical weapons production, storage and destruction facilities. It will not cover other relevant military or civilian installations, notably the civil chemical industry. And, there would be no challenge inspections in the form envisaged for the CW Convention. Therefore, most of the problems that have proven to be so

[86] The composition of retained stocks is not constrained, but there will be a limitation on the aggregate capacity of unfilled chemical munitions.

[87] See, for example, the May 1991 issue of Arms Control Today. Statement by the Director of the US Arms Control and Disarmament Agency, Ronald Lehman, before the Senate Foreign Relations Committee on 22 May 1991.

difficult to resolve in negotiations on the CW Convention do not arise under the bilateral Agreement.[88]

The starting point for the monitoring of compliance are declarations submitted in the framework of a bilateral Memorandum of Understanding, signed by the two countries in September 1989.[89] This Memorandum provides for a bilateral verification experiment and data exchange related to the prohibition of chemical weapons. During the first phase of this project, the two sides are to exchange data on their CW capabilities and carry out a series of mutual visits to the relevant facilities. Several visits under phase one, which started in mid-1990, have already taken place. During phase two, which is to start at an agreed date, but not less than four months prior to the initialling of the multilateral Convention, more detailed data would be exchanged and mutual on-site inspections would be conducted to check the accuracy of the data. Unless specified otherwise in the Memorandum, the declarations are to be made according to the relevant provisions of the rolling text of the multilateral Convention. There have been indications that Phase II of the Memorandum may start already at the beginning of 1992 to signify that the Chemical Weapons Convention is expected within a few months.

Under the bilateral Agreement, each declared CW production facility will be subject to systematic on-site monitoring to ascertain the non-production of chemical weapons. The two countries must also provide access to each others CW destruction facilities, and to CW holding areas within these facilities, to allow the monitoring of non-diversion and destruction of chemical weapons. The monitoring will be carried out through the continuous presence on-site of inspectors and on-site instruments. Once a party has removed all its weapons from a particular storage facility, it must notify the other party. The other party will then have the right to request an on-site inspection to make sure that there are no chemical weapons left at this facility. Subsequently, each party will have right to inspect, not more than once each year, until the CW Convention enters into force, such a facility to check that no chemical weapons are stored there.

Each party may inspect, not more than once a year, after destruction has begun and until the CW Convention enters into force, each CW storage facility of the other side which is not already covered by the procedures mentioned above. Such inspections would determine the quantities and types of chemical weapons that are stored there.

After the whole destruction process is completed, each party will have to declare where its remaining stocks are located, and provide detailed information on the remaining stocks. Each party would have the right to inspect these storage facilities to verify the accuracy of the information.

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[88] The two countries seem to be aware of the fact that the lessons to be drawn for the multilateral Convention are limited. To gain more experience, they have agreed to conduct an inspection experiment under the Memorandum of Understanding, and have agreed in the bilateral Agreement to carry out trial challenge inspections at facilities not declared under the Memorandum of Understanding.

[89] The text of the Memorandum can be found in CD/973 of 23 February 1990.

Decision-Making on Compliance Issues

Since the Agreement is bilateral, the decision-making on compliance issues is up to the individual party. The Agreement holds (Article V) that "On the basis of reports of its inspectors and other information available to it, each Party shall determine whether the provisions of this Agreement are being satisfactorily fulfilled and shall communicate its conclusions to the other Party." No special consultative body has been established to deal with compliance disputes and other issues. The normal diplomatic channels, specifically-designated representatives or other means must therefore be used.

Conclusions

1. The most difficult verification problems under the envisaged multilateral CW Convention relate to the routine monitoring of the civil chemical industry, and to challenge inspections. The problem of routine monitoring stems from the fact that most CW relevant chemicals and technology have a dual use, and that the size of the chemical industry to be monitored is enormous. The problems connected to challenge inspections are primarily of a political nature.

2. The routine monitoring system, to be used under the CW Convention to check that the civil chemical industry is not misused for the production of chemical weapons, must be designed so as to be manageable from the point of view or resources. Confidential proprietary information must also be protected. On the other hand, the monitoring system must provide enough confidence that the Convention is not being circumvented. The system envisaged so far leaves a number of important gaps and may, at the same time, be very costly. It is therefore likely that the negotiations will develop in the direction of widening the coverage of verification - by selecting the facilities to be inspected also on the basis of other than just production or consumption criteria - and at the same time reducing the intrusiveness of inspections for the sake of reducing costs. The discussion on ad hoc inspections, the Swedish proposal, and the discussion on "CW capable" facilities underlines this development.

3. The challenge inspection formula that has, since 1984, been envisaged for the CW Convention is much more intrusive than any of the monitoring mechanisms of the multilateral arms control or disarmament treaty now in force. There are legitimate concerns that the right to request an inspection anytime, anywhere, and without the right of refusal by the requested party, could be misused for political or intelligence gathering purposes not related to the CW Convention. However, the problem of possible abuse is difficult to solve if the basic purpose of the measure is to be preserved. A right of refusal, be it by the requested State, by an international body, or even by a national court, would leave a substantial loophole for would-be violators. It therefore seems that the concept of "managed access" could constitute a practical solution. This procedure would uphold the principle of "anytime, anywhere, with no right of refusal" and would, at the same time, provide the parties with a tool to protect some highly sensitive parts of a site under inspection. But it appears that such a

solution is not acceptable to the United States and a few developing countries. The "perimeter approach", proposed by the United States in July 1991, provides for a right of refusal by the requested State and therefore constitutes a radical departure from the position the United States had held since 1984. Even though the US proposal, if accepted, would seriously reduce the effectiveness of the monitoring system of the Convention, it may provide some common ground for countries that seek a very intrusive challenge inspection mechanism, and for some members of the Group of 21 and China which would prefer to establish a political filter to screen any request for a challenge inspection (which probably implies a hidden right of refusal).

4. There are no special provisions in the rolling text to check the non-transfer of chemical weapons, one of the fundamental obligations under the projected CW Convention. Routine and challenge inspections could help in preventing such transfer among the parties to the Convention, but would be of limited effect as far as non-parties are concerned. National export controls by the parties, with regard to parties and non-parties, could strengthen the non-transfer obligation. Such export controls could be coordinated within the framework of the Convention or outside, for example in the Australia Group. However, there is strong opposition by developing countries against export controls, especially if they apply among the parties to the CW Convention.

5. The lessons to be drawn from the chemical weapons inspections in Iraq under Security Council Resolution 687 are threefold. First, a very intrusive challenge inspection mechanism is needed to detect or deter violations under the CW Convention. However, the negotiations seem to move in the opposite direction. This may raise doubts about the effectiveness of the whole verification system under the projected Convention. Second, Iraq provides a good training ground for inspectors and their equipment which can hopefully be employed for an effective implementation of the multilateral Convention from the very start. Third, the Iraq experience has shown that national technical means are essential in pin-pointing challenge inspections and also national nominations in the context of a non-systematic but routine inspection mechanism, if the latter were to be agreed. There are substantial inequalities in this respect. In the case of Iraq, the UN inspectors were to a high degree dependent on intelligence supplied by the United States. Too much reliance on the intelligence capabilities of one country under a CW Convention is very undesirable since information may be held back or may be provided according to the national interest. However, this inequality is a fact of life and cannot be changed through a disarmament treaty. On the positive side, national technical means constitute an additional source of information and increase the probability of being cought if cheating.

6. As to the problem of legal and political assessment of the data obtained through routine monitoring or challenge inspections, there are two schools of thought which are difficult to reconcile. One stresses the collective approach while the other opts for the unilateral one. It is likely that the final judgement about compliance or non-compliance of a party will be passed by each individual State, but that the Executive Council or the Conference of the States Parties will have the right to assess the situation and make recommendations.

7. The discussion of possible collective enforcement measures under the multilateral Convention has started only recently and several fundamental questions remain to be addressed. However, it is unlikely that some type of collective security system will emerge in the framework of the Convention. The UN Security Council will remain responsible for treating grave cases of non-compliance with the Convention, but there may be some treaty-specific measures that could be taken in case of minor violations.
8. The monitoring tasks under the bilateral US-Soviet Agreement are rather simple compared to the monitoring problems connected to the CW Convention: the bilateral Agreement does not provide for challenge inspections in undeclared facilities and the civil chemical industry will not be checked. The lessons to be drawn for the CW Convention are therefore limited, in particular because comparable provisions for the multilateral Convention have already been drawn up and are tentatively agreed.

Postscript

Compared to the high expectations raised by the US initiative in May 1991 and the agreed aim of concluding the CW Convention by 1992, the latest round of negotiations in the Ad Hoc Committee on Chemical Weapons, which took place in January 1992, ended with little progress. The agreements that were reached related to minor technical details such as definitions of the facilities to be inspected or the Schedules of chemicals. All major verification problems such as the basic approach to the monitoring of the chemical industry or challenge inspections remained far from being resolved. The consequences of the disintegration of the USSR for the negotiations on a CW ban are not yet clear, but one may suspect that they could accentuate the existing problems. Firstly, the emergence of many new States on the territory of the former USSR increases the number of negotiating partners which in turn increases the difficulties of coming to an agreement. Secondly, the desperate economic situation in these States casts doubts on their capability to ensure the (costly) implementation of the CW Convention. As a first consequence, the preparations for the entry into force of the bilateral US-Soviet chemical weapons agreement have virtually come to a halt.

Chapter 3
Making the Ban on Biological Weapons More Effective

Jozef Goldblat and Thomas Bernauer

Verification Provisions of the BW Convention and Their Weaknesses

The BW Convention, signed in 1972 and in force since 1975, prohibits the development, production, stockpiling, or acquisition by other means, or retention of microbial or other biological agents or toxins, as well as of weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict (Article I). The prohibition applies only to types and quantities of biological agents and toxins that have no justification for prophylactic, protective or other peaceful purposes.

No specific measures are set forth in the BW Convention to verify compliance with these obligations.[1] The parties are not even obliged to declare the biological agents or toxins used in non-prohibited activities, or the laboratories engaged in research and development of substances that could be used as agents of warfare. And yet, advances in biotechnology have made it possible to produce large quantities of potent toxic substances in a short period of time and in facilities which are difficult to identify. These substances may be stored in inconspicuous repositories for eventual "weaponization". Consequently, a violator could relatively easily break out from the Convention. Moreover, States joining the Convention are not required to declare the possession or non-possession of the banned weapons. Nor are they obligated to prove that they have fulfilled the commitment assumed under the Convention to destroy the stocks of these weapons or to divert them to peaceful purposes. The Convention prohibits the transfer of the relevant agents and equipment to "any recipient whatsoever", but provides for no internationally agreed means to check compliance with this obligation. Also this circumstance may be taken advantage of by would-be violators.

Each party is obligated to take measures, in accordance with its constitutional processes, to prohibit and prevent the activities banned by the Convention from taking place within its territory and under its jurisdiction or control anywhere (Article IV). Each State is thus responsible for ensuring the observance of the Convention prohibitions not only by its own authorities, but also by private organizations or individuals. So far, only a small number of parties have taken the required steps.

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[1] For a discussion of the difficulty to verify the BW Convention see also A. Karkoszka, "The Convention on Biological Weapons (1972)." In S. Sur (Ed.), *Verification of Current Disarmament and Arms Limitation Agreements. Ways, Means and Practices.* Aldershot 1991: Dartmouth (UNIDIR).

The parties have undertaken to consult each other and to co-operate in solving problems relating to the objective or the application of the provisions of the Convention. Such consultation and co-operation may also take place "through appropriate international procedures within the framework of the United Nations and in accordance with its Charter" (Article V). This language is rather vague. It is not evident what "appropriate" procedures should amount to.

Complaints regarding breaches of the Convention may be lodged with the UN Security Council. The parties have undertaken to co-operate in carrying out any investigation which the Security Council may initiate on the basis of a complaint, and are entitled to be informed of the results of the investigation. Each complaint must contain "all possible evidence" confirming its validity (Article VI). However, the outcome of such a procedure is uncertain because the great power veto in the Security Council may be used not only to block substantive decisions, but even to reject proposals for investigation. A suggestion made during the BW negotiations, that the Council's permanent members should waive their right of veto with regard to resolutions dealing with "technical" investigations of complaints, was not accepted. Should, nevertheless, an investigation be decided upon, it is not clear to what extent the parties are committed to co-operate in carrying it out and, in particular, whether they are under the obligation to allow inspection on their territory.

The circumstance that the fact-finding stage of the complaints procedure is not clearly separated from the stage of legal/political consideration and judgement is a serious shortcoming of the BW Convention. It makes it difficult to ascertain a violation. Moreover, a State under suspicion of having violated its obligations has no international impartial mechanism to turn to in order to free itself from that suspicion. Ill-considered allegations can therefore be made with impunity.

Indirectly, and independently of the BW Convention, compliance or non-compliance with the prohibitions can be demonstrated through investigations which the UN Secretary-General is empowered to carry out in response to reports that may be brought to his attention concerning the possible use of chemical and biological or toxin weapons.[2]

Should a violation of the Convention occur, the parties would have to provide or support assistance, in accordance with the UN Charter, to any party which so requests, if the Security Council decides that this party has been exposed to danger as a result of the violation (Article VII). It would follow from the negotiating history that the assistance was meant primarily as action of medical or other humanitarian nature. No sanctions against States violating the Convention have been explicitly provided for.[3]

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[2] United Nations document A/44/561.

[3] For a more detailed analysis of the provisions of the BW Convention see J. Goldblat and T. Bernauer, *The Third Review of the Biological Weapons Convention: Issues and Proposals.* New York 1991: United Nations (UNIDIR).

Allegations of Non-Compliance

Several allegations of non-compliance with the BW Convention have been made since the Convention entered into force.[4] Almost all these allegations were poorly substantiated, and none has been either proved or disproved. Those which received most attention were the so-called "Sverdlovsk" and "Yellow Rain" cases.

In 1980, the United States put forward a claim that an airborne release of anthrax spores from a Soviet biological facility operated in contravention of the BW Convention had caused an outbreak of anthrax in the city of Sverdlovsk in the spring of 1979. The Soviet Union confirmed that there had been an outbreak of anthrax in the Sverdlovsk region, but attributed this occurrence to the fact that anthrax-contaminated meat from cattle and sheep had been put on the market in violation of veterinary regulations.[5]

In 1981, the US Government accused the Soviet Union of also being involved in the production, transfer and use of trichothecene mycotoxins in Laos, Kampuchea and Afghanistan in violation of both the 1925 Geneva Protocol and the BW Convention.[6] The allegation was categorically rejected by the Soviet Union. US charges were based on reports by alleged victims and eye-witnesses who stated that since the autumn of 1978 enemy aircraft had been spraying a toxic yellow material (hence the name "Yellow Rain"). Chemical analyses of samples of the yellow material and medical checks of the affected persons were conducted to substantiate the case. However, the reliability of the evidence was increasingly questioned.[7] Some authoritative scientists have found that the yellow substance consisted to a large extent of excrements of wild

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[4] Descriptions of these allegations can be found in the SIPRI Yearbooks or the Arms Control Reporter (published by the Institute for Defense and Disarmament Studies, USA). Many allegations of the production and use of biological means of warfare were made also before the BW Convention. None of them could be verified in an objective manner. In most cases, there was no or little evidence to support the accusations. A somewhat larger body of information existed with regard to biological warfare reportedly conducted by Japan from 1939 to 1944.

[5] BWC Review Conference document BWC/Conf.I/SR.12 para 29. For detailed descriptions of the case see M. Meselson, *The Biological Weapons Convention and the Sverdlovsk Anthrax Outbreak of 1979.* Federation of American Scientists Public Interest Report Vol.41(7). Washington D.C., September 1988; E. Harris, "Sverdlovsk and Yellow Rain: Two Cases of Soviet Noncompliance?" In: *International Security,* Vol.11, No.4, Spring 1987, pp.45-47; Ch. C. Flowerree, "Possible Implications of the Anthrax Outbreak in Sverdlovsk on Future Verification of the Biological Weapons Convention: a US perspective." In S.J. Lundin (Ed.), *Views on Possible Verification Measures for the Biological Weapons Convention.* Oxford 1991: Oxford University Press (SIPRI); V. Issraelyan, "Possible Implications of the Anthrax Outbreak in Sverdlovsk on Future Verification of the Biological Weapons Convention: a Soviet perspective." In *ibid.*

[6] The allegation was stated in public for the first time by Secretary of State Haig in September 1981 (US Department of State, *Press Release*, 13 September 1981). More details were given in: US Department of State, *Chemical Warfare in Southeast Asia and Afghanistan.* Special Report No.98, Report to the Congress from Secretary of State Alexander M. Haig, Jr., March 22, 1982; and US Department of State, *Chemical Warfare in Southeast Asia and Afghanistan: An Update.* Special Report No.104, by Secretary of State George P. Shultz, November 11, 1982.

[7] A UN expert team, dispatched by the Secretary-General in 1981 and 1982, was not able to shed more light on the issue (UN documents A/36/613 Annex and A/37/259).

honeybees, and extensive analytical efforts in several laboratories failed to confirm the initial positive reports of trichothecenes.[8]

Neither the Sverdlovsk nor the Yellow Rain case has been settled. The lack of provisions in the BW Convention for effective verification and resolution of compliance disputes has given rise to a debate about whether and how to improve the situation. This issue was thoroughly discussed in the course of three Review Conferences of the parties to the BW Convention, held in 1980, 1986 and 1991.

The First and Second Review Conferences

At the First Review Conference, the parties to the BW Convention agreed that Article V of the Convention, which deals with consultations, allows flexibility as regards the international procedures that can be used to solve problems relating to the objective or application of the Convention. According to the Final Declaration of the Conference, such procedures include the right of any State party to request that a "consultative meeting" open to all States parties be convened at expert level. The wording of the Declaration did not indicate to whom requests for a consultative meeting should be addressed and who should convene the meeting. It also remained unclear what the consultative meeting could achieve without an objective investigation of a complaint. Such investigation was not explicitly provided for.[9]

In 1982, more than two years after the First Review Conference, Sweden introduced in the First Committee of the UN General Assembly a draft resolution recommending that a special meeting of the parties to the BW Convention be convened. The task of the meeting would be to establish a "flexible, objective and non-discriminatory procedure to deal with issues concerning compliance with the Convention". The resolution was adopted by the UN General Assembly, but the proposed conference never convened.[10]

The Second Review Conference agreed on a slightly improved version of the understanding reached at the First Review Conference and decided that a consultative meeting, to be convened "promptly" at the request of any party, may consider any problems relating to the objectives or application of the provisions of the Convention; suggest ways and means for further clarifying, with the assistance of technical experts, any matter considered ambiguous or unresolved; and initiate "appropriate" procedures and request specialized assistance through such procedures, within the framework of the United Nations and in accordance with its Charter.

To build up confidence that the Convention is not being circumvented, the Second Review Conference agreed on a series of voluntary measures to enhance the

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[8] For an analysis of the yellow rain case, disputing the allegations, see J. P. Robinson, J. Guillemin and M. Meselson, "Yellow Rain in Southeast Asia: The Story Collapses." In S. Wright (Ed.), *Preventing a Biological Arms Race*. Cambridge Mass. 1990: MIT Press.

[9] BW Review Conference document BWC/CONF.I/10.

[10] UN Resolution A/37/98 C of 13 December 1982.

transparency of activities involving biological agents and toxins. These measures include:

"1. Exchange of data, including name, location, scope and general description of activities, on research centres and laboratories that meet very high national or international safety standards established for handling, for permitted purposes, biological materials that pose a high individual and community risk or specialize in permitted biological activities directly related to the Convention.
2. Exchange of information on all outbreaks of infectious diseases and similar occurrences caused by toxins that seem to deviate from the normal pattern as regards type, development, place, or time of occurrence. If possible, the information provided would include, as soon as it is available, data on the type of disease, approximate area affected, and number of cases.
3. Encouragement of publication of results of biological research directly related to the Convention in scientific journals generally available to States Parties, as well as promotion of use for permitted purposes of knowledge gained in this research.
4. Active promotion of contacts between scientists engaged in biological research directly related to the Convention, including exchanges for joint research on a mutually agreed basis."[11]

The Review Conference underlined the importance of national measures to implement the Convention. It noted, in particular, the need for legislation regarding the physical protection of laboratories and other relevant facilities to prevent unauthorized access and removal of pathogenic or toxic material. It encouraged the parties to include in textbooks and in medical, scientific and military educational programmes information dealing with the prohibition of biological and toxin weapons and the provisions of the 1925 Geneva Protocol which prohibits the use of chemical and biological weapons. The parties were invited to forward to the UN Department for Disarmament Affairs the texts of specific legislation or other relevant regulatory measures adopted for the purpose of implementing the BW Convention.

Detailed guidelines for the exchange of data were worked out by a group of governmental experts in 1987.[12]

The Third Review Conference

At the Third Review Conference, held in September 1991, the possibility of setting up a verification mechanism under the BW Convention was the subject of intensive debates. The Conference decided to establish an "Ad Hoc Group of Governmental Experts" open to all parties to identify and examine potential verification measures from a scientific and technical standpoint. The Group was scheduled to meet in Geneva

[11] BW Review Conference document BWC/CONF.II/13/II, p.6.
[12] BW Review Conference document BWC/CONF.II/EX/2.

from 30 March to 10 April 1992 and hold additional meetings, if necessary, to complete its work preferably before the end of 1993. It was to study, among other questions, the ability to distinguish between prohibited and permitted activities, the technology, material, manpower and equipment needed for verification, as well as the financial, legal, safety and organizational implications. The report of the Group, to be adopted by consensus, was to be circulated among the parties. A conference may be convened at the request of a majority of States parties to examine the report and decide on further action.

Building upon and expanding the earlier understandings reached by the parties, the 1991 Review Conference set up a workable mechanism to settle disputes over compliance. Requests to convene a consultative meeting may be directed to the Depositaries of the BW Convention (the Governments of the Soviet Union, the United Kingdom and the United States). Within 30 days of the request, an informal meeting of interested parties would have to discuss arrangements for the formal meeting open to all parties. The latter must be convened within 60 days of the receipt of the request. The formal meeting could be preceded by bilateral or other consultations by agreement of those involved in the dispute.

In considering questions relating to the objective or application of the Convention the consultative meeting may suggest ways and means for further clarification of matters considered ambiguous or unresolved. It may also initiate appropriate international procedures within the framework of the United Nations and in accordance with its Charter. The consultative meeting or an individual party may request specialized assistance in solving any arising problem. Questions of procedure may be decided by a majority of participants present and voting. Questions of substance are to be decided by consensus, if possible. If no consensus is reached and a matter of substance comes up for voting, the vote shall be deferred for 48 hours for consultations. If there is still no agreement, voting shall take place and the decisions shall be taken by a two-thirds majority of those present and voting. This machinery will help avoid situations, where charges of violation remain uninvestigated and, therefore, neither proved nor disproved.[13] Nonetheless, the competence of the consultative meeting is still not quite clear. In particular, it is not certain whether the meeting could initiate an on-site inspection and, if so, what would be the format of the inspection.

In the absence of actual verification, confidence-building measures have become the main instrument in assuring the parties that the BW Convention is being observed. However, the implementation of the measures agreed at the Second Review Conference in 1986 proved unsatisfactory: the level of participation in the exchange of information was low; most parties, mainly the developing countries, did not send in any declaration; in many cases the provided information was incomplete, and in some cases it was of no relevance to the Convention. One of the main tasks of the Third Review Conference was, threrefore, to improve the reporting by the parties.

[13] This has been the case with the US allegations against the Soviet Union.

The Third Review Conference ended with a revision and expansion of the 1987 guidelines for the exchange of information. The novel elements, as specified in the Annex on the agreed confidence-building measures attached to the Final Declaration[14], are as follows. A new form is to be filled in by those parties that have nothing, or nothing new, to declare. There are precise indications for providing data on facilities that possess maximum containment laboratories. Supplementary information on national biological defence research and development programmes is required; this information should cover the activities (including outdoor studies of biological aerosols), purposes, organization, locations, staffing, funding of the programmes, facilities having biological defence contracts, publications resulting from research, etc. A clearer definition has been given of the outbreaks of infectious diseases and similar occurrences caused by toxins, which are to be reported. The parties have agreed to declare whether or not they had conducted offensive and/or defensive biological research and development programmes since 1 January 1946 and, if so, to provide relevant information. It has also been decided that each party would declare all facilities producing vaccines licensed by the State within its territory or elsewhere under its jurisdiction or control. Contacts between scientists engaged in biological research have been encouraged. They may include exchanges and visits for joint research.

All data specified in the Annex on confidence-building measures is to be sent to the UN Department for Disarmament Affairs (DDA) on an annual basis, no later than 15 April, and should cover the preceding calendar year. The duties of the DDA will include receiving the submitted information, compiling it and making it available to the parties.

The Conference agreed that the parties would declare, on an annual basis and in a simple yes/no-form, whether they have taken measures to assure domestic compliance with the Convention within their territory or at any other place under their jurisdiction or control. The parties are also expected to state whether they have taken steps of legislative, regulatory or other nature related to exports or imports of micro-organisms[15] and toxins. Amendments to the existing acts must be notified as well. If requested, the parties "shall be prepared" to submit copies of their legislation or regulations, or written details of other pertinent measures, to the DDA or to individual States. The Conference invited the parties to consider the application of national measures of implementation (including penal legislation) to the activities of their nationals in any country.

Proposals for establishing an international committee to oversee the implementation of the confidence-building measures, as well as a technical unit to systematize and assess the provided information, were discussed but proved controversial. The parties could not agree on the composition (restricted or open-ended) and the mandate of such bodies.

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[14] BW Review Conference document BWC/CONF.III/2/Add.3.

[15] Micro-organisms were defined as pathogenic to man, animals and plants in accordance with the Convention.

Conclusions

The Review Conferences have strengthened the BW Convention. Particularly important is the development and expansion of the confidence-building measures tending towards increased openness and transparency of all activities in the biological field. These measures, though not legally binding, carry a strong political commitment. However, several additional undertakings would be needed to make the BW Convention fully effective. These undertakings, which could take the form of agreed understandings and be assumed without tampering with the language of the Convention, should include the following:

- The subject of the prohibitions should be defined with greater precision to avoid circumvention of the BW Convention. A list of items relevant to the Convention, especially of biological agents and toxins which are putative warfare agents, should be drawn up. This list could be illustrative and subject to periodic updating by a scientific body.
- The parties should declare the types and quantities of microbial or other biological agents or toxins, which they possess for the purposes not prohibited by the BW Convention. Such declarations, possibly based on the list suggested above, would be useful in checking compliance.
- Parties supplying material and equipment relevant to the BW Convention to other parties should request the recipients to submit periodical statements about the use made of the supplied items. All co-operation in the field of biology and related technology with non-parties should cease. This would help avoid possible misuse of such co-operation for purposes prohibited by the BW Convention.
- All parties should adopt legislative or regulatory measures necessary to implement the BW Convention. Failure to do so should be considered as a non-fulfillment of the obligations assumed under the Convention.
- A committee of the parties, assisted by technical experts, should be established to assess systematically the implementation of the agreed confidence-building measures in the periods between review conferences. A review conference itself, convened once in several years, cannot properly perform this task.
- The question of responses - collective or by individual countries - to established breaches of the BW Convention must be addressed. Violators must not be allowed to get away with impunity.
- An opportunity to bring about the improvements recommended above will present itself at the next Review Conference to be held in Geneva at the request of a majority of States parties not later than 1996.

Chapter 4
Conventional Arms Control[1] Verification

Henny J. van der Graaf

The aim of this monograph is to identify and explore developments with respect to the verification of conventional arms control agreements in Europe and in some other regions. The study starts with a short description of the political environment in which verification will have to take place, followed by a discussion of the scope and future of conventional arms control in Europe. The existing verification arrangements of both the 1990 Vienna Document on Confidence- and Security-Building Measures and the Treaty on Conventional Armed Forces in Europe are analysed and an indication is given of what is left to be agreed upon. This is followed by the assessment of some options for the improvement of the existing systems. Finally, some remarks are made about expected developments in the field of the verification of arms control agreement in some other parts of the world, notably Central America and the Middle East region.

Europe

The Environments

The Political Environment

The geostrategic map of Europe has been redrawn dramatically. The division of Europe, the post-war alliances and the deployment of large conventional forces, together with a large arsenal of tactical nuclear weapons, have disappeared overnight from Eastern Europe. The bipolar European security system has been replaced by a very complex situation in which a number of independent actors are positioning themselves into a new correlation of forces in which the Warsaw Treaty Organisation (WTO) does not exist anymore.

A new web of diplomatic, economic and institutional bonds is being formed in Europe, ultimately leading to a new, possibly cooperative security regime from the Atlantic to the Urals. A first step towards that goal is the transformation of the Conference on Security and Cooperation in Europe (CSCE), from a set of conferences, to a number of institutions, ranging from all-European communication links to risk reduction institutions.

Also the NATO Alliance is subject to change. The Alliance is trying to enhance its political component and is in the process of changing its strategy and integrated force structure, leading to substantial lower levels of forces but increased mobility through

[1] For the purpose of this study arms control is interpreted in its broadest sense, comprising Confidence- and Security-building Measures, constraints on military activities, arms limitation and arms reduction and disarmament.

multinational rapid deployment forces with greater striking power by the employment of high- tech weapons. As long as the Soviet Union remains an unpredictable factor in European security, NATO may continue to play a role in assuring collective security for the Western European countries, but ultimately NATO may also fall victim to the changed political environment if it does not accept membership of the other Eastern European countries, including the Soviet Union.

It is difficult to predict how the security situation in Europe will develop, but it is questionable whether NATO, being the product of the cold war, could ultimately be the core of a new security order in Europe. It can be envisaged that a future European security system will be composed of a variety of existing and new institutions and supported by a network of arms control agreements. Those who argue that arms control initiatives have been overtaken by recent political developments forget that a new security order should also be supported by arms control arrangements. Only through negotiations and the resulting treaties and agreements, can one hold a grip on the developments. Only through treaties can one make the process less reversible and keep it under control with the help of cooperative verification arrangements.

A related question is: what is the need for verification when much lower levels of forces will be reached and when much more openness and transparency will exist in Europe. The mere fact that countries in Europe are changing the pattern of their armed forces towards a heavier reliance on rapidly mobilizable forces will put a premium on the monitoring capabilities of the participating states. It is to be expected that countries want to be sure that the restructuring of the participants' armed forces will not lead to a lesser degree of security than before.

As developments have dramatically shown, security in Europe will be heavily influenced by events in other parts of the world. The Middle East war has had a direct impact on the security situation in South East Europe; for the first time in the history of NATO, forces from a number of NATO countries were actively assisting an ally in the defence of its borders. It is not unrealistic to believe that the unstable situation in these regions, together with the growing strength of Islamic fundamentalism, will strongly influence the future of the European security system.

Europe's future security system should therefore be able to minimize the risk that brushfires at its borders will ignite a general conflict. As a consequence, East-West arms control and disarmament agreements should not be sought exclusively for Europe, but should be seen in close relation with similar developments in other parts of the world, especially in the Mediterranean and the Middle East.

As most of the European countries are not yet adequately organised to deter potential threats emanating from regions outside Europe, they will ultimately have to rely on the United States and possibly the Soviet Union. That means that both countries will have to be integrated in any future European solution. Consequently, any arms control and disarmament arrangement will involve the participation of both the United States and the Soviet Union.

The Arms Control Environment

The Scope

European countries will be confronted with a number of arms control and confidence- and security building measures. Each agreement will be accompanied by specific verification provisions. There have been concerns that these various treaty-specific verification procedures may lead to a very complicated situation. The European States would be subject to different forms of data exchange and visits by various inspection teams conducting routine and challenge inspections, in order to check certain military activities as well as the numbers of deployed, stored and manufactured weapons limited by treaty. Under some treaties, parties would be permitted to monitor a number of declared facilities through permanent monitoring by inspectors, fencing and sensors.

The following treaties and agreements, which are in various stages of negotiation or ratification, are to be considered:

- The 1987 INF Treaty[2], under which a number of European countries, the so-called basing countries[3] may be subject to on-site inspections until the year 2000 (for 13 years after the entry into force).
- The 1986 Stockholm Document on Confidence- and Security Building Measures[4], under which an observation and inspection regime is in force to monitor, from the Atlantic to the Urals, large scale military activities of the 34 CSCE countries. Since the conclusion of the agreement some 100 observations and 50 inspections have been conducted. During the CSCE summit in Paris in November 1990, participating states have adopted a new document which integrates the Stockholm Document, with a new set of measures.[5] These include, among others, provisions for an annual exchange of military information on the CSCE participants' land and air forces and their weapon deployment plans and budgets. This so-called static-information will be verified through an additional number of so-called evaluation visits on each other's territory, with a maximum of 15 visits a year, depending on the number of military units which

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[2] *Treaty on the Elimination of Intermediate-range and Shorter-range Missiles* entered into force on 1 June 1988. It affects land-based ballistic and cruise missiles with ranges between 1000 and 5500 km and shorter range missiles with ranges between 500 and 1000 km.

[3] The basing countries are the FRG, Netherlands, Belgium, United Kingdom of Great Britain and Northern Ireland, Italy, Czechoslovakia, and the former German Democratic Republic.

[4] *Document of the Stockholm Conference on Confidence- and Security-Building Measures and Disarmament in Europe, convened in accordance with the relevant provisions of the Concluding Document of the Madrid meeting of the Conference on Security and Cooperation in Europe*, Stockholm 19 September 1986.

[5] *Vienna Document 1990 of the Negotiations on Confidence- and Security-Building Measures Convened in Accordance with the Relevant Provisions of the Concluding Document to the Conference on Security and Co-operation in Europe.* This document integrates a set of new confidence- and security-building measures with measures adopted in the Document of the 1986 Stockholm Conference and is the result of the CSBM negotiations during the Third CSCE Follow-on Conference. The document has been endorsed at the November 1990 CSCE Summit and will be in force as from 1 January 1991.

each country has operational on its territory. At the same Summit, it was also agreed to establish a mechanism to discuss unusual military activities causing concern to a participating state, as well as the establishment and organisation of a communication network between the 34 states. Lasty, the Vienna Document contains measures regarding the enhancement of military contacts between the military establishments of the parties and regular visits to each others military airbases.

- The Treaty on Conventional Forces in Europe (CFE)[6], involving 22 countries of NATO and the WTO, requires reductions in five major weapon systems (tanks, armoured vehicles, artillery, attack helicopters and combat aircraft). The Treaty includes a comprehensive on-site inspection regime on the basis of which both groups of states have the right to conduct approximately 300 inspections. It has been agreed in principle that aerial inspection will be an integral part of the CFE Treaty. When modalities are worked out, this may add a substantial number of inspections annually.
  It is expected that future negotiations on CFE and CSBMs will be combined in one single negotiation on disarmament and confidence building, which will include the European Neutral and Non-Aligned countries (NNAs) in CFE type negotiations as well. This may lead to a corresponding increase in the number of ground and aerial inspections.
- The planned removal of most of the tactical nuclear weapons in Europe may lead to post-reduction inspections of former nuclear storage sites on the territory of a number of European countries including inspections on the deployment and storage of the remaining nuclear capable aerial delivery means and warheads.
- A world-wide ban on chemical weapons is planned be verified through an International Inspectorate which will have to conduct hundreds of inspections. A considerable number of these inspections would take place on European territory.

In the light of the above-described developments, it is clear that each country will be heavily burdened by these verification arrangements. All this may lead to the situation that different verification regimes, partly with identical features, will be in force in Europe. This might not only lead to ambiguities during implementation but it will also be very cost-ineffective. It is obvious that cost-effectiveness should be realized through burden sharing by seeking multilateral or international solutions. And, as we have seen, the European political situation is promising in this regard. In fact, only some larger countries could afford to monitor compliance of all these treaties and agreements with their own means. The creation of one single verification mechanism for conventional arms control would hence seem advisable.

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[6] *Treaty on Conventional Forces in Europe* (CFE), Paris, 19 November 1990.

The Future of Conventional Arms Control in Europe

After this brief survey of the existing and potential provisions imposed upon the European countries, the focus will be upon developments regarding conventional arms control in Europe. The question arises whether arms control will play the same dominant role as in the eighties. It goes without saying that the political situation in Europe and the implementation of the cuts provided for by the CFE-I Treaty has already led to fundamental changes in the military strategies and doctrines of all countries concerned. Changes with respect to the forward deployment of forces as well as to the force-to-space-ratios, the relationship between active and mobilizable forces and reinforcement policies, are in full swing. The key problem is how to sustain and organise sufficient forces both for legitimate defence requirements and for responding to crises elsewhere. The latter operations should preferably be performed in the framework of multilateral organisations like CSCE and the United Nations.

The ongoing negotiations on conventional arms control in Europe, will codify military stability at much lower levels of forces through the elimination of the capacity for surprise attack and large scale offensive actions, as well as by the further elaboration of confidence- and security-building measures. The ultimate goal for follow-on negotiations would be a military posture predominantly structured towards defence, without any capability for strategic offensive actions against any of the participating states. In the 1990 Charter of Paris,[7] it is agreed that after the 1992 Helsinki Follow-up Meeting CSCE states will agree to new negotiations on disarmament and confidence and security building open to all participating states.

The goals for the immediate follow-on negotiations on CSBMs and Conventional Forces are clear. Until the 4th CSCE Follow-up Meeting, which will start in March 1992 in Helsinki, the agreed set of CSBMs will be further elaborated. Probably the Soviet Union, together with some of the neutral countries, will put strong emphasis on the development of naval CSBMs. CFE-Ia will address the question of the reduction of troops, and possibly the elaboration of stabilizing measures, with the emphasis on constraints on large-scale mobilization activities as well as the elaboration of an aerial -Open Skies- inspection regime. So, again, in this follow-on phase, arms control will mainly focus on quantitative aspects. However, the temptation of relying on high-technology, fuelled by the Middle East war, together with a tendency to rely on considerably smaller but highly mobile forces in the future could trigger a new, but now qualitative arms race.

In the USSR and some Eastern European countries a process has started to lessening the burden of military production by converting large parts of the military industrial capacity towards civilian applications.[8] However, in the West one can observe a tendency to maintain the defence industrial technological base by emphasizing technological innovations of existing weapon systems, thus trying to

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[7] *Charter of Paris for a New Europe, a New Era of Democracy, Peace and Unity*, Paris, November 1990.

[8] Herbert Wulf, Arms Production, Chapter 8, *SIPRI Yearbook 1991, World Armaments and Disarmament*, Oxford University Press, 1991.

compensate for lower figures in numbers of personnel and weapon systems. Such a development creates serious problems for future arms control negotiations. In the first place, such technological innovations may limit the importance of the arms control treaties by offering quality for quantity. Secondly, it could be considered as a violation of the spirit of such treaties. The implementation of the CFE treaty is illustrative in this respect. Although one cannot speak of a circumvention of the treaty in the true sense of the word, it looks strange that amidst the modest reductions NATO (and former WTO) nations will be allowed to carry out a broad programme of weapons modernisation. More than 2500 tanks, 1000 armoured vehicles and 175 artillery pieces from the excess holdings of Germany, the Netherlands and the United States, are transferred to a number of other NATO members with much older systems. This so-called "cascading" process will allow NATO's oldest equipment to be destroyed. An even more serious problem is the redeployment of armaments and material from Europe to other regions. A number of CFE countries are exporting weapons to sensitive areas which otherwise would have been limited by the CFE Treaty. Bulgaria, Czechoslovakia and Hungary planned to export considerable amounts of weapons due to the countries economic and social situation. Due to the Gulf War, the United States and other NATO members have moved thousands of weapon systems from Europe to the Middle East, of which a considerable number will remain in the area.

The quantitative character of the CFE Treaty is also highlighted by the fact that nations will be free to replace all existing equipment with newer, more capable material since there are no restrictions on production and R&D. Since CFE sets the ceiling for aircraft above the current NATO holdings, one can notice already a shift in force planning towards an emphasis on air power.[9]

Such developments will also put additional strains on verification. Already after the signing of the treaty, a verification related element became a contentious issue in the CFE-I treaty. The monitoring of the annual data-exchange, together with the removal of large quantities of armaments and manpower puts the system under heavy pressure. CFE would require keeping track of about 70,000 remaining weapon systems on both sides, together with hundreds of thousands of troops, as soon as the follow-on negotiations result in lower manpower levels in the participating states. Most of the armaments are relatively small and highly mobile, so they can be easily moved outside the ATTU area. Already the first exchange of CFE-data showed a serious discrepancy between the figures declared by the Soviet Union and the Western estimates of thousands of weapon systems. This was partly due to the fact that the Soviets had redesigned three of their army divisions to coastal defences which are under naval command and thus excluded from CFE. They also moved, as a result of their announced unilateral reductions, considerable quantities of weapons and equipment east of the Urals. These moves would lower the number of inspections which should be carried out on the territory of the USSR, since the number of inspections each state is

[9] *Vienna Fax, Institute for Defence and Disarmament Studies*, 2001 Beacon str. Brookline MA 02146, 26 December 1990, No. 31, 32.

obliged to accept is defined as a percentage of the number of objects of verification (OOVs) declared by each state.[10] The Soviets declared a number of about 900 OOVs while western estimates were between 1200 and 2000.[11] The dispute was difficult to solve. The matter has been discussed in the CFE-Joint Consultative Group, the only mechanism which was already in force under the treaty, and was ultimately solved bilaterally between the United States and the Soviet Union. The dispute was solved in such a way that the Soviet Union would move and destroy tanks and armour elsewhere in order to compensate for those previously tranferred to naval units and those moved outside the treaty area.[12] The dispute lasted over six months after the signing of the treaty and delayed the process of ratification accordingly. Another complicating factor is the growing number of sovereign states in Europe. Estonia, Latvia and Lithuania became sovereign states and a deviation of clauses in the CFE Treaty arose. Although Soviet equipment present on the territory of those states will remain subject of all the Treaty provisions, inspection will require the consent and cooperation of those states which are now outside the Treaty area. Also the status of the Ukraine is a source of concern.Its intention to create national armed forces of about half a million men, which may remain outside the CFE Treaty, is unlikely to be acceptable for the CFE members.

Another problem worth mentioning is verification of the correctness of the exchanged base-line data through inspections can only take place after ratification of the treaty. This shows clearly that at least some verification arrangements should in principle be in force immediately after the signing of a treaty and not after the ratification of the treaty.

These problems, together with problems raised by qualitative changes in the categories of declared weapon systems through technological innovation, indicate that to reduce the verification burden to a manageable level, other approaches to verification should be investigated. Verification shall have to deal with revolutionary changes in land and air warfare caused by deep strike technology capable of delivering fire by ground and air systems such as stealthy aircraft and cruise missiles backed up by sophisticated target acquisition and information systems. The existing verification arrangements are not designed to cope with such developments.

A possibility would be to focus future verification efforts on the structure, combat readiness and activities of armed forces, as well as on nodal points in the development and production cycle of weapon systems rather than on individual weapon systems.[13] Focusing the verification efforts on the structure of the armed forces presupposes that the agreed goal of the CFE is fully met, notably, that all participating states will have

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[10] OOVs are formations, units, storage sites, reduction sites, repair or maintenance units, training establishments and airfields which hold treaty limited equipment (TLE).

[11] *Focus on Vienna*, No. 22 Febr./March 1991, Osterreichisches Komitee fur Europaeische Sicherheit und Zusammenarbeit, p. 2.

[12] For a detailed description of the compromise reached see: *The Arms Control Reporter*, A Chronicle of Treaties Negotiations Proposals, Weapons and Policy, 1991, Vol. 10, No. 6, June 1991, 407.B.447.

[13] Klaus Oestreich, Arthur Knott, "Verification von Rustungskontrolvereinbarungen - Systemanalytische Betrachtungen", *Wehrtechnik*, September 1989, p. 33-36.

eliminated their capacity for surprise attack and large-scale operations, leaving only forces for defence and multilateral peace keeping. Thus, verification should not focus only on treaty limited items but also encompass security related measures beyond the strict limits of arms control agreements. Focusing verification on military structures means that monitoring should be concentrated on locations and training patterns, logistics and infrastructures of the operational and strategic levels of active military formations. Also the capacity for larger-scale mobilization should be monitored. Monitoring the non-offensive posture of logistics could involve forward -deployed equipment like tanks, aircraft, bridging equipment, tank transporters, missile systems, fuel and ammunition storage.

The history of arms control offers little experience with regard to the verification of military research, development and production.

However, if we engage gradually into the era of qualitative arms control, monitoring of research, development, testing and production of military equipment should be an integral part of the future verification systems for conventional arms control agreements. It does not make sense to limit certain weapon systems if the possibility is left open for circumvention, because large amounts of modernized equipment and weapon systems are available off-the-shelf, stored or kept ready in industries.[14] One could start to investigate a number of feasible options ranging from possible reporting systems for the exchange of information on military research to intrusive monitoring of testing and production. Nodal points in the life-cycle of weapon systems should be identified for monitoring taking into account legitimate commercial interests.

Other developments which have a direct bearing on the future of arms control and disarmament in Europe are:

- The statement of the 34 CSCE countries in the CSCE Paris Charter of 19 November 1990, calling for the successful conclusion of the negotiations on "Open Skies", which would permit aerial reconnaissance of the entire territory of the NATO and former WTO States, including the United States and the Asian part of the Soviet Union.
- In the same Charter it was agreed to establish a Conflict Prevention Centre (CPC), which among other things, has been tasked with some verification elements, such as the exchange of military data, the investigation of unusual military activities and the annual implementation assessment meetings.
- CSCE countries agreed to continue the arms control process in Europe within the CSCE framework beyond the ongoing negotiations. It was suggested that in the future, resulting from decisions taken at the 1992 CSCE Follow-up Meeting in Helsinki, the two negotiating processes (CSBMs and CFE) should be fused into new negotiations on disarmament and confidence and security building open to all participating states.

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[14] John Grin, Henny van der Graaf (eds), *Unconventional Approaches to Conventional Arms Control Verification, A Preliminary Assessment*, VU University Press, Amsterdam, 1990, p. 251-256.

"The success of each confidence building measure justifies the next one, until a net work of confidence-building measures provides the sound basis on which more far reaching agreements in the field of international security can be built."[15] Indeed if one looks at the set of confidence and security building measures concluded so far, one can conclude that these measures have now reached a stage that can provide a sound security basis. Therefore, after the next CSCE Follow-up Meeting, the process of confidence building should be integrated into the "new negotiations" announced in Paris, whereby confidence- and constraining measures should be an integral part of further going conventional disarmament negotiations. The emphasis should shift from military-technical CSBMs to the more political military orientated ones. However, at this junction it is not very clear what future negotiations should have to address. It seems not unlikely that after first stage reductions countries would want to wait a couple of years before thinking of further reductions in their armed forces. Most countries are now in the process of re-evaluating their security needs and of adapting their force structures to new circumstances. But the momentum should not be lost and the process should continue with in-depth discussions on the changing military strategies. These discussions should start in the framework of the Conflict Prevention Centre and its Consultative Committee, thus making these institutions fora for discussing basic concepts for force restructuring and military technological developments.

A possible new area where CSBMs can play a role will be arms control at sea. In general, one may say that verification of arms control at sea is easier to implement than on land. Monitoring of the surface fleets of the various participants will not cause much problems. Such a prior notification system will, from a technical point of view, not be difficult to implement. Quite another issue is the monitoring of submarines which may cause considerable problems. But here one may think of formulas limited to the prior notification of submarines when they are leaving and returning to their harbours. The key question is a political one. Are participating states willing to consider arms control at sea as a viable option, and is it possible to restrict arms control at sea to the European waters? The United States continues to oppose negotiations on naval arms control due to their geo-strategic position which asks for secure sea lines of communication. The Soviet Union as a landpower is less dependent on secure sea communications and has always been in favour of naval arms control. But also a number of European countries, especially those in the Northern region, do see advantages in starting negotiations on naval arms control. They fear that as landforces are reduced and regulated through a network of confidence- and security building measures, an unregulated situation in northern waters could easily result in a decoupling of the Northern countries from the new cooperative security system in Europe. In general, arms control at sea makes sense only on a global basis. But one

[15] Jan Martenson, in : "Confidence Building Measures", Karl Kaiser (ed.), *Arbeitspapiere zur Internationale politik*, No. 28, Forschungsinstitut der Deutsche Gesellschaft fuer Auswartige politik, e.V. Bonn, December 1983, p. 9-17.

can also envisage a number of confidence building measures applicable for specific European regions or specific countries.

Another area of interest should be arms transfers to countries inside and outside the treaty area. Although such proposals may not have much "flesh on the bones", such reporting systems should be seen in combination of a verifiable code of conduct on arms and technology transfer. The Gulf war has dramatically shown the urgent need for such a code of conduct. The present Missile Technology Control Regime (MTCR) system has limited guidelines, no binding status, only a few participants and no verification arrangements.[16]

The Verification Arrangements

At present, two verification systems for conventional arms control are in force, viz. under the 1990 Vienna Document on Confidence- and Security-Building Measures and under the 1990 CFE Treaty.

Verification of Confidence- and Security-Building Measures

The verification arrangements of the Vienna Document consist of provisions for the obligatory invitation of observers (formally, observation is not considered as an inspection measure but as a confidence-building measure) to notifiable military activities and a very detailed on-site inspection regime for checking compliance with the agreed confidence- and security-building measures. The main modalities are the following:

- each participating state has the right to conduct inspections on the territory of any other participating state which has territory in Europe;
- no participating state will be obliged to accept more than three inspections per year or more than one inspection by the same state;
- the state which requests an inspection must give its reasons but a request cannot be refused;
- permission must be given within 24 hours, and the inspection team may begin the inspection in the designated area within 36 hours;
- certain areas, defence installations, warships or military vehicles and aircraft cannot be inspected;
- inspections may be performed on the ground, or from the air, or in both ways;
- per team no more than four inspectors are permitted;

[16] On 7 April 1987 an agreement to limit the export of large missiles and related technology was reached by Canada, France, FRG, Italy, Japan, UK and US. Halting exports of rockets able to carry 500 kilograms over 300 kilometres. Major components, production equipment and technology would be halted to friendly and neutral countries alike. The USSR wants to join (source *Arms Control Reporter*, 1991, 706.A.1.). As a result of the Gulf War, new initiatives include stronger guidelines and the application of the system to other weapons of mass destruction as well as conventional weapons. As of 1 August 1991, 17 countries joined the Regime, while a number of other countries have expressed interest in adopting the MTCR export guidelines.

- they may divide in two subteams;
- the host state generally provides vehicles and aircraft.

The document also contains a number of provisions regarding the rights of inspectors. No multilateral consultative arrangements were provided for in the original Stockholm Document. Consultation was to be carried out by existing bilateral diplomatic channels.

Experience with the verification system of the Stockholm CSBM agreement has been satisfactory to date. After a flare-up of inspections during the first two years of implementation, the system came to rest and inspections are conducted at much more relaxed intervals. Except for helicopters, aircraft has not been used for inspection purposes. During the implementation, it was felt that inspectors should be permitted to use more equipment than photo cameras, such as night vision cameras and hand-held passive night vision devices. Also missing was a provision dealing with informing troops and officials in the area under inspection regarding the presence and functions of inspectors. It was also felt that inspectors were not always sufficiently briefed by commanders or other representatives of the inspected state. Accordingly, in the newly adopted Vienna Document on CSBMs[17], the inspection provisions have been extended with such provisions. A number of other suggestions were made, but it proved not yet to be possible to get general agreement on these provisions. For instance it was suggested to lower thresholds for observation, to increase the number of inspections and to consider notification and observation of independent air and naval activities.

The Stockholm Document did not contain any explicit provision about the periodic exchange of military information. During the Stockholm negotiations the Western and most of the NNA-countries constantly stressed the importance of this vital element of any verification system, but the inclusion of such a provision was always fiercely opposed by the USSR. The new Vienna document contains extensive provisions for the annual exchange of information on military forces, plans for the deployment of major weapon and equipment systems and military budgets. This information exchange will be supported by the earlier described system of evaluation visits and by a communication network between CSCE capitals. Already during the Stockholm negotiations, such a network was proposed by a number of participants, but due to a lack of time it could not be agreed upon. In Stockholm, parties could also not agree to set up a consultative commission as a forum for assessing the implementation of the agreement. A number of NATO countries were opposed to such a forum because they feared that it would give the Soviets a "droit de regard" on Western European security matters. However, in light of the changed international situation, it proved no longer a problem at the 1990 CSCE Summit in Paris to agree upon the establishment of a CSCE Consultative Committee. This Committee will be responsible for, among other things: annual implementation of assessment meetings, discussion and clarification of information exchanged under agreed CSBMs, preparing seminars on military doctrines and such other seminars, and, holding meetings to discuss unusual military activities.

[17] Vienna Document, *op cit.* (see note 5).

Through the CPC it will establish and maintain a data bank, to be used by all participating states, compiled on the basis of exchanged military information and published annually. The secretariat is also tasked with the publication of yearbooks on military information.[18]

CFE Verification

The CFE verification regime[19] includes detailed notification and exchange of data, provisions for the use of national or multinational technical means, inspections of declared sites and challenge inspections to undeclared sites and areas (the latter with the right of delay and ultimately refusal). Although the principle of aerial inspections is accepted, no agreement could be reached on the details. Parties have committed themselves to negotiate them in the follow-up talks.

There are four types of inspections: inspections to declared sites, challenge inspections to specific areas, inspections to witness reductions and inspections to witness certification. The inspection regime is divided into four distinct phases:

1. The baseline validation phase, 120 days-intense inspection of baseline data.
2. The reduction phase, three years; inspections to witness destruction and certification.
3. The residual level phase, 120 days-intense inspection of notified baseline data following reductions.
4. The residual phase, for ever-inspections to check data at declared and undeclared sites.

A new feature compared to the verification arrangements of the Stockholm agreement is each state party's right to inspect all other states. This means, e.g., that WTO states can inspect each other. (It was on the insistence of some of the WTO states to include this possibility.) Inspection teams may consist of up to nine inspectors, may be divided into three subteams and may spent ten days on the territory of the inspected state. Detailed provisions exist for the time spent during that period at the various objects of verification (OOVs). Helicopters may be used to overfly the area during an inspection, if that area is greater than 20 sq. km, for up to one hour. The equipment which inspectors are allowed to take includes: portable passive night vision devices, binoculars, video and still cameras, dictaphones, tape measures, flashlights, magnetic compasses, lap top computers and other equipment subject to approval by the host state. The notice to inspect is 36 hours. The inspected state has the right at the inspection-site to shroud equipment and items not limited by the treaty and to deny access to sensitive points.

CFE has been negotiated in a political climate very different from that of the Stockholm CSBM agreement. Both East and West showed a willingness to actually

[18] *Supplementary Document to Give Effect to Certain Provisions Contained in the Charter of Paris for a New Europe*, Paris, 19 November 1990.

[19] Information derived from *Trust and Verify, The Bulletin of the Verification Technology Information Centre*, No. 16, December 1990/January 1991.

reduce arms. In addition there was an increased acceptance by the East to accept deeper cuts in their armed forces, together with the readiness to accept intrusive monitoring measures such as detailed information exchanges and obligatory on-site inspections. The implementation of the CFE verification provisions such as the exchange of data, the conduct of on-site inspections and judgments about compliance are the responsibility of each sovereign state party to the treaty. Thousands of sites are eligible for inspection on both sides, while there will be a unprecedented exchange of information in various phases of the verification process.

The inspection protocol of the CFE treaty is the most comprehensive one to date. It breaks new grounds by including challenge inspections to undeclared areas, unfortunately with a right of refusal. In principle, each state is able to participate in the on-site inspection activities, but it is considered to be a national responsibility. Not many states have sophisticated national technical means of verification at their disposal. The United States and the Soviet Union have high resolution imaging satellites and very sophisticated electronic intelligence satellites. In 1992, France, in cooperation with Italy and Spain, will launch the military imaging satellite HELIOS. The other participants will have to rely on less sophisticated means or will have to rely on the willingness of the "have's" to get the necessary information. History has proven that states should not expect too much of the latter. Especially the former WTO states will have to rely completely on their own limited resources to get the information they may need for targeting inspections. This inequality violates the principle that each participant should be able to detect possible violations in a timely manner. Therefore, one could have wished that the relevant information gathered by participants to the treaty with their NTMs should be shared on a routine basis with all the other participants. Multilateral arms control treaties should include provisions obliging owners of NTMs to share such information with all the other participants.

A loophole in the treaty is the absence of provisions for the monitoring of the production facilities of TLEs. The United States proposed such a provision but a number of West European states blocked this because it would have excluded the defence industries of the United States and Canada and two-thirds of the industrial capacity of the USSR situated east of the Urals, thus outside the area of application.

Another important feature which is missing, is the absence of provisions for aerial inspections. However, agreement in principle has been reached on aerial overflights for inspection purposes. The parties have committed themselves to further negotiate this aspect in the CFE follow-on negotiations so that aerial inspections could start after the completion of the process.

However, future negotiations on aerial inspection in the context of CFE should be seen in close relationship with the Open Skies negotiations. Although the Open Skies concept must be seen as a confidence building measure rather than a means for monitoring a specific treaty, there are so many similarities that the difficulties in the 1989/1990 Open Skies negotiations regarding the use of technology, the number of overflights and the organisation of the system, had a strong impact on the CFE negotiations.

Open Skies should be negotiated in close relationship with the CFE aerial inspection regime. The area of application is not only the European territory of the NATO and former WTO states but also the territory of the United States, Canada and the Soviet Union east of the Urals. It would be advantageous if the neutral European countries could be parties to the agreement as well, because it would give real effect and expression to the political symbol of openness and transparency. In light of the emerging security situation in Europe and the emerging institutionalisation of the CSCE, it would be an excellent step to establish a central international organisation for Open Skies. Such an organisation could serve as a primary training ground for future multilateral mechanisms for crisis prevention and arms control verification.

Satellite Surveillance as an European Perspective

Satellite surveillance is not excluded in the existing European arms control agreements. Already in the 1986 Stockholm Document the role of satellites is explicitly mentioned. It is stated that " the participating States recognize that National Technical Means can play a role in monitoring compliance with agreed Confidence- and Security Building measures". This phrase is restated in the 1990 Vienna Document. The sentence reflects the situation whereby only the United States and the Soviet Union possess military surveillance satellites which are also used for the monitoring of arms control agreements. The CFE Treaty has a little bit more to say about the use of satellites for monitoring purposes. In article XV it is stated that a State Party shall have the right to use national or *multinational* technical means of verification at its disposal in a manner consistent with generally recognized principles of international law and it is agreed that a State party shall not interfere with these systems or use concealment measures that impede verification of compliance by NTMs. This language in the CFE treaty opens the possibility for closer European cooperation in monitoring from space. The changed security situation in Europe, the complete withdrawal of Soviet troops from Eastern Europe, a more restricted American military presence in Europe, the lessons from the Gulf War and last but not least, the more dominant role Europe wants to play in exercising an independent foreign policy are incentives for a closer European cooperation in this field. As a first step, closer cooperation is foreseen in the framework of the Western European Union which reportedly at the end of 1992 will start to operate a satellite data analysis centre using images from commercial satellites like SPOT and LANDSAT and images produced by the French/Spanish/Italian HELIOS satellite which will be launched in 1993/1994. The images can be used for the monitoring of arms control agreements, crises and environmental disasters. But not only cooperation should be sought between Western European countries, but participation should be open to all European interested countries. It could be envisaged that the WEU data centre, after having gained some experience with a limited group of participants, can open the organization for other interested European states as well. At the same time the data analysis should not be restricted to data obtained from western sources. Other data producers like USSR Soyuskarta could be used as well.

Without extensive monitoring capabilities of their own the new emerging European institutions cannot react adequately upon events in and outside Europe for which they claim responsibility. It should therefore be considered to link or integrate the WEU data analysis Centre into the CSCE machinery.

The Use of OSI Technology

The use of technology for on-site inspection (OSI) is very limited under the CFE treaty. In fact, there are only provisions for hand-held equipment such as cameras, binoculars, laptop computers and maps. A lot of research is going on about the applicability of other forms of OSI technology, ranging from techniques for portal monitoring of production plants, storage sites and garrisons to the use of tags and seals.

Already civilian industry has a variety of technologies available which could have application to on-site remote sensing and fencing of such installations.

Tagging and sealing are also widely known techniques. A seal is a device connected to the items of interest in such a way that to open or enter the item the seal has to be broken. A tag is a permanent addition to a piece of military equipment whose purpose is to provide a means of identification to assist the process of counting. One of the advantages of this kind of technology is that they simplify the problems of violations and verification of limits on numbers. Patricia Lewis[20] observed that tags allow verification of Treaty Limited Equipment (TLE) to be as simple as the zero-option in the INF-treaty: any untagged TLE observed is a clear treaty violation.

However, it is hardly conceivable that such techniques could be used in a verification system based on national responsibility. It goes without saying that it presupposes a central body responsible for the acquisition, operation and maintenance of such equipment. As a start it would be a practical solution to consider a wide range of options in the CFE Joint Consultative Group - the mandate of which does not exclude such an approach[21] - with the view that such technologies may be discussed and negotiated in follow-on talks. There should be a coordinated effort to make cost-effective use of technology not only to assist the human factor in the process but also to make procedures simpler by the introduction of automated systems for data collection, analysis and assessment.

A distinction could be made between sensor technologies in direct support of on-site inspectors in counting treaty limited equipment and autonomous on-site or out of area sensors (manned or unmanned) and using dedicated communications where necessary. Sensors could be employed for monitoring the weapon destruction process and for the permanent monitoring of equipment in the field or in military depots and garrisons. In using technology for monitoring arms control treaties and agreements it should be available to all participating states and not restrict the operational use of treaty limited equipment beyond restrictions imposed by the treaty provisions. (This could be the case

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[20] Patricia M. Lewis, "Technological Aids for On-Site Inspection and Monitoring", in: John Grin and Henny van der Graaf (eds), *op cit.* (see note 14).

[21] See *Treaty on Conventional Armed Forces in Europe*, Article XVI, pt. 2 (C).

by using active tags which could be read at long distances by aircraft or satellites, thus creating the possibility of revealing at short notice large quantities of military equipment for targeting purposes)

From a technical point of view there are hardly any limits to the use of technology for monitoring purposes. Most of it is available "off the shelf" such as, bar code tags and readers which are in wide use in supermarkets. The same is the case for a variety of portal monitoring equipment. The main problems with the use of technologies for monitoring purposes are of a political, military and budgetary nature.

Politically, the use of these technologies asks for close cooperation between the participating states for the introduction, operation and maintenance of such systems. Militarily, the benefits of the use of such technology should be weighed against the wider military concerns of the participating states. However, it is expected that technology can solve this problem effectively. Apart from these constraints one has to consider the cost factor. For instance, any active ground sensor system which will be interrogated by satellite or aircraft asks for high capital and operating costs, while sensor systems in direct support of on-site inspectors can probably be installed at rather low costs.[22] This leads to the conclusion that of the options to be considered priority should be given to those current and new sensor systems which are politically/militarily acceptable and cost effective and which will enhance the effectiveness of the on-site inspection teams. Instead of putting the emphasis on those highly sophisticated satellite readable sensor systems, one should primarily search for systems which optimize the inspection teams' productivity during the rather limited inspection hours defined in the treaty. (48 hours in the case of CFE). In an evolving scenario more technical equipment could be added if needed and affordable. That means that a wide range of options should be studied now in order to have them available during the forthcoming negotiations.

Organisational Arrangements

Another problem is the absence of any organisational arrangement for verification in the CFE treaty. It is clearly stated that the implementation of the verification provisions will be the responsibility of each sovereign state party. Also judgments about treaty compliance will be a national responsibility, albeit that within the framework of the Joint Consultative Group (JCG) state parties may address questions relating to compliance with, or possible circumvention of the provisions of the treaty. The treaty leaves room for the organisation of multinational technical means and for groups of states to coordinate their verification efforts. In this respect it may be noted that NATO has established a Verification and Information Systems Directorate. Without affecting national responsibilities, it will play a role in coordinating national verification efforts, and act as clearing house for data exchanges.

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[22] Nato Industrial Advisory Group (NIAG) Subgroup 32, *Conventional Disarmament Verification Technology*, Brussels, May 1991.

However, it is unlikely that the Eastern European participants would set up a similar mechanism. Since July 1991 the Warsaw Pact Treaty Organization does not exist anymore. So there is no mechanism for coordination of arms control for the Eastern European countries. They will have to rely on their own limited resources for gathering data for the possible targeting of inspections and the verification of compliance. So this "implementation imbalance" creates an unequal situation whereby NATO states may rely on the combined resources of the Western participants, including NTMs, while their Eastern European counterparts will have to rely on snippets of information insufficient for checking compliance through timely on-site inspection. Although it may not violate the principle of "equal rights" to the letter, it certainly violates the spirit of this principle.

During the CFE negotiations various specific references were made with respect to the development of multilateral forms of verification as a means of enhancing cooperation in Europe.[23] But the Charter of Paris hardly touches upon this. It was only accepted that the future Crisis Prevention Centre should also be tasked with the exchange of military data related to the CSCE Confidence- and Security-Building Measures.

Although a unilateral "country-by-country" verification system, with some intra-alliance coordination, may be a practical solution for the short term, the new security situation in Europe asks for a cooperative security system in which a multilateral system of verification will be an important element.

A pure national responsibility for the verification of a multilateral arms control treaty like CFE, has both political and technical drawbacks. As mentioned before, it generates inequality between participating states. This is especially the case for countries not members of an alliance. Due to the fact that they have no access to sophisticated early warning systems, they probably cannot react timely to possible violations.

The effectiveness of verification may also be hampered by diverting political interests of individual countries, thus lowering the level of crisis stability. In a purely unilateral verification system the use of cooperative means such as ground sensor systems, tags and sealing techniques, would be too complicated. Finally, joint verification efforts within a multilateral system would probably generate more confidence and trust than unilateral actions.

Prospects for a Joint Verification System[24]

It goes without saying that in a UNIDIR sponsored research attention should be paid to the possible role of the United Nations in the field of verification. Recently a

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[23] E.g.*Memorandum on the European Security Commission* issued on 6 April 1990 by the Federal Ministry of Foreign Affairs of the Republic of Czechoslovakia (A/45/223); and Address President USSR during CSCE Summit, Paris, November 1990.

[24] For a more extensive discussion of the prospects for cooperation in verification, see my contribution to a verification seminar, Southern Methodist University, Dallas, *Prospects for European Cooperation in Arms Control Verification*, 26 April 1991.

group of governmental experts was requested by the UN to undertake an in-depth study. However, as expected, the experts concluded that there seems not to be much international support for a global verification organisation. At most, the UN machinery could be of some help by serving member states with an UN data-base and some forms of fact-finding and similar activities.[25] However, the verification role of the United Nations in Iraq under Security Council resolution 687 and the United Nations monitoring of the Central American peace process may indicate that the United Nations is becoming a more effective forum for arms control verification and fact finding than it has ever been before. One should however keep in mind that its more effective functioning is strengthed due to the new cooperative relationship between the Superpowers. And as Patricia McFate and Sidney Graybeal observed: "there will however be States that offer less than whole-hearted co-operation and even refuse all participation."[26]

There seems to be more future for centralized verification machinery on a regional or treaty related basis. Participants which have a direct interest in the region and the treaty may show more willingness in joining their interests in a common endeavour.

Sometimes it is advocated that some neutral European countries should perform the verification function on a regional basis. However, such a "third country" arrangement has some serious drawbacks. Parties to an agreement have more to gain by allowing mutual access to each others territory than handling over the verification of compliance to third parties. Moreover, it would be probably too great a burden for a neutral country to be responsible for triggering a conflict by making public evidence of non-compliance. Finally, the option will not at all be feasible anylonger when future conventional arms control negotiations will be merged into one single negotiation comprising all the CSCE states.

Central European systems for verification could be considered in the context of alliances, groups of countries or in an all European organisation. A separate verification system for NATO and for the former WTO countries seems hardly feasible anymore. At present, only NATO is able to organise such a system. But as we have seen it can have only a very limited mandate, due to the fact that some countries are very reluctant to give up elements of their national responsibilities or join their monitoring assets with their alliance partners. If both alliances could have set up such verification agencies there would have been, from a technical point of view, a number of advantages. Existing infrastructure and procedures could have been used. Data exchanges, on-site inspections, the use of technology and intra-alliance use of data could have been optimized. On the other hand, the close relationship between the alliance verification machinery and the crisis management and alert systems of the alliance, could pose serious stability problems in times of tension. Another problem would be the

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[25] *Verification in All its Aspects*, study on the role of the United Nations in the field of verification, General Assembly, A/45/372, 28 August 1990.

[26] Patricia Mc Fate and Sidney Graybeal in :*Verification to the year 2000*, Arms Control Verification Studies No. 4, Arms Control and Disarmament Division, External Affairs and International Trade, Canada, 1991, p. 9.

integration of the other European states into the systems once the two sets of negotiations will be merged.

A possibility could be that a number of countries join their efforts to lessen the burden. It could be conceivable that some Eastern European countries would coordinate their verification efforts. Given that they may be interested to inspect the Soviet Union as well, they could even wish to rely on information coming from Western participants. This may look rather awkward, but Hungary has already made known its desire to team up with any NATO nation when undertaking inspections and to share the results of all CFE inspections among all signatories.[27] However, using the alliance or separate groups of countries as a framework for verification, does not seem to be an optimum solution politically. Even if these organisations would have reorganised into more political institutions, they could be seen as symbols of continued confrontation and mistrust.

In the light of the political situation in Europe and recent efforts to institutionalise the CSCE process into new structures, the CSCE framework should be exploited to its full extent. The Paris Charter states that to strengthen peace and to promote unity in Europe, a new quality of political dialogue and cooperation thus development of the structures of the CSCE is needed. Especially in the light of the recent unrest in the Soviet Union, everything should be done to integrate that country in as many multilateral European structures as possible. A situation should be avoided that through the building and strengthening of Western European structures the Soviet Union would feel itself isolated.

As stated before, a new European security order will probably not be realized through radical changes but will advance gradually, seeking to combine and integrate existing structures and creating new structures embracing all the former antagonists. In this perspective much could be said in favour of creating an all-European CSCE verification organisation. From a technical point of view, compared to national systems resources, it can be centralized and used in a more cost-effective way. Moreover it would provide a practical organisational framework when large-scale application of technology is foreseen. This will also be true for the organisation and conduct of on-site inspections and the possible future use of multilateral aircraft and satellite systems. From a political point of view, the analysis of arms control verification data can be done much better by a centralized verification agency than by individual states. If states are to analyse possible violations individually, they may come to different conclusions and subsequently to more ambiguities and mistrust. Another political advantage is that a centralized monitoring system will allow smaller states to participate on a equal footing while the same facilities would be available to all parties to the agreement.

Preferably, the verification organisation should be closely linked to or integrated into the CSCE Conflict Prevention Centre located in Vienna which is already tasked, among other things, with the tabulation and exchange of CSBM-related military data,

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[27] *The Arms Control Reporter*, 407 B, 431.

including data about military budgets and about the deployment of major weapon systems. The CPC will also be used for consultations regarding unusual military activities and hazardous incidents. Apart from giving the Centre substantial responsibilities for the verification of arms control agreements in Europe, it should also act as a clearing house for pre-notification of military activities and render fact-finding, mediation and arbitration services. Joint Consultative Commissions established in the context of arms control treaties and agreements should also work under the aegis of the CPC.

With respect to the verification tasks the Centre should include facilities for planning/coordination, data management, training and compliance analysis.

It goes without saying that such an organisation can only work effectively if participating states are willing to give up some of their sovereignty with respect to verification. The centre should have a sufficient degree of independence in performing its duties, in order to avoid delays between the interpretation of data and the submission of inspection teams. To that effect it should be avoided to mix political judgements and technical functions in the verification organisation. The main function should be to perform monitoring, handling of data, procurement and operation of technical equipment, training of inspectors, etc. Political judgements regarding compliance should be the responsibility of higher CSCE organs and ultimately of the individual parties to the treaty or agreement.

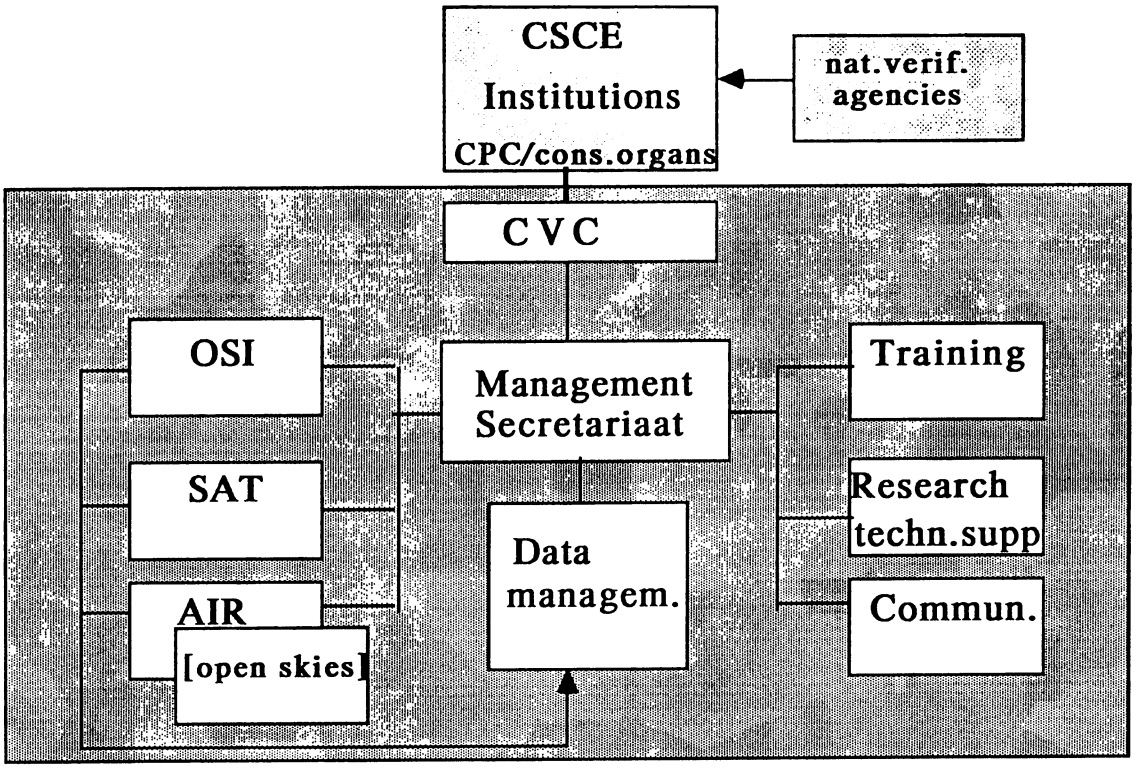
As long as the centralized system lacks adequate remote sensing means of its own, it may not be able to react timely to possible treaty violations. Therefore, it should not be excluded that individual states with better monitoring capabilities may reserve the right to conduct challenge inspections under national responsibility. But states should report these inspections immediately to the agency in order to make sure that no duplication will occur.

Theoretically, a central verification system could consist of the following elements: management, data processing, technical equipment section and special segments for space monitoring, aerial monitoring and on-site inspection. It could also include training facilities for inspectors (see figure 1).

The Cost Factor

One of the consequences of the national responsibility for verification is that each nation will have to establish its own full scope national verification agency. Such agencies will have to associate themselves not only with the organisation and conduct of observation and inspections but also with the handling of data, training of inspectors and escorting services.

Figure 1: Possible Organisational Structure for CSCE Verification



The only costs which will be shared among all the participants are the costs associated with the operation of the Joint Consultative Group. Under the CSBM and CFE agreements participating states are individually bearing the costs for visiting inspection teams on their territory. These costs involve: meals, lodging, transportation, medical care, security protection and escort services for the inspection teams. On-site inspection is not the only means of verification. Countries possessing NTMs will also use these for verification purposes. Whether this will lead to additional costs is questionable. Much of the information needed to verify arms control treaties is gathered anyhow for intelligence purposes.

In analyzing the costs of verification one should keep in mind that these should also be compared with the savings that arms control might bring about.

Substantial expenses will be associated with the destruction of large quantities of equipment. This will especially be the case for a number of WTO countries; in certain categories the WTO will have to destroy up to 50% of its weaponry, while about 7-15% of NATO's tanks will be subject to limitation in order to comply with the treaty.

In the CSBM and CFE Inspection Protocols, no provisions are foreseen for portal-perimeter monitoring of storage sites. This reduces the costs considerably because such monitoring can be very expensive, both for the inspecting country and for the host country.

When in the follow-on talks, aerial inspections are permitted and the conduct of such overflights might be rather costly when implemented under national authority. In an American study[28] the costs for an aerial component in CFE verification consisting of one or two aircraft is estimated at $ 40 to 180 million for one-time costs and $ 5 to 10 million annually. A part of these costs could be borne within the existing budgets by combining normal training missions with verification tasks and thus using existing assets and resources.

By comparing available figures of the costs of verification under national responsibility or conducted by a central agency, it can be concluded that a centralized system of verification is much more cost-effective (see tables 1 and 2). One should, however, keep in mind that also in the case of a centralized verification system, individual countries will have to anyhow establish a national verification focal point for the reception of inspectors on their territory and for the possible conduct of challenge inspections. Although it seems to be agreed without too many problems, it is a strange phenomenon that all the costs for hosting inspectors will have to be borne by the host country. This is especially the case if a conducted challenge inspection proves that no violation has occurred. Probably this problem will be one of the subjects of follow-on talks: some participants have already shown some dissatisfaction with the chosen solution.

Table 1 shows that the United States Congress' figures on the costs of US verification efforts (excluding the costs of NTMs) range from $ 105 to 780 million for initial costs and from $ 25 to 100 million dollars annually. It is estimated by the US that they will conduct 20 to 25% of all NATO inspections and be the subject of 20 to 33% of all inspections conducted by WTO members. On the basis of these figures, one can estimate the aggregate costs for all Western participants to be about three or four times as high. This amounts for recurring costs from $ 100/125 to $ 400/500 million annually.[29]

For the comparison of these figures with the possible costs of a central verification agency, not many figures are available. One possibility is to look into the budget of the International Atomic Energy Agency (IAEA) in Vienna. This agency is conducting its inspection duties with a staff of 200 inspectors and about 500 supporting staff, with a yearly budget of about $ 63 million.[30] Another indication is given in a study of the Western European Union (table 2) which estimates the costs of a Western European Verification Agency at about ECU 500 million for one-time costs and ECU 175 million annually (one ECU= $ 1.17) These figures include procurement and operation of a fleet of 6 aircraft for aerial inspections, but exclude the participation of Eastern European and NNA-countries.[31] As a first step, it has been decided in the WEU to

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[28] *US Costs of Verification and Compliance Under Pending Arms Treaties*, Congress of the United States Congressional Budget Office, September 1990.

[29] The big difference between these two figures is caused by the very rough estimate of the baseline inspection costs, which are not specified in the study.

[30] See *Budget IAEA 1991*, Section 5, Safeguards, summary of costs, table 83, 1991, I Vienna, 1991.

[31] *Verification System for a Conventional Arms Control Agreement in Europe*, Ag I (89), D/14, Paris.

create a WEU Satellite Centre, which at first will be used for training of image interpreters and for the development of technology and will initially cost 38 million ECU. It should be operational in the course of 1992.

Table 1: Compliance/On-Site Inspection Costs

One time procedures	*Million $*
Observations of WP eliminations	10 - 50
Baseline inspections:	
at US bases	20 - 385
at WP bases	2 - 15
Baseline suspect-site quota inspections:	
at US bases	3 - 30
at WP bases	2 - 5
establishment aerial reconnaissance	40 - 180
initial planning and management	5 - 15
R&D	25 - 100
Total costs	105 - 780
Annual recurring procedures	*Million $*
Short notice quota inspections	
at US bases	5 - 25
at WP bases	1 - 5
Suspect site quota inspections	
at US bases	1 - 10
at WP bases	0 - 2
air reconnaissance	10 - 30
management/analysis	10 - 25
Total costs	27 - 107

Source: Congressional budget office, CBO study, 1990

Another example is the estimated costs for a future world-wide chemical weapons Convention.[32] Here, it is estimated that the costs for the International verification Agency will amount to $ 70 million annually.[33] These estimates suggest that an international verification organisation is much cheaper than the totals of the national institutions.

[32] *Verifying the Projected Chemical Weapon Convention, A Costs Analysis*, AFES PRESS Report, No. 13, 1989.

[33] These figures are for the control phase. A strict verification regime for the destruction phase amounts to $ 297 million/year, see note 32, p. 96.

At the Centre for Verification Technology of the Free University of Amsterdam, some research is being done to analyse costs for a multilateral verification organization for conventional arms control in Europe. The study has not been concluded yet, but the figures can be regarded as accurate estimates.[34] The figures show that the monitoring of residuals of TLE holdings is quite expensive if portal/perimeter systems are foreseen. The total costs of a central CSCE verification system (excluding the use of satellites and excluding portal monitoring) would be about ECU 400 million for one-time costs and ECU 200 million annually. If the CSCE distribution key for the common expenses will be applied than the contributions will range from 8.8% for the larger countries to 0.16% for the smallest ones.

Table 2: Costs of a West European Verification Agency

In million ECU	*One-time*	*Annual*
Agency	70.0	53.5
On-site inspections	0.9	5.9
Observer teams	5.6	14.2
Perimeter contr.	302.8	33.1
Aerial observations	120.0	27.6
Tags/tagging	16.0	1.0
Escorts	0.8	39.9
Total	516.0	175.0

(Figures derived from WEU Study Ag.I (89), D/14)

Application of the European Conventional Arms Control Elsewhere

The experience in Europe with confidence and security building measures and the reduction of conventional armed forces has demonstrated that arms control in potential hostile environments can be successful. However, conventional arms control in Europe has a long history of failures as well. Real breakthroughs were only possible when the international climate was less tense and more orientated towards cooperation and conditional upon the commitment by the parties to restructure their military relations towards defence dominance. Such arms control arrangements could be implemented in various regions. The efforts for stability in one region cannot be seen in isolation from the efforts for stability in other regions. This is dramatically highlighted by the developments in the Middle East. It could be argued that the end of the Cold War in

[34] Wim K. Meijer, *Costs of Multinational Verification Organizations in Europe - A Comparative Analysis*, CVT Report No. 3, INSTEAD, CvVT, Free University, Amsterdam, 1991.

Europe and the fact that the superpowers do not consider themselves as adversaries anymore, made the Gulf War possible. Conversely, military conflict outside Europe may endanger the newly gained detente and lead to new instabilities. Potential and real crisis areas are Southeast Asia, Africa, Latin America, Central America and the Middle East. A number of countries in these regions have a number of common characteristics which are quite distinct compared to Europe: very weak economies; foreign interventions; under-developed infrastructures; ill defined borders; internal political instability; extensive insurgents movements; etc. It is beyond the scope of this study to deal with all the regions outside Europe. Therefore, two regions will be analyzed in more detail: Central America and the Middle East. It is conceivable that a number of findings will also be applicable for other regions.

Prospects for Conventional Arms Control and Verification in Central America[35]

150 years ago, the Confederation of Guatemala split up in five independent countries: Guatemala, Honduras, Nicaragua, Costa Rica and El Salvador. Since that time the region has been plagued by border disputes, interference in each others internal affairs and local wars. At present (1991), groupings of insurgents are active in El Salvador and Guatemala. The security situation in Central America is very distinct compared to the European situation.

Notwithstanding the ongoing peace process: border disputes, mutual interference in each others affairs, regime instability, internal armed subversion and dominance of the military are still going on in Central America. The total area is about 450,000 sq. kilometres, with extended sea-coasts, rivers, large lakes, forests and mountains. In general, there are difficult terrain conditions, especially in border areas, while traffic communications are very poor. Arms control and verification in this region is further complicated by the fact that armies have been directed at domestic rather than at foreign threats. Notwithstanding the fact that the armed forces in the region are ten times as high as 20 years ago, the armed forces of the above mentioned states in the region are relatively small, totalling about 200,000 troops, 200 tanks, 100 combat aircraft and the same number of helicopters. One is tempted to consider the military activities in that region as so-called low-intensity conflicts. However, compared to the military losses in a real war like the Gulf War, casualties in this region are very high: El Salvador alone with a population of about six million people, suffered in its insurgent war over 70,000 deaths. The ongoing peace negotiations are very complicated and initiatives triggered by third parties, as the so-called Contadora Group[36] and others

[35] Information on the Central American situation derived from H.P. Klepak, Verification of a Central American Peace Accord, Arms Control Occasional Paper, No. 2, prepared for the Arms Control and Disarmament Division, External Affairs, Canada, 1989.

[36] The Contadora Group, named after the island of Contadora consists of Mexico, Panama, Columbia and Venezuela. The group established in 1983, drafted a peace settlement for Central America entitled *The Contadora Act on Peace and Cooperation in Central America.* The draft failed to get support from all the states involved

outside the region, progress very slowly. A hopeful development may be that the internal subversive movements in Central America, due to the changed relationship between the superpowers, are not seen by them any longer as part of the East-West conflict. But apart from this, the situation remains very complicated. In contrast to the situation in Europe, one has not only to negotiate with the neighbouring states but also with the armed opposition groups in some of these countries.

That makes verification of any accord in that region immensely complicated. This has been well understood by the states in the region. In 1986 the heads of the five Central American countries took command of the peace process themselves and signed in August 1987 the Esquipulas II Peace Accord.This accord can be considered as a substantial contribution to the peace process in Central America. It was also well understood by the Heads of State that verification constitutes a absolutely essential element in the peace process in Central America.

However, they considered it as impossible that verification could be implemented by the participating countries. They proposed that verification should be left in the hands of a strong third party. Here, one can notice a remarkable difference with the European situation where participating states want to be involved in the verification process themselves. But in the Central American region verification is not only directed to the verification of troop reductions and military activities but also to the process of democratisation, reconciliation and cease-fires, to the disarming of irregular forces and to the problem of the presence of foreign advisers.

The Contadora Group, the Organisation of American States (OAS) and the Contadora Support Group supported by the United Nations, succeeded in establishing an International Verification Commission, but this commission soon fell victim to the internal situation in the countries. After delivering its first negative report on the lack of progress in the participating state's implementation of the Esquipulas-Peace Goals, the commission was abolished by the Central American States during their 1988-Esquipulas meeting and replaced with a security commission headed by the five ministers of foreign affairs themselves: the messenger of bad news was killed.[37] It showed again that in all-days' practice the concept of third party verification - although asked for by the direct actors themselves did not work satisfactorily.[38] "The question of judging compliance could obviously not been left in the hands of an independent organ"; as Klepak observed, "It became clear that any verifying agency would be expected by the Central Americans to report to them, rather than to an impartial overseeing body." This shows the enormous difficulty in exercising verification in such regions.

A possible practical solution may be to discuss and implement verification arrangements through "military diplomacy". Alexandre de Barros suggested such an

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and was heavily opposed by the United States behind the scenes. In 1985 the Group was reinforced by four South American states: Argentina, Brazil, Peru and Uruguay (The Contadora Support Group).

[37] Klepak, *op cit.*, p. 49 (see note 35).

[38] It should be noted that also the Ministers of Foreign Affairs of the Central American States were members of the Verification Commission.

approach whereby multilateral confidence-building measures and crisis prevention mechanisms be developed through the use of *military* diplomacy: "It would offer a good opportunity for the military from the countries in the region to get socialized into interacting with each other in a cooperative-prone situation rather than in a conflict-inducing one."[39] However, De Barros made this suggestion for the South American region, where no major wars took place for over 100 years and the prime task of the military establishments was to guard the internal security. Moreover, the military in neighbouring states was not supporting internal subversive activities in adjacent states.

However, the Central American situation is quite different. As we have seen, the region shows a history of armed conflict, whereby the armies during the last decade are well-trained in counter-insurgency operations and were not hesitating to support "friendly" insurgents in other countries, an example is the Nicaraguan Contra rebel camps in Honduras. Thus there is no tradition of friendly military contacts between the military establishments of the main opponents in the region. In fact, the Honduras military despised the Nicaraguan military.

At the end of the eighties, talks between the Contras and the Nicaraguan government resulted in the end of the armed struggle with the Contras, their subsequent demobilisation and the fall of the Sandinistic government in the general elections of November 1990. It was agreed in the so-called 1989-Tella Accords that again an International Commission of Support and Verification should be created by the Organisation of American States (OAS) and the United Nations to oversee the regional demobilisation of the Contra rebels in Honduras and Nicaragua. This observer group worked quite well and it shows that under certain circumstances moderate Third-party assistance is possible as long as the commission's mandate is restricted in scope and time.

Although developments in Central America can be seen as moderately positive, one should not be too optimistic. In some countries insurgents are still active and military coups are not excluded either. Central America is still far away from a comprehensive peace settlement. There are only limited accords of which some have only been concluded in principle, while others have been signed and ratified. Although the OAS and the UN played a substantial role in the course of the process it seems to me that more can be expected from negotiations between the states in the region.It is hoped that the Esquipulas process will trigger a CSCE type conference for Central America: the Conference on Security and Cooperation in Central America (CSCCA). The advantage of such an approach is that it links all aspects of security, including the behaviour of states, confidence building, economic and cultural cooperation, human rights, arms control and verification. As arms control verification needs to be in accordance with the scope and content of agreed measures, it should in principle not

[39] Alexandre S.C. de Barros, *Confidence-Building Measures in South America: Some Notes on Opportunities and Needs;* in: Karl Kaiser (ed.), *Confidence-Building Measures,* Proceedings of an International Symposium 24-27 May 1983 at Bonn, Forschungsinstitüt der Deutschen Gesellschaft für Auswartige Politik e.V., Arbeitspaper No. 28, p. 185-200.

proceed the arms control negotiations. But that does not mean that so-called "political verification",[40] controlling the absence of subversion between states, could not be established with priority. This could well be done by a small international verification commission like CIAV, manned with international civilian and military inspectors.

Arms Control and Verification in the Middle East

If we look at the Middle East-the most urgent region for regional arms control- the indicators pointing towards conflict resolutions by peaceful means are more promising than before. But still confidence is at a zero level, military forces throughout the region are in a state of constant improvement, while the majority of states in the region are internally challenged by fundamentalism and extreme nationalism. But as a result of the Iraq War there seems to be a willingness to consider new approaches towards new security structures in the Middle East. The current situation is fluid and changing and all the parties seem to be willing to search for realistic solutions. Along the political track a comprehensive settlement is needed based on an early recognition of the State of Israel by its Arab neighbours and on the implementation of the UN resolutions 242 and 338. The acknowledgement of the right of existence within secure borders of all states in the region should be accompanied by a generally accepted non use of force declaration and a declaration on the settlement of disputes by peaceful means.

In the region of arms control a serious attempt should be made to stop the arms proliferation in that area. This includes both weapons of mass destruction and conventional weapons because the conventional arsenals of several Middle Eastern states dwarf those of most European states. However, the problem of weapon proliferation has not only a regional dimension but is triggered by countries outside the region and has as such also a global dimension. This means that it primarily should be addressed at the global level. The American Middle East Arms Control Initiative of May 29, 1991 fulfils that purpose, provided it will be supported by all the main actors in the process. The five permanent members of the United Nation Security Council have supplied more than 80/90% of the weapons sent to the Middle East in recent years. Therefore global action is needed for the establishment of guidelines for the transfers of arms and associated technology to potential trouble areas. As a minimum such guidelines should include regulations for effective domestic export controls, end-use certification of dual-use technologies, advanced notification of arms sales, and an annual reporting system about arms sales. Preferably, the process of arms sales should be verified through a United Nation organ under the responsibility of the Secretary-General of the United Nations. These global actions should be reinforced by regional guidelines and codes of conduct for arms tranfers supported by effective verification and sanction mechanisms.

Up till now parties in the region failed to come up with blueprints for future security in the region. Most Arab countries want to start the arms control process with

[40] Klcpak, *op cit.* p. 44 (see note 35).

making the Middle East a zone free of weapons of mass destruction, hereby thinking of Israels nuclear capabilities which they fear most. Israel favours direct bilateral negotiations with its Arab neighbours with the emphasis on the recognition of Israel and on conventional weapons because conventional weapons are considered to be the primary threat to Israel.

So, the problem is where arms control should start. Because of the complex dynamic web of antagonists, no clear deterrence patterns exist. It is very difficult to find a starting point for arms control.

The most fundamental approach would be that Israel and its direct neighbours start discussions about the levels and nature of the armaments required for their "reasonable sufficient defence." But this will be an enormous problem. The asymmetry in the Middle East countries' military capabilities and geo-strategic positions make it very difficult to define yardsticks and sufficiency rules for the military potentials of the individual countries in the region. However, a solution may be found in following the line of thinking as used in defining the goals of conventional arms control in Europe: i.e. elimination of the capacity for surprise attack and large scale offensive operations as well as barring the ability to project power outside its borders by choosing for purely defensive postures. In the course of this process it could be necessary to build up the military potentials of the weaker states to a reasonable level of sufficient defence in order to get a more balanced situation. (An alternative might be that weaker states in the region will become subject of international security guarantees under auspices of the UN Security Council.) This should be accompanied by measures to stop, or preferably, reverse the arms spiral of the over-militarized countries in the region. But such goals can only be implemented when more insight exist in the ultimate security arrangements in the Middle East region. A preferable solution would be to strive ultimately for a CSCE type security arrangement which includes all the countries in the region, perhaps also including some western Mediterrenean States and Turkey as well.

This long term process should be preceded by a set of confidence and security building measures meant to enhance tranparency and openness about the existing military situation. Parties should be prepared to present full information about their weapon inventories, preferably accompanied by moderate verification arrangements in order to be able to check the correctness of the exchanged information. These verification arrangements could be organized along the lines of the so-called data evaluation visits as mentioned in the CSCE 1990 Vienna Document on Confidence-and Security-Building Measures. This type of verification should primarily not be mandated to a centralized organ but be conducted under national responsibility. As such it can be an excellent training ground for future more comprehensive verification arrangements and at the same it can be used as a confidence building mechanism. However, this does not exclude the involvement of third parties monitoring more political related agreements, such as disengagements and controlling the absence of subversion between participating states.

A next step in the process of confidence building could be the establishment of a notification system about military activities in border areas. Such notification could be supported by the obligatory invitation of observers to such activities and provisions for the monitoring of compliance.

A related problem is how to define the area of application for arms control. Should it also include the Mediterranean countries or would it be restricted to the Arab countries, Israel and Iran? The inclusion of Turkey would link a Gulf CSBM system to the CSCE-CSBM system. However, if one looks into the history of arms control in Europe, one should keep in mind that the start of multilateral arms control negotiations was plagued by endless discussions about the number of states participating in the negotiations. We have seen this in the MBFR negotiations as well as in mandate talks within the CSCE process. It could be envisaged that arms control will start with some limited confidence and -security building measures, as mentioned above, between a restricted number of participants, notably, Israel and its direct neighbours. The verification of these first steps could be left in the hands of the parties involved. On the basis of experience gained these measures could be extended to the other participants.

The ultimate goal of arms control in the Middle East region is to reach a regional balance of power at the lowest possible level of conventional armaments organized in purely defensive postures, followed by a zone free of weapons of mass destruction. To reach that goal, mixing negotiations on weapon proliferation, conventional and nuclear arms control should be avoided. From the European perspective, one can learn that the arms control agenda should not overburden with too many items at the same time. It would make the process much too complicated and may lead to a situation in which progress in one area is kept hostage to progress in other ones. This is especially the case for the problem of nuclear weapons. All parties in the region accept the need of a Middle East nuclear free zone. Disagreement exists whether such a zone should proceed or follow conventional arms control. The Arab countries consider such a zone a higher priority while Israel sees confidence building measures which inhibit further wars as the indispensable and principal sine qua non precursors of a credible nuclear free zone.[41]

Regional initiatives should be reinforced by global arms control actions. Rapid completion is needed of pending international agreements like the Chemical Weapons Convention, the full extension of the Non-Proliferation Treaty to the region as well as much tighter supply restraints on the flow of weapons and dual-use technology into the Gulf region. The so-called Missile Technology Control Regime should be transformed into an international treaty supported by an effective international safeguards regime. Eighteen countries already possess ballistic missile capability; by the year 2000 this figure could well reach 24 as more countries acquire western technology and develop their own indigenous ballistic missile capability.[42]

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[41] Ambassador Ephraim Tari on 25 April 1991, NGO Committee on Disarmament, United Nations.

[42] See also: Aaron Karp, in SIPPRI Yearbook 1991, chapter 9: *Ballistic Missile Proliferation*".

It should be analyzed whether existing organisations like the Nuclear Suppliers Group, the Committee for Multilateral Export Control (COCOM), the Missile Technology Control Regime and the Australian Consultation on Export of Chemical Agents should not be combined into a new multilateral Organisation (including the Soviet Union and China) for the export control of strategic technology to potential crisis areas.

But one should not be too optimistic. Notwithstanding successful American diplomacy in bringing the countries in the region to the conference table the real problems will have to be solved in follow-on negotiations between the direct participants. Without normalized diplomatic and political relations and without certain rules of behaviour, the process of confidence building cannot start. It will be a long lasting process with ups and downs. In Europe with a less defused situation the development of CSBMs was also built upon diplomatic efforts lasting more than a quarter of a century.

It would be an important step forward if countries could decide upon a UN sponsored security commission for the region with the primary task of securing more warning time for those countries which feel threatened by the opponent's air and missile capabilities. One could image that the United Nations establish a mixed verification commission of neutral countries with the purpose of verifying through on-site inspection, the air and missiles inventories of the participating states. States would be obliged to submit to the commission updated compilations of the inventory of aircraft and missiles, as well as pre-notify exercises with these weapon systems. A precedent may be set by the United Nations special commission in Iraq conducting on-site inspections of Iraq's biological, chemical, nuclear and missile capabilities.[43] If the United Nations are not accepted as a player in this process, another solution might be to ask the main players in the region and the United States and others to participate in such a verification role.

Concluding Remarks

One of the key questions is how in the future the monitoring and verification resources should be used. Will verification remain primarily a national responsibility with limited multilateral coordination or will it be possible to organize centralized verification systems. This question has both a political and technical dimension. Will verification only play a role in checking compliance of the various confidence-building and arms limitation and disarmament agreements or will it also play a more independent role as a mechanism for stability and trust? In this analysis it is concluded that the various verification arrangements for conventional arms control in Europe should be combined into a single system with a certain amount of independence. Although a certain synergistic relationship exists between the various autonomous verification regimes the cost factor and possible increasing future use of technology clearly indicates the

[43] UN Security Council Resolution No. 687, 3 April 1991.

advantages of a multilateral centralized system. From a political point of view, the situation seems to be more complicated. Although participating states by definition enjoy the same rights in implementing the verification provisions of the respective arms control agreements, in practice a very unequal situation exists. Most of the participating states lack adequate means for permanent monitoring and therefore have to rely on the few ones which possess such means and consequently are dominating the monitoring and verification process. At the time Europe was divided in two parts, a rather simple solution could have been found by establishing two centralized verification centres. But in the new situation especially the former WTO partners of the Soviet Union, are in a vacuum. They do not want to rely anymore on the resources of the Soviet Union but do not have means of their own. As a consequence some of them turn to NATO for cooperation in the field of verification which would lead to a de- facto verification confrontation between the Soviet Union and all the other parties to the agreement. In the meantime NATO has organized a Verification and Information Systems Directorate which has already developed a data base for collection and dissemination of inspection reports. Although, reportedly, other nations might be given access to the data base upon request, such an institution should be an integral part of the new CSCE machinery. Only a central verification machinery would give effect and expression to the notion of equality of states and will give especially the smaller states more opportunities to take part effectively in the monitoring process while the same technical and operational facilities would be available to all parties to the agreement.

One has to accept as a fact that for the near future only the national technical means of the United States and the Soviet Union, and after 1993 to a limited extent France, are in the position of collecting sufficient detailed information for checking compliance. The possibility of an European satellite system for arms control and crisis management is still a rather remote option but will have to be organized in the future. Especially in crisis situations there is no alternative to satellite surveillance. Aerial monitoring is no alternative for monitoring from space but can play a useful role as an adjunct to on-site inspection and for the monitoring of limited areas. In the context of confidence building a centralized Open Skies regime under CSCE responsibility could be an excellent training ground for gaining experience with centralized monitoring.

By centralizing monitoring capabilities, creating new political barriers in the conduct of inspections could be avoided. It goes without saying that it is not realistic to expect the realization of a fully CSCE centralized verification system right from the beginning. Taking into account the political sensitivities and the unequality in resources of the participants it would be wise to follow a step by step approach.

A logical step would be to organize within the CSCE frame work a Verification organ which has the authority to coordinate national efforts in the field of data, routine inspections and inspections of the destruction process for all the relevant arms control agreements. The work of the organ should primarily be of a technical and coordinating nature. Assessments about implementation and compliance should remain the responsibility of higher CSCE organs and/or the individual parties.

With respect to arms control verification in other regions of the world, it is difficult to predict how it should be developed. It can be expected that the United Nations verification efforts will get more relevance in phases preceding arms control negotiations. The United Nations' special commission conducting inspections of Iraq's weapons of mass destruction is another example but seems to be a very specific case which will probably and hopefully not be repeated in other parts of the world. The situation in Central America shows also clearly that the United Nations can play a useful role during the period of change towards more stable relations. A good example of such "political verification is the 1989 UN sponsored Commission of Support and Verification for the monitoring of the demobilization of the Contras in Central America. But ultimately countries in those regions will have to create their own mechanisms for overseeing compliance with the arms control agreements they have concluded with each other. In that respect a lot of lessons could be drawn from the European situation.

Last but not least, some words should be devoted to the future relevance of verification arrangements in Europe. Is it still relevant to enhance the requirements for verification in a completely changed political environment? In a situation of growing co-operation between former antagonists leading to cooperative security, verification might lose its significance. But the use of the verification system should not be restricted to the overseeing of specific arms control agreements but be seen in a broader political perspective. Verification machinery should also be capable to be useful in monitoring crisis situations like Yugoslavia. As such it can only work when independent machinery and sufficient guarantees of objectivity exist. The advantage is that all the players, including the challenged ones, are organically included in the process thus guaranteeing a sufficient amount of objectivity. Beside the monitoring of specific arms control agreements, verification should be much more geared to overseeing that no destabilizing changes in the security situation of the participants will occur, thus enhancing strategic stability in the region.

A final question is whether CFE type verification arrangements are able to cope with future revolutionary changes in land and air warfare. The dramatic increase in land and air capabilities to deliver massive firepower over hundreds of kilometres with a unprecedented accuracy, combined with sophisticated target information systems and highly survivable stealthy strike aircraft and cruise missiles can probably not be monitored by nowadays treaty related verification arrangements.[44] Further study is needed how the role of verification in the future must be able to cope with these trends in the art of war.

[44] Philip Borinski, *The CFE Verification Regime and the Future of Conventional Arms Control in Europe*, paper presented at The Verification Conference: "Issues and Challenges of Verification", Southern Methodist University, Dallas, 27 April 1991.

Chapter 5
Measures to Facilitate Transparency

Ellis Morris

Introduction

In recent years it has been recognized that, in addition to data generated by technical measures under national or international control and data exchanged by States Parties to an agreement, the verification process is facilitated by cooperative measures that simplify the collection of data. These cooperative measures to facilitate transparency may be part of an arms control or disarmament agreement or may be confidence-building measures, established in the absence of any agrement, which may later be incorporated into an agreement under negotiation. The study by a group of governmental experts on the Role of the United Nations in the Field of Verification[1] has identified a number of such measures, including designing weapon systems and their deployment modes in ways that simplify verification; permitting aircraft overflights to observe military related installations and activities; pre-notification of weapons tests to permit monitoring; joint verification experiments to assist monitoring efforts; arranging for foreign representatives to observe or inspect, with an appropriate degree of intrusiveness and timeliness, installations or activities; and non-interference with national technical means of verification. In the realm of confidence-building, other measures to facilitate transparency, primarily information exchanges, such as publication of defense information, publication of defense budget figures, establishment of consultative commissions, development of communications "hot lines" and joint crisis control centres, advance notification of exercises, force movements and mobilizations, and mandatory invitations to observe such activities, have been identified.[2]

Other sections of this study deal with specific sets of transparency measures being considered or incorporated into specific arms limitation and disarmament agreements such as CFE, START, Chemical Weapons Convention and Outer Space. This section deals in general with confidence-building measures to facilitate transparency and more specifically with the Open Skies negotiations as a case study to highlight the more important aspects which must be considered in dealing with the development of future measures.

Open Skies and other measures to facilitate transparency fall more into the realm of confidence-building measures than verification measures *per se*. They are

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[1] A/45/372, *Verification In All Its Aspects; Study on the Role of the United Nations in the Field of Verification*, 28 August 1990, pp. 36-39.

[2] See, for example, James Macintosh, *Confidence (and Security) Building Measures in the Arms Control Process: A Canadian Perspective*, Ottawa, Department of External Affairs, 1985.

cooperative measures requiring the active participation of all parties. They are not measures designed for the verification of any particular arms control measure, although they may be used to augment or supplement existing verification regimes or may be incorporated to form a part of a verification regime for a future arms control agreement. For example, the establishment of an Open Skies regime would provide a widely available complement both to national technical means of data collection and to information exchanges and verification arrangements established by current and future arms control agreements. Open Skies overflights may be used to supplement the verification measures contained in the CFE Treaty and negotiations are taking place which will add aerial inspection to the existing verification regime or will incorporate the concept as a part of the verification regime of follow-on agreements (CFE IA or CFE II).

Information Exchanges

Verification regimes need to employ cooperative measures in addition to data collection by technical means. The demand for ever-increasing types and numbers of on-site inspections has led to a perception that technical measures and on-site inspections are the sole means of monitoring and verifying arms limitation treaties. The mutual benefits of cooperative measures such as data exchanges and notifications regarding treaty-limited equipment and activities are often ignored. The provision and exchange of data can be an extremely important cooperative measure. It can build confidence and increase transparency and may also lay the groundwork for more intrusive forms of verification, especially on-site inspection. Information exchanges form the basis for arms limitation treaties and confidence-building agreements, such as SALT II and the Stockholm Document on Confidence and Security Building Measures in Europe. More detailed information exchanges, with mandatory on-site inspection to verify the data exchanged, form an integral part of the INF Treaty, the START Treaty, the Vienna Document and the CFE Treaty, and are considered essential to a Chemical Weapons Convention.

Other arrangements for information exchanges have, unfortunately, not proved as fruitful. Advocates of the reduction of military budgets on a mutually agreed basis as an approach to disarmament have long recognized that openness of information about military spending and the comparability of budgets was essential. They recognized a need for the use of a standardized system for the reporting of military expenditures. The question of developing a standardized system for defining and reporting military expenditures and of verifying compliance with agreements to reduce these expenditures has been discussed in the United Nation since 1973. An instrument for standardized reporting was developed in 1976[3] and General Assembly resolution 35/142 B of 12

[3] The standardized reporting instrument is contained in document A/31/222/Rev. 1. It is interesting that information exchanges in the Vienna Document are based on this instrument. See sections by Henny van der Graaf and Chantal de Jonge Oudraat in this volume for more detail.

December 1980 urged all Member States to make use of the reporting instrument and make annual reports of their military expenditures to the Secretary-General. Only a small number of states have bothered to submit reports. Similarly the Final Declaration of the Second Review Conference of the Biological Weapons Convention provided for a number of information and data exchanges concerning research centres and laboratories, outbreaks of infectious diseases and similar occurrences caused by toxins, and publications of the results of research. Only a small number of the Parties have participated in the exchanges to date.[4]

Questions have been raised as to the legally binding nature of these latter commitments to data exchange. It would seem that more formally agreed information exchanges have proved more useful in building confidence and increasing transparency. As in all such measures, cooperation of all the parties is essential if the effort is to succeed.

Open Skies

Open Skies was first proposed by US President Dwight Eisenhower during a Four Power Summit held in Geneva in 1955. Eisenhower proposed that the United States and the Soviet Union open their skies and provide each other with facilities for aerial reconnaissance, essentially to inspect each other's military establishments by air, in order to reassure each other and the rest of the world that no surprise attack was being mounted, thus lessening danger and reducing tensions. This was a revolutionary proposal at the time. Satellite technology had not been developed and opening national territory to aerial photography would have been a considerable step toward building confidence among the states. France and Great Britain enthusiastically endorsed the US proposal and the Soviet Union promised to study the concept. The Soviet position hardened soon after, however, viewing "open skies", along with proposals for on-site inspection as thinly disguised excuses for "legalized espionage". Although discussions on the proposal took place over the next few years, focussing primarily on the establishment of zones where overflights might take place, Soviet resistance to the concept remained firm and the idea was not brought to fruition.[5]

US President George Bush reintroduced the concept of Open Skies in a speech to the graduating class of Texas A&M University on 12 May 1989. The idea had reemerged during a review of US arms control policies following the election of the Bush administration. Canada learned that the Open Skies proposal was once again

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[4] See Andrzej Karkoszka, "The Convention On Biological Weapons (1972)" in Serge Sur ed., *Verification of Current Disarmament and Arms Limitation Agreements: Ways Means and Practices*, Aldershot, Dartmouth, 1991, pp. 219-221.

[5] For an analysis of the Eisenhower proposal and reaction to it, see W. W. Rostow, *Open Skies: Eisenhower's Proposal of 21 July 1955*, Austin, University of Texas Press, 1982. See also Peter Jones, "Open Skies: Opportunity for the 1990s" in Michael Slack and Heather Chestnutt (eds.), *Open Skies: Technical, Organizational, Operational, Legal and Political Aspects*, Toronto, York University, Centre for International and Strategic Studies, 1990, pp. 153-155.

under consideration during the course of regular arms control consultations with the United States and strongly urged its acceptance. It also urged that the proposal be expanded to include all the nations of NATO and the Warsaw Treaty Organization.[6]

Relevance of the Open Skies Proposal

The revival of the Open Skies concept for aerial surveillance is extremely relevant, even in an era dominated by satellite technology. In the first place, satellite technology is possessed by only a small number of states and access to this technology is expensive and not available to all states. Aerial surveillance technology is more readily available and more readily affordable. Open Skies would allow states that did not have access to satellite technology the opportunity to participate in a significant confidence-building regime and, at the same time, would provide a flexible and efficient means of supplementing information from satellite reconnaissance. Aerial surveillance has by no means been rendered obsolete or redundant by satellite technology. Aerial surveillance provides more flexibility in terms of choices of time and target. Satellite surveillance is governed by the orbit of the satellite. It may not be able to photograph a given area at a given time. Aerial surveillance would enable coverage of targets of particular interest to any of the participants at any time. The reconnaissance airplanes would also be able to fly below the cloud cover which hampers satellite surveillance of Europe for a significant portion of the year.

Open Skies would build confidence by increasing transparency of military activities. It is a cooperative venture, requiring the permission of observed party. Granting permission for an overflight would itself be a cooperative signal of non-aggressive intent. An Open Skies regime could also prove particularly valuable in the emerging new order in Europe. It could offer the Eastern European nations reassurance of the peaceful intentions of their neighbors, reducing risks that resurgent ethnic and nationalist tensions could lead to war. An Open Skies agreement would give the parties routine access to detailed photoreconnaissance information, which might also be of great assistance in the verification of future multilateral agreements. The aircraft might also carry air sampling devices which might aid in the verification of future agreements banning chemical weapons and nuclear testing.[7]

Open Skies does not fit neatly into the conventional definitional categories of verification. It is a cooperative measure requiring an agreement and having as its main purposes transparency and confidence-building, even though it could and probably will contribute to the monitoring and verification of multilateral arms control agreements. It is not a verification technique or measure *per se* but a confidence-building measure; an arrangement that exists independent of any particular arms control agreement,

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[6] See Jane Boulden, "Canada and Open Skies", in Slack and Chestnutt, pp. 105-112.

[7] For an overview of the capabilities of airborne sensing platforms see Allan Banner, Keith W. Hall and Andrew Young, *Aerial Reconnaissance for Verification of Arms Limitation Agreements*, Geneva, United Nations, UNIDIR, 1990 and Allan Banner, *Overhead Imaging for Verification and Peacekeeping: Three Studies*, Arms Control Verification Occasional Papers, No. 6, Ottawa, External Affairs and International Trade Canada, 1990.

dedicated to the general improvement of the East-West security environment through enhanced openness.[8] However, an Open Skies agreement could make a significant contribution to the verification of current and future arms control agreements. It could provide a widely available complement both to national technical means of data collection and to information exchanges and verification arrangements established by current and future arms control agreements. In addition to confidence-building it could also provide significant background information to complement information gathered in support of specific arms control measures and would allow states to achieve an independent capability to monitor events of particular interest.

Background to the Negotiations

The US Open Skies concept was presented in more detail to the NATO countries later in May 1989 and was welcomed as an important initiative in their communique of 30 May 1989. Under an Open Skies regime, participants would voluntarily open their airspace on a reciprocal basis, permitting the overflight of their territory in order to strengthen confidence and transparency with respect to military establishments and activities. The Open Skies regime would extend beyond Europe and include the territory of the United States and Canada and all the territory of the Soviet Union. NATO countries hoped that the Soviet Union would welcome the proposal as a concrete method of implementing the new concept of openness in Soviet policy.

Soviet Foreign Minister Shevardnadze endorsed Open Skies concept, noting that it complemented other Soviet proposals, and called for extending it to "open space" and "open seas". He repeated earlier Soviet proposals for the establishment of an international space inspectorate and the exchange of data on fleet postures and major naval exercises. However, the Soviet Union did place caveats on its acceptance of the proposal. In its view, an Open Skies regime could not be established without agreed constraints. It was essential to rule out the possibility that information obtained during overflights could be used to harm the security of the observed party. There would also have to be full equality in access to the information obtained. The Soviet Union felt that this could best be achieved through the use of a multinational pool of aircraft and sensors and by a sharing of collected data by all parties.

In November 1989 Canadian Prime Minister Brian Mulroney announced that Canada would host an Open Skies Conference to be attended by the states of NATO and the WTO. The purpose of the conference would be the negotiation of a treaty which would allow individual states of one of the two alliances to overfly individual states of the other alliance on short notice using unarmed reconnaissance aircraft. The overflights would enhance the feeling of security of participating states by allowing each of them a means of satisfying themselves of the peaceful intentions of the other

[8] See the discussion by James Macintosh, "Open Skies as a Confidence-Building Process", in Slack and Chestnutt, pp. 41-56.

participants. Participation in the conference would be by individual states rather than on an alliance to alliance basis.

On 15 December 1989 the NATO Foreign Ministers issued a "Basic Elements Paper", outlining their approach to the Open Skies negotiations. The NATO members felt that an Open Skies regime should initially be open to all members of NATO and the WTO. All the territories of the participants, in North America and Asia as well as in Europe, would be included. Quotas for overflights would be established based on the geographic size of the participating countries. Each participant would be required to accept a minimum of four overflights a year.

Observation overflights would be conducted on a national basis, either individually or jointly in cooperation with allies. Aircraft and data could be shared within each alliance but not between them. The entire territory of participants should be opened to observation overflights, limited only by requirements of air safety. A wide variety of sensors would be allowed except for devices for signals intelligence (SIGINT). Aircraft would be subject to inspection for forbidden sensors and would carry host country observers. There would be agreed procedures designed to ensure transparency and air safety. An Open Skies consultative body should be established to promote the objectives and implementation of the Open Skies regime.

In January 1990, a Canadian Forces C-130 aircraft made a trial overflight of Hungary following the basic guidelines set forth in the Basic Elements Paper. The overflight trial was designed to test air traffic control procedures. It did not involve the use of cameras or other surveillance equipment. The Canadian aircraft arrived in Hungary 24 hours before the overflight was to take place and was subject to inspection by Hungarian authorities. The overflight lasted 3.5 hrs, flying in a large figure 8 pattern, following a flight plan submitted earlier by Canada. Both Canadian and Hungarian observers were aboard. In Canada's view, the overflight was a tremendous success, proving that an Open Skies regime could work in a strictly technical sense, without any impact on air safety or inconvenience to air traffic control.[9] A reciprocal overflight of Canadian territory by Hungary was postponed because Hungary had no aircraft suitable for trans-Atlantic flight.

The Negotiations

The first meeting of the Open Skies negotiations took place in Ottawa on 12-13 February 1990. The Ottawa Conference was opened by the Foreign Ministers of the participating states, an indication of the importance that was placed on the negotiations. The Foreign Ministers met for two days. Further negotiations took place over the next few weeks at a lower level. The Ottawa Conference demonstrated a broad consensus, although not total agreement, on a number of fundamental elements of an Open Skies

[9] See "NATO Test Flight in Hungary Signals Optimism for Open Skies", *Trust and Verify*, No. 7, February 1990, p. 2 and "Foreword" by Canadian Secretary of State for External Affairs Joe Clark in Slack and Chestnutt, p. viii.

regime. Most of the participants agreed that all of the national territory of participants should be open to overflights. The overflights should be limited only by flight safety considerations. There should be no areas permanently closed to overflights. There should be a sufficient number of overflights to cover the territory of the participants. An Open Skies regime must be able to operate in all circumstances, day or night and in all weather. To accomplish this, observation aircraft should be able to carry a variety of sensors besides traditional cameras. Finally, an Open Skies regime should operate on a national basis so that the observing state (or voluntary group of states) could define its own mission objectives, design flights to meet those objectives and control flights so as to have full confidence in their results.[10]

The communique issued by the Foreign Ministers following their meetings on 13 February 1990 stated that an Open Skies regime should ensure maximum possible openness and minimum restrictions on overflights. It would allocate observation flights on the basis of annual quotas that would provide "equitable coverage" of all the territory of the participants. It would provide for the use of unarmed aircraft and sensor equipment "capable in all circumstances of fulfilling the goals of the regime". It would allow for the possible future participation of other countries (particularly the European neutral and non-aligned states) and should promote greater openness in the future in other spheres.

On 14 February 1990 the states members of the Warsaw Treaty Organization issued their own "Basic Elements Paper". This paper was designed, in part, to offset Western technological advantages in sensor technology and data analysis. It stated that, in order to ensure "equality of access", overflights should be conducted using a common fleet of aircraft, piloted by multinational crews. The aircraft might be based on the territory of any party. The aircraft would be equipped with either a uniform sensor package or sensors of agreed types and technical characteristics which would be listed in an appendix to the agreement. All data collected should be processed at a central facility by multinational teams and should be made available to all parties on an equal basis.

The WTO Basic Elements paper highlights a number of difficulties which were encountered in the Open Skies negotiations. Although many Western officials viewed Open Skies as a straightforward negotiation that might be concluded by mid-May 1990, two rounds of multilateral talks in Ottawa and in Budapest on 23 April-14 May 1990 have been unable to bridge the gap between NATO and WTO proposals. The differences between the parties focussed on five major issues: quotas (the number of overflights to be permitted); territorial scope of the overflights; ownership of the aircraft to be used; type and quality of the sensors permitted on the aircraft; and the question of data sharing.

It was agreed in principle that the annual number of overflights should be based on the geographic size of the country. There would be a minimum of four overflights

[10] See Jonathan B. Tucker, "Back to the Future: The Open Skies Talks", *Arms Control Today*, Vol. 20, No. 8, October 1990, pp. 20-24.

per year. Western nations suggested about 100 overflights per year for each alliance. The United States offered to accept one overflight per week and felt that the Soviet Union should be willing to accept twice as many because of the difference in geographical size. The Soviet Union proposed to limit the number of overflights to 30 per year for each alliance with no more than 50 per cent to take place in any one country, effectively proposing to limit the number of overflights of the Soviet Union to 15 per year.[11]

While most nations agreed that the entire territory of the participants should be open to overflights, the Soviet Union sought to limit the territorial scope of the overflights by excluding portions of its territory on grounds of national security. The Soviet Union also insisted on the right of the observed country to select whose aircraft would fly over its territory. This position was based, in part, on a concern that illegal sensors might be concealed on foreign aircraft. Western nations feared that such a provision would allow the Soviet Union to refuse overflights by Western aircraft. The Western nations felt that participants should be able to use their own aircraft, to see for themselves, rather than have to rely on the good offices of the observed party.

The type and quality of the sensors to be permitted on the aircraft posed considerable problems in the negotiations. Western nations proposed that a wide variety of sensors, which would permit observation at night and under all weather conditions, be permitted on the aircraft. Only devices for collecting signals intelligence (electronic eavesdropping) would be prohibited. The permitted sensors might include, *inter alia*, visible light photography, thermal infra-red systems and synthetic aperture radar (SAR). The United States proposed the use of optical and electro-optical scanners, magnetometers and gravitometers, among others. In view of the wide variety of sensors available and continuing developments in technology, Western nations felt that only sensors to be prohibited should be listed in the agreement. Western nations felt that the question of the commercial availability of comparable levels of technology should not pose an insurmountable barrier. Trade restrictions on sensitive technology with the Soviet Union and East European states would be lifted so that permitted sensors would be available to all participants.

These difficulties were addressed at the second round of negotiations held in Budapest 23 April-14 May 1990, but at the end of the Budapest Conference a number of issues were left unresolved. The NATO countries agreed to negotiate limits on sensor performance and to make sensor systems with comparable Western sensor technology available to all participants. This position set de facto limits on sensor capabilities since Western nations could only employ the same level of sensor technology that it was prepared to sell. The Soviet Union continued to propose extremely restrictive limitations on sensor parameters. It was firmly opposed to the use of infrared sensors and air sampling devices.

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[11] With the dissolution of the Warsaw Treaty Organization, an alliance-to-alliance quota system, perhaps the easiest to implement, was no longer feasible. A more complex quota matrix, still based on geographic size, had to be worked out. For an analysis of various possible quota systems, see Peter Jones, "The Determination of Overflight Quotas for an Open Skies Regime", in Slack and Chestnutt, pp. 63-76.

In an attempt to alleviate the concerns of the Soviet Union, the NATO countries offered a compromise proposal on 30 April 1991.[12] Under this proposal countries to be observed could provide aircraft for the overflight so that they would not have to have foreign aircraft flying over their territory. Costs of the overflight would be borne by the inspected country. The aircraft would carry a standard limited suite of data sensors. The proposal would restrict the use of sensors to those that are commercially available ("off-the-shelf" technology) and would allow their export to the Soviet Union and East European states. Duplicates of all data collected would be given to the host country.

The Open Skies negotiations resumed in the fall of 1991. In this round of negotiations the Soviet Union has agreed to open its entire territory to aerial inspection. Optimistic Western negotiatotrs hope to have the treaty completed by a meeting of the Conference of Security and Cooperation in Europe scheduled to take place in March 1992.[13] However, the problems of the number of overflights to be permitted and the type and technical characteristics of the sensors to be carried remain. The Soviet Union has increased the number of overflights it is willing to accept to 40. In light of the rapidly changing circumstances in the Soviet Union it is likely that the problem of quotas will exacerbate before it is resolved. It is likely that the quota matrix will have to be substantially revised as the individual Soviet republics enter the negotiations acting as semi- or fully independent actors.

Analysis

There are two fundamental underlying problems which help to explain the difficulties of the Open Skies negotiations: the close association with the negotiation of an aerial inspection component of a verification regime for the CFE Treaty and the lack of a clearly defined purpose for the Open Skies overflights. When the Open Skies negotiations began it had been agreed in principle that aerial inspection would become part of the verification regime of the CFE Treaty. Many Western nations believed that if the Open Skies negotiations were pursued aggressively, its provisions could be transferred to the CFE Treaty. There would, of course, have been many benefits to having an Open Skies regime in place before the signing of a CFE Treaty. If a multilateral organization had been established to oversee the operation of the Open Skies regime, negotiators for the CFE Treaty would have had an existing organization to draw on for verification purposes, in a manner similar to the use of the IAEA in verification of provisions of the NPT Treaty. Even without the existence of a multilateral organization, the structure for a system of aerial overflights of the parties would have been in place and this structure could have been transferred to the CFE Treaty, with appropriate modifications to overflight quotas, sensor packages, and so on.

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[12] See "NATO Offers Soviets New 'Open Skies' Plan", *Aviation Week and Space Technology*, June 10, 1991, p. 27 and "Glimmer of Light for Open Skies", *Trust and Verify*, No. 21, July/August 1991, pp. 1-2.

[13] See "Moscow Agrees to Aerial Inspection Treaty", *New York Times*, 6 November 1991, p. A6.

However, the accelerated pace of the CFE negotiations and the difficulties encountered in the Open Skies negotiation led negotiators to concentrate their efforts more on the CFE negotiations, which also ended without the inclusion of an aerial inspection regime.

The second and more fundamental obstacle to agreement in the Open Skies negotiations was a lack of an agreed purpose for the overflights. The basic goal of the Open Skies regime as proposed by President Bush was to build mutual confidence among the participants through increased scrutiny of each other's military activities. All of the participants recognized that greater openness would build confidence, but disagreement arose over the degree of scrutiny necessary to build this confidence. This led to a number of practical questions, such as how many overflights were necessary to build confidence and demonstrate a commitment to openness (quotas); what should the overflight look for (object of the overflight); where should it look (territorial coverage); and what types and qualities of sensors were necessary to fulfil the objectives of the overflights (sensors).

The Soviet Union maintained that a large number of overflights was not necessary to demonstrate a commitment to openness and if the aim of Open Skies was to build confidence by demonstrating the peaceful intentions of the participants, that there were no preparations for imminent hostile military activities, then overflights of the far eastern areas of the Soviet Union were not really necessary. The objective of the overflight should be to look for increased activities in mobilization centres, unusual increases in shipping or railroad traffic or unusual massings of large troop formations. Many of these activities would require notification under the terms of the Vienna agreement in any event.

If the goal of the overflights were to identify rapidly massing military formations, or simply to provide information on military activities and facilities on a 24-hour all-weather basis, it would not be necessary to employ the latest state-of-the-art technology. The objectives could be met with relatively simple technology, capable of discerning, for example, between a tank and a truck, but not necessarily being able to identify the type of tank or truck. However, at the same time it must be recognized that the ability to provide such information on a 24-hour all-weather basis requires more than simple cameras. Radar and night-vision cameras are required at a minimum and providing information on a 24-hour basis requires, by definition, that there be no restrictions on the time the sensors are turned on.

The hope in Western nations that the Open Skies negotiations could be completed before the conclusion of the CFE negotiations and that the provisions of the agreement could be transferred, with some modifications, to the CFE Treaty, influenced the proposals for the types and quality of sensors to be carried. Requirements for reassurance about compliance with an arms limitation treaty were higher than those for a confidence-building measure. NATO officials had difficulty trying to distinguish between airborne CFE verification and requirements for Open Skies. Both would require airborne sensors to track aircraft and helicopter movements as well as movements of ground forces and armour. Western analysts felt that the aerial

inspections anticipated for CFE could involve, *inter alia*, cameras, radar and heat-detecting infra-red sensors for monitoring production, storage and movement of treaty-limited items.[14] Support for the inclusion of more sophisticated sensors in Open Skies were based on the proposition that if some confidence were generated by overflights with minimal data sensing capabilities, then more would be generated if more sophisticated sensors were used. Arguments such as "Clearly an Open Skies Treaty would be more effective if more sophisticated sensors were used"[15] and "international confidence derives from the substance of what the regime produces and not solely or even primarily from the symbolism or novelty of the fact that the regime exists at all"[16] were common.

The questions of ownership of aircraft to be used in the overflights and data sharing still remain open. Western nations firmly opposed a Soviet proposal that a common fleet of surveillance aircraft be employed and that intelligence data gathered should be shared by all parties. The Soviet proposal for the establishment of a common fleet of aircraft manned by multinational crews was raised again in the Budapest meetings. Opponents of the proposal argued that it would involve unnecessary acquisition and administrative costs and could possibly lead to problems over crewing and purchase of aircraft. Furthermore, all of the participant possessed aircraft capable of performing overflight duties. Although this latter argument ignores the difficulties encountered by Hungary when it wished to make a reciprocal overflight of Canada, the Western desire to use its own aircraft was strong. Allowing host countries to provide the aircraft for the overflights has been a major concession.

The question of data sharing has proved troublesome. Western countries initially proposed that data be shared within but not between ailiances while members of the Warsaw Pact felt that all data should be processed at a central facility by multinational teams and should be made available to all parties on an equal basis. They argued that data sharing on this basis would underline the cooperative and confidence-building nature of the regime. The NATO compromise proposal would provide a copy of raw data collected to the host country presumably to do with as it pleased.

The proposal for data anlysis carried out at a central facility and shared equally among the parties has many benefits both in terms of confidence-building and more importantly, in terms of equal participation in the Open Skies regime. If a standard limited suite of data sensors are to be used in all overflights, as seems likely at this time, then protection of sensor capabilities is no longer an argument against full data sharing. Full data sharing may also reduce the number of total overflights because

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[14] An interesting comparison of the types and quality of sensors required for both sets of negotiations may be found in Peter Jones, "CFE Aerial Inspections and Open Skies: A Comparison", in Heather Chestnutt and Michael Slack (eds.), *Verifying Conventional Force Reductions in Europe: CFE I and Beyond*, Toronto, York University, Centre for International and Strategic Studies, 1991, pp. 87-108.

[15] *Trust and Verify*, No. 10, May 1990, p.1.

[16] John H. Hawes, "Open Skies: From Idea to Negotiation", *NATO Review*, Vol. 38, No. 2, April 1990, pp. 6-7.

states will not be placed in the position of having to duplicate an overflight made by another participant because they did not have access to the data obtained by the previous overflight.

Costs for analyzing data may affect the ability of some states, particularly the East Europeans, to fully participate in the regime. While being equal participants in principle, economic factors may prevent the delegation of necessary resources for equipment and manpower necessary for data analysis and thus limit, in practice, the ability of some states to participate in the regime. A data analysis centre, open on an equal basis to all participants would allow full participation by all.[17] An additional argument in favor of a central data facility is that it may influence the quality of sensors used on the overflights. Sensors may produce data in analog or digital form. More sophisticated sensors only produce digital data which is more costly to analyze. It is possible that resistance to the use of some sensors may be due to the cost involved in analyzing the data they produce rather than resistance to their use in principle.

The concept of Open Skies has gained acceptance both a transparency measure and as a verification tool. It is obvious that Soviet concerns will require some compromise on issues related to sensors, aircraft, flight patterns, data reduction and sharing, and overflight quotas. It now seems likely that an Open Skies regime will have to await the outcome of CFE follow-on negotiations on aerial inspections before coming to fruition. The function of an Open Skies regime in this event may seem largely redundant in the European context, but the establishment of the regime and the structure it takes will be extremely useful for future use in the CSCE context and possibly also in the Chemical Weapons Convention.

Conclusions

The development of measures to facilitate transparency, particularly information exchanges, are extremely important to the future of arms control and verification. These measures must be carefully designed so that they make a positive contribution to the process. Confidence-building cannot take palce if only a small portion of participants contribute to the process or if the measure itself is used to cloud rather than clarify issues. For example, a number of proposals have been made to increase transparency in the field of weapons research and development, including information exchanges and reciprocal visits to military laboratories. If the object of the exercise is not carefully designed and personnel capable of fulfilling the objective chosen, there is a risk that the exercise may be similar to the invitation of US Congressmen to visit the Krasnoyarsk radar site. This invitation and visit was used to deflect charges of what was later admitted to be a clear treaty violation. On the other hand, carefully planned exercises such as the reciprocal visits to chemical weapon destruction sites

[17] See also the argument made in favor of a centralized verification organization for CFE verification in Henny van der Graaf's chapter in this volume.

have proved to be extremely useful in building confidence and developing verification methodologies.

The Open Skies negotiations have provided a number of important lessons for the development of future transparency measures. Information exchanges, an extremely important component of any verification regime, have proved to be more fruitful when negotiated by the parties concerned in the context of an agreement. There must be clearly defined objectives for any transparency measure and the measures themselves must be carefully designed to meet these objectives. The reality of equality of access to information produced, as well as the principle must be carefully addressed. This issue is best addressed through the creation of centralized organizations to receive and distribute information gathered. This method also appears to be cost effective for the majority of participants and avoids possible duplication of efforts which might otherwise occur.

Chapter 6
Naval Arms Control: Concepts, Verification Issues, and Prospects

Amy Smithson

Over two-thirds of the surface of our globe is water. How far can we progress towards a more peaceful world without also considering the naval dimension? - Sverre Lodgaard, 1990[1]

Introduction

Though unilateral actions were recently taken by the United States and the former Soviet Union, several decades have passed since a formal naval arms control agreement of any real consequence has been concluded. Yet, the history of naval arms control provides convincing evidence that significant treaties, as well as confidence-building measures (CBMs), are possible. For example, the 1922 Washington Treaty restricted the British and US navies to total displacements of 525,000 tons. Japan was allotted 315,000 tons, and France and Italy were each allowed 175,000 tons. The 1930 London Treaty updated this formula. Though the 1936 Montreux Convention expired in 1956, it is still observed and regulates passage through the Turkish Straits and deployments in the Black Sea. The 1937 Nyon agreement placed severe restrictions on submarine activities in the Mediterranean Sea. These accords show that arms control can address such difficult issues as the size of naval forces and their movement through international waters.

Implementation of these treaties was not without fault, but they have been assessed as daring and, for the most part, successful. According to two experts, the Washington and London Naval Treaties sunk "more battleships than all the admirals of the world had sunk in centuries" and were "the only serious attempt in modern times to limit the development and deployment of weapons central to the military posture of the great powers" prior to the signing of the 1972 US-Soviet Strategic Arms Limitation Treaty.[2] Given such an illustrious history, it is somewhat surprising that naval arms control has not been placed higher on the modern arms control agenda.

An exchange of dramatic unilateral measures in the Fall of 1991 by US President George Bush and former Soviet President Mikhail Gorbachev quickly brought naval

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[1] Sverre Lodgaard, (ed.), *Naval Arms Control*, International Peace Research Institute, Oslo, SAGE Publications, London, 1990, book jacket introduction.

[2] Thomas H. Buckley, "The President, The Senate, and Arms Control: The Washington Conference Ratification Debate, 1921", chapter in *The Politics of Treaty Ratification*, the Henry L. Stimson Center, Washington, St. Martin's, New York, forthcoming, p. 65; and Barry M. Blechman, *The Control of Naval Armaments: Prospects and Possibilities*, The Brookings Institution, Washington, 1975), p. 14.

arms control back to the forefront. Along with mutual unilateral reductions of tactical ground-based nuclear weapons and CBMs for strategic nuclear systems, the two presidents also stated their intent to take all tactical nuclear weapons off of surface vessels and submarines. These unilateral withdrawals included all categories of tactical naval nuclear weapons - depth charges, anti-ship missiles, aircraft bombs, anti-aircraft weapons, and, most importantly, sea-launched cruise missiles (SLCMs). Some of the deactivated, tactical systems will be destroyed, while others, such as the more modern SLCMs, will indefinitely be garrisoned on shore. Officials of the new Commonwealth of Independent States have indicated that they will abide by the arms control treaties signed by the Soviet Union. Many issues related to command and control of Soviet nuclear, chemical, and conventional forces remain unsettled.

The issue of reducing or banning tactical naval nuclear weapons has long been at the center of the naval arms control debate. A particularly onerous matter has been the disposition of SLCMs. Negotiators found these weapon systems so difficult to deal with that only a politically-binding agreement was possible in the Strategic Arms Reduction Treaty (START) framework. No reductions or real restrictions could be achieved.[3] The withdrawal of all nuclear SLCMs and other tactical nuclear weapons from deployed vessels is a major milestone for naval arms control. The scale of these reductions can be derived from the fact that in 1990, the US deployed 2,500 and the USSR 2,608 nonstrategic nuclear warheads onboard 138 and 565 nuclear-capable vessels, respectively.[4] Some experts, in fact, have argued that this development for all intent and purpose obviates the need for naval arms control.[5]

To the contrary, the denuclearization of US and former Soviet navies is by no means the only item on the naval arms control agenda. Additional quantitative, qualitative, geographic, and CBM concepts deserve consideration.[6] An impressive array of concepts has been suggested in the last decade, including ceilings or freezes in force levels and restrictions on the number of platforms in different ship classes. The desirability of limits on the numbers or movements of attack submarines and those carrying submarine-launched ballistic missiles (SLBMs) might also be evaluated.

Nor should the naval nuclear issue be considered closed since unilateral withdrawals are underway. A number of different CBMs and optimally a formal treaty could supplement these unilateral withdrawals. Suggestions to that effect will be included in the next segment of this essay, which is devoted to naval CBMs. Other

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[3] Both sides committed to annual declarations on planned SLCM deployments. No more than 880 SLCMs were to be deployed. No multiple warhead SLCMs would be produced.

[4] For updates on US and Commonwealth nuclear weapon deployments, see *Nuclear Weapons Databook*, Natural Resources Defense Council, Ballinger Press, New York, 1990.

[5] "US Withdrawal of Cruise Missiles May End Naval Arms Control Efforts", Robert Holzer, *Defense News* October 7, 1991, p. 27.

[6] Michael L. Ross discusses a variety of naval arms control measures in "Disarmament at Sea", *Foreign Policy*, Winter 1989-1990, pp. 94-112. See also, James McCoy, "Ante Up", *US Naval Institute Proceedings*, September 1990, pp. 34-39; and Barry Blechman et al, *Naval Arms Control: A Strategic Assessment*, The Henry L. Stimson Center, New York: St. Martin's Press, 1991.

issues that challenge naval arms control and verification are addressed in the subsequent section of the essay.

Naval Confidence Building Measures

CBMs are devices that increase predictability and reduce mutual suspicions, instability, and misperceptions. Unlike other arms control measures, CBMs do not decrease the size of armed forces or their modernization. Formal verification usually does not accompany a CBM agreement, yet in some respects CBMs often assist verification. For instance, many CBMs include data exchanges or other actions that improve each signatory's ability to understand the military activities of other treaty parties. CBMs are often referred to as transparency measures, but some proposals would go well beyond such a designation by restricting the movements of forces in certain areas or prohibiting the passage of ships carrying certain types of weapons.

Many CBMs have been suggested for naval forces. The first echelon of proposals involves exchanges of data on fleet postures and construction programs. For example, signatories would provide each other with annual notices about the size and nature of naval shipbuilding, deployment, and retirement programs. One variant of this concept calls for these exchanges to include program plans for several years into the future. Also included in this category of CBMs would be a continuation of the new practice of exchanging port calls. Sponsorship of discussions on naval doctrine and the establishment of an exchange program for naval officers at military schools are other CBMs that might be explored.

Another type of naval CBM would be patterned after an arrangement already in place in Europe for land forces, which requires treaty parties to notify each other of military exercises above certain force size thresholds.[7] Any exercise above the highest size threshold automatically triggers invitations to other signatories to send observers, but treaty parties are also under obligation to accept observers at lower thresholds, upon request. Similar arrangements could be negotiated for naval forces, which could be structured around large naval exercises or maneuvers, notifications of movements of large naval formations, or of troops by sea to areas close to the borders of other states.

The deployment of nuclear weapons onboard ships has been controversial because seagoing vessels ply the waters close to the shores of littoral nations around the globe. To reduce the dangers associated with such deployments, many proposals were made to establish nuclear weapon-free zones (NWFZs). The sea variant of a Treaty of Tlatelolco, which establishes the continent of South America as a NWFZ, has been advocated for waters such as the Mediterranean Sea, Indian Ocean, the South Atlantic,

[7] The Conference on Confidence- and Security-Building Measures and Disarmament in Europe (CDE) introduced a series of CBMs through the 1975 Helsinki Final Act and the Final Documents of Madrid (1980), Stockholm (1986), and Vienna (1990).

the Nordic Zone, and the South Pacific.[8] With US and Commonwealth tactical nuclear weapons being taken off ships, calls for the creation of these NWFZs may cease. Inhabitants of these regions may, however, continue to propose freezes in the force levels of US and Commonwealth navies freezes as a mechanism to halt the growth in military activity and as a first step toward reducing the concentration of US and Commonwealth naval operations in these waters.

To buttress the comprehensive unilateral withdrawals of naval tactical weapons that are taking place, the Commonwealth states and the United States should negotiate a series of CBMs. First, data exchanges and notifications on the progress of these withdrawals should be instituted. Next, observers might be invited to witness the destruction of some tactical weapon systems, excluding of course any acces to the sensitive aspects of weapon design. This exchange of observers need not occur with each destruction activity, but the issuance of some invitations would allow the US and Commonwealth nations to gain confidence that the promised withdrawals and subsequent destruction are proceeding apace.

Finally, invitations might be extended to visit storage sites for the nuclear weapons that will not be destroyed in the near future. A few such site visits would help relieve any apprehensions that Commonwealth and US officials might have about pulling these weapons off of the ships in the first place. Such CBMs might also encourage officials to consider a formal treaty to seal this unilaterally achieved ban on naval tactical nuclear weapons. If such a treaty were negotiated, the data base to support verification and many of the procedures for on-site inspection would be extensions of these recommended CBMs.

Other issues in Naval Arms Control and Verification

Most naval verification problems fall under the general heading of intrusiveness. Nations are reluctant to make sensitive naval technologies and the flexibility of naval operations subject to the provisions of a monitoring regime. With the withdrawal of tactical nuclear weapons, future naval arms control proposals are likely to focus on force size, structure, and movements. Naval weaponry, with the exception of SLBMs and carrier aircraft, will probably receive far less attention in arms control efforts.

One category of proposals concerning surface ships seeks to place ceilings on the number of ships or to begin reductions in the number of platforms deployed. While aircraft carriers are often singled out in these proposals, restrictions could also apply to battleships, destroyers, cruisers, and other support ships. No matter what the final formula is, such ceilings or reductions, if agreed, would not be difficult to verify.

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[8] See "Banning Nuclear Weapons at Sea: A Neglected Strategy", Ivo Daalder and Tim Zimmermann, *Arms Control Today*, November 1988, pp. 17-23. Michail E. Kokeev discusses nuclear weapon-free zones in "Naval Nuclear Disarmament", *Naval Arms Control, op. cit.*, pp. 198-205. See also Andrei E. Granovskiy's "Confidence-building Measures in the Maritime Environment: Necessity of Including Naval Armaments in Disarmament Negotiations", *Disarmament*, Vol. XIV, No. 1, 1991, pp. 155-182.

The foundation of any naval arms control monitoring regime would consist of data exchanges, national technical means (NTM), and on-site inspections. Both sides would exchange data on the vessels that are to be controlled. In some cases, baseline inspections might be used to confirm the database, but this measure might not be needed for agreements dealing with ships that can be readily observed with NTM.[9] Where the agreement required reductions and/or eliminations, schedules would be set for retirement and the observation of destruction. Provisions could allow to navies to mothball vessels at declared sites until destruction was possible. For example, the capacity to retire submarines is at a rate of approximately three per year. Agreement of a faster reduction schedule would necessitate mothballing, which could be observed by NTM.

Aside from simply limiting the number of submarines, one of the most prominent concepts of submarine limitations is the restriction of submarine patrol areas. This approach would delineate certain waters near "home" territory as bastions for the deployment of submarines carrying ballistic missiles (SSBNs). This sanctuary is intended to enhance strategic deterrence by prohibiting anti-submarine warfare (ASW) activities in zones, likely to be home waters, so that the retaliatory capability of SSBNs is not threatened by the ASW detection that enables subsequent destruction of SSBNs. A second variant of submarine patrol restrictions would isolate ballistic missile submarines in stand-off zones, not allowing them to patrol as extensively in order to reduce the threat of surprise attack against the coastal regions of opponents. Stand-off zones would also increase strategic warning time by causing the flight times of any missiles launched to be longer. Concepts of limiting submarine patrol areas have been discussed since the days of SALT I, with the first modern proposals being tabled by the Soviets in 1978 during the SALT II negotiations.[10]

In all candor, naval arms control advocates must concede that despite the compelling rationale for submarine buffer or stand-off zones, these measures would be extremely difficult to verify. The ability to detect and track the underwater movements of submarines - both the attack submarines prohibited from threatening SSBNs and the SSBNs in their stand-off zones - would be mandatory in order to monitor these measures. Although the Commonwealth and the United States possess sophisticated ASW capabilities, neither country can profess reasonable confidence in being able to pinpoint the movements of all submarines at all times. The ability of submarines to

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[9] According to Nikolai Brusnitsin, the United States has fifteen low orbit electronic surveillance satellites covering the world's oceans, a hydroacoustic network, dedicated surveillance ships, imagery satellites, and other systems just for this very purpose. See *Openness and Espionage*, USSR Ministry of Defense (Military Publishing House, Moscow, 1990. Other sources attribute similar, though perhaps not equal, NTM capabilities to both countries in discussions of the role of satellites in arms control monitoring. See Bhupendra Jasani, Toshibomi Sakata (eds), *Satellites for Arms Control and Crisis Monitoring*, Stockholm International Peace Research Institute, Oxford, Oxford University Press, 1987. See also David Foxwell, "Satellite Surveillance: Ocean Observation with Synthetic-Aperture Radar", *International Defense Review*, Vol. 24, August 1991, pp. 811-815.

[10] For further explanation of these proposals, see "SSBN Sanctuaries for Submarine Stand-Off Zones: A Possible Naval Arms Control Trade-off", Ronald G. Purver, in *Naval Arms Control, op. cit.*, pp. 224-239.

hide from detection is perhaps their primary military asset as an instrument of attack, but it is also their downfall from the standpoint of verification. Related CBMs, such as requiring designated submarines to surface upon request, would still leave treaty parties wondering whether an illegal submarine was lurking off of their coastal waters or threatening their SSBNs. Other proposals regarding submarines do, however, appear more promising.

Proposals to reduce the number, not the movements, of attack submarines have also been made. This measure would lessen the US threat to Commonwealth submarines carrying SLBMs and decrease the Commonwealth threat to sea-lines of communication across the Atlantic. Attack submarine reductions might also function as a force de-multiplier.[11] The term force de-multiplier refers to the assumption that decreased numbers of attack submarines would in turn lessen the need for large deployments of ASW systems such as sonar, long-range maritime aircraft, frigates and their air defense escorts, and groups of helicopter carriers. If reductions in attack submarine fleets were negotiated, the resulting decrease in force levels, mothballing and destruction of retired submarines, and adherance to agreed force ceilings could be monitored by NTM. Some OSIs to observe the elimination of submarines might also be part of such a verification regime.

After START reductions are completed, experts expect the United States and the Commonwealth to deploy about 3,450 and 1,660 SLBM warheads, respectively. Some additional strategic systems were deactivitated as a result of the 1991 unilateral measures. Gorbachev pledged to reduce the overall number of accountable strategic warheads allowed under the START by 1,000, though specific numbers were not given for SLBMs or their land-based counterparts. The US retired older US naval nuclear systems, namely the SLBMs on Poseidon class ships.[12] President Bush also called for negotiations that would focus on lowering the number of multiple independently-targeted reentry vehicles (MIRVs) on land-based missiles. De-MIRVing, or downloading, SLBMs might also be considered. SLBMs are likely to receive less attention in such a negotiation because these systems are comparatively invulnerable and are regarded as retaliatory, not first strike weapons. Nonetheless, if not in START II, then possibly in a subsequent treaty, the desirability of de-MIRVing some SLBMs might be evaluated.

If the downloading of SLBMs were negotiated, the main verification obstacle would be arranging inspections so that they do not infringe too deeply upon deployment and maintenance cycles. Naval officers are hesitant to standby at sea while inspectors monitor warhead inventories or to bring ships into port for the same purpose. Such requirements would interfere with naval operations. Routine maintenance of nuclear weapons takes place at depot maintenance facilities. US

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[11] See J. Eberle, "Naval Arms Control: Where do we go from here?", *Naval Forces*, No. 4, 1989. See also Eric Grove's "The Verification of Naval Arms Control", in J.B. Poole (ed.), *Verification Report 1991: A Yearbook on Arms Control and Environmental Agreements*, New York: Apex Press, 1991, pp. 155-161.

[12] START allows both sides a total of 6,000 accountable nuclear warheads. President Gorbachev did not specify what percentage of the additional Soviet reduction would come from naval nuclear systems.

SLCMs, for example, were maintained on a three-year cycle.[13] Most likely, inspections to verify the de-MIRVing of SLBMs would be done in port, not on the high seas, and would use or adapt many of the same techniques developed for START. These straightforward techniques involve removal of the missile nosecone and observation of the re-entry vehicles (RVs), which can be covered. Access to SLBMs may be more difficult than to land-based systems, so non-damaging RV inspection techniques that allow RV counting without removal of the nosecone might also be considered.[14]

Each of these arms control concepts must be evaluated to determine whether they enhance deterrence, allow the United States and the Commonwealth republics to meet national security requirements, and can be successfully verified. The mobility of warships will undoubtedly pose monitoring difficulties. Nonetheless, a monitoring regime can be envisaged for most of the proposed measures that would allow a reasonably high level of confidence in verification while not overtaxing naval operational prerogatives.

Prospects for Naval Arms Control

The key to progress in naval arms control lies in identifying desirable and verifiable measures that make a meaningful contribution to bilateral and international security. Simple approaches that do not overburden monitoring resources or impose heavily on operational freedom are more likely to succeed than complex formulas. For example, negotiation of platform limits might prove cumbersome because differences between US and Commonwealth destroyers, frigates, and other vessels would make agreement upon category definitions very difficult. On the other hand, negotiation of overall tonnage limits, modelled on the Washington and London Naval Treaties, might be easier to achieve. "Proceeding step-wise, from agreements on less sophisticated measures where elements of mutual understanding do exist . . . . one can arrive at limitations on and reductions in naval armaments."[15]

The selection of initial naval arms control steps should be guided by certain criteria. Two principal guidelines for these proposals would be that they enhance security and impose reductions in a graduated fashion. Demands that parties rapidly relinquish core military capabilities will simply not be constructive. Third, ready detection of militarily significant violations using NTM and land-based on-site

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[13] "Verification of Limits on Long-range Nuclear SLCMs", Valerie Thomas, Science & Global Security, Vol. 1, Nos. 1-2, July 1989, p. 37. For a more complete treatment of the subject of nuclear warhead detection capabilities, see Steve Fetter, Valery A. Frolov, Marvin Miller, Robert Mozley, Oleg F. Prilutsky, Stanislav N. Rodionov, and Roald Z. Sagdeev, "Detecting Nuclear Warheads", in Frank von Hippel and Roald Z. Sagdeev (eds), *Reversing the Arms Race*, New York: Gordon and Breach Science Publishers, 1990, pp. 265-368.

[14] Gamma-ray and neutron imaging techniques are two such alternatives. See Robert Mozley's "Verifying the Number of Warheads on Multiple-warhead Missiles", Frank von Hippel and Roald Z. Sagdeev, *Reversing the Arms Race*, New York: Gordon and Breach Science Publishers, 1990, pp. 117-140.

[15] Alexander Churilin, "Soviet Approach to the Limitation of Naval Activities and Naval Armaments", in *Naval Arms Control, op. cit.*, p. 134.

inspections would seem a prerequisite for proposals that might attract both the Commonwealth and the United States to the negotiating table. Then, verification could not be touted as an impediment to naval arms control. These criteria might rule out some of the more aggressive proposals, but significant measures can still be taken under these guidelines.

So far, the United States has deferred a deluge of denuclearization, force reduction, and CBM proposals, citing a need to maintain strong naval forces to offset imbalances brought about by smaller Western land forces and geographic isolation. Atlantic and Pacific Oceans separate the United States from key allies, making the ability to secure sea lines of communication central to US military planning.[16] A mobile and flexible counterbalance to a variety of threats, the US Navy is described as an essential instrument of power projection. Moreover, US opponents to naval arms control can point to US force reductions already underway and the key role of US naval forces in the Persian Gulf War to buttress their arguments.[17] While these factors may strengthen the resolve of many to resist naval arms control, military and political changes worldwide are also spurring a growing realization that naval arms need not necessarily be exempt from arms control. Influential individuals and organizations, such as former Ambassador Paul Nitze, former Chairman of the Joint Chiefs of Staff Adm. William Crowe, and some members of the US Congress have begun to advocate certain naval arms control measures.[18]

Many proposals have been raised, but one concept that readily fits the three suggested criteria is a reduction in the number of attack submarines. This proposal would build upon and codify the momentum of unilateral nuclear weapon reductions and force structure build-downs that are already taking place. Placing controls on attack submarines does not call upon either side to relinquish core naval defense capabilities, nor does it wreak havoc with the overall military balance or weaken deterrence. At the same time, this approach enables a significant reduction in threats

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[16] Douglas M. Johnston argues about how arms control would be detrimental to the crucial role that naval forces play in US defense capabilities and strategies in "Not in the Nation's Best Interest", *US Naval Institute Proceedings*, August 1990, pp. 35-38. See also, Roger W. Barnett, "The New Imperatives for Naval Arms Control", in Eric H. Arnett (ed.), *New Technologies for Security & Arms Control: Threats & Promise*, Washington: American Association for the Advancement of Science, 1989, pp. 171-184.

[17] Six US aircraft carriers carrying 450 aircraft participated in the air war against Iraqi forces. Almost 30 US naval craft were deployed in the Persian Gulf, with another 13 US naval vessels in the northern Arabian Sea, 12 in the Red Sea, and 29 in the Mediterranean Sea. "Navy Sends More Ships Into Gulf", John M. Broder, *Los Angeles Times*, January 11, 1991, p. 6; see also John H. Cushman, Jr., "Sea-Launched Cruise Missile Proves Value in Early Attack", *The New York Times*, January 18, 1991, p. A5; Bill Gertz, "Battleship's Target Is Chemical Brigade", *Washington Times*, February 7, 1991, p. B-5. US surface combatants are scheduled to decline from 203 to 167 ships over the next five years. See "Navy to Shrink Surface Ship Fleet to 55-Year Low", Robert Holzer, *Defense News*, December 3, 1990, p. 4.; Robert Holzer, "US Surface Fleet Will continue Decline Despite Gulf Conflict", *Defense News*, January 28, 1991, p. 4.

[18] For instance, Adm. William Crowe and Ambassador Paul Nitze have supported banning nuclear weapons onboard surface ships. Nitze proposed a bilateral ban on all surface nuclear weapons in April 1988. Crowe argued in January 1990 that "The only thing in the world that can sink an aircraft carrier is a nuclear weapon" and "that there shouldn't be anything sacrosanct" from potential negotiations. R. Jeffrey Smith quotes Crowe in "New Approach Is Suggested on Naval Nuclear Arms Cuts", *The Washington Post*, January 8, 1990, p. 1.

to SSBNs, sealanes, and coastal regions.[19] Even though the requirements of the monitoring regime would not be too intrusive, militarily significant violations could be detected. Furthermore, the negotiation of additional CBMs might also lessen the chances that US and Commonwealth officials could misinterpret each other's intentions while overall conventional and nuclear forces are being reduced and restructured.

These initial steps might not push naval arms control too hard, but making some headway is better than making no headway at all. Proponents of naval arms control might learn a lesson from the INF experience. While this treaty mandates the elimination of only small percentage of the US and Soviet nuclear stockpiles, it constitutes an important first step that has enabled the parties to gain confidence in how arms control can enhance security, to acquire first-hand experience in intricate on-site inspection techniques, and to move on from this step to more substantial reductions in strategic arms. Whereas overly ambitious proposals might sink the naval arms control ship altogether, less lofty, but still meaningful first steps might allow naval arms control to set sail.

[19] Ronald O'Rourke reviews the issues involved in bilateral attack submarine limitations in "Naval Arms Control: A Bilateral Limit on Attack Submarines?", Congressional Research Service, The Library of Congress, May 23, 1990.

Chapter 7
Space Weapons Verification: A Brief Appraisal

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Introduction

The objective of this Chapter is to appraise what verification methods and procedures an agreement on space weapons would plausibly necessitate. Prior to that appraisal, however, the reader is introduced to essential information on discussions related to issues such as definition of terms, space weapons, as well as military-related developments in outer space.

The major portion of the Chapter, Part I, concentrates on a discussion of present verification provisions and potential methods of verification. A comprehensive and stringent verification machinery would probably require on-ground and space-based procedures to verify both the non-production of space-weapons and their non-placement in outer space. In this connection, two fundamental questions are addressed in this essay: (a) what major weapons, weapon systems and components are likely to be subject to a verification regime and (b) to what extent the various existing ground and space-based monitoring technologies are suitable to ensure the task of verification. Concomitantly, an attempt is also made to analyze cost factors with respect to the technical methods of verification discussed.

Parts II and III address proposals for the creation of a multilateral verification machinery and confidence-building measures on space-related activities, respectively. They consider efforts made both on the bilateral level by the United States and former Soviet Union and the international community as a whole.

The Chapter concludes with a number of reflections on the technical feasibility and the implications of different methods of verification, as well as on the need for and direction of political decisions that could change the *status quo* of discussions on a space-related agreement in general, and space weapons verification in particular.

Definition of Terms

The definition of key terms concerned with the different utilizations of outer space has become the subject of considerable concern over the years. To reach collectively agreed definitions of fundamental concepts and the many key terms is no easy task, especially because the adoption of common definitions must take into account the complex technical, legal, and doctrinal meanings of words, phrases, terms, and weapon systems, as well as military and military-related space activities. The following discussion will therefore consider the definitions generally perceived as a fundamental

element in conditioning the clarity of treaties in both positive law and intended obligations of future outer space agreements involving verification procedures.

Military Use of Outer Space

There is a tendency to confuse the *military use* of outer space with the *weaponization* or *militarization* of that environment and care should be taken to differentiate between them. To begin with, it seems reasonable to assume that the use of outer space for arms control verification purposes is one type of military use of outer space to which the majority of States are likely to subscribe. In the Strategic Arms Limitation Treaties, SALT I and SALT II, the Anti-Ballistic Missile (ABM) Treaty, the Intermediate-Range Nuclear Force (INF) Treaty, and most recently the Strategic Arms Reduction Talks (START) Treaty, the United States and the Soviet Union have accepted, within the parameters of international law and practice, the use of National Technical Means (NTMs) of verification - a military use of outer space - as a legitimate activity within the verification process. In the multilateral dimension, the 1986 Stockholm Document, the 1990 Vienna Document and the 1990 Conventional Armed Forces in Europe (CFE) Treaty have reinforced this legitimacy through the inclusion of a non-interference clause for NTMs within each of the documents. Without such an application of the use of military satellites for verification purposes, many significant international arms control agreements would not have been possible. It is therefore generally recognized that this type of military use of outer space is inherently stabilizing. While military surveillance from outer space has been clearly beneficial in its application as part of the arms control verification process, other military uses of outer space (e.g., early warning, communication) have also been viewed by some States as stabilizing.

At the other end of the spectrum, *weaponization of outer space* seems to refer to the placement of *weapons* in outer space or their use in or from that environment. To the best knowledge of the international community, weapons have not yet been placed in orbit on a permanent or semi-permanent basis although it is generally assumed that Anti-Satellite (ASAT) weapons have been inserted into full or partial orbit for testing purposes on more than one occasion in the past. Trajectories of Intercontinental Ballistic Missiles (ICBMs) - of which post-boost, midcourse, and portions of the missiles' boost and terminal phases take place in outer space - have not been interpreted as the weaponization of outer space.[1] The important distinction between weapons placed in outer space, weapons which only transit outer space on the way to their targets and weapons based elsewhere which are used to attack targets in outer space is often blurred in discussions.

Between the *military use of space* - which seems acceptable to many countries - and the *weaponization of outer space* - which appears not to be widely accepted - falls the concept of *militarization of outer space*. While the term *militarization of outer space* is particularly vague, it appears to be less pejorative than *weaponization* but more so

[1] Provided that such missiles are not used in a mode designed to strike objects in outer space.

than *military use*. The working papers on the proceedings of the Geneva-based Conference on Disarmament (CD) and its *Ad Hoc* Committee on the Prevention of an Arms Race in Outer Space (*Ad Hoc* PAROS Committee) are replete with references to the *prevention* of outer space militarization. While some States refer to the need for the *non-militarization* of outer space, others advocate that efforts should be devoted to the *demilitarization* of that environment. For some States, *militarization* seems to be used in the same sense as *weaponization* - that is to refer exclusively to weapons. Other States seem to use the term *militarization* to include any military use of outer space.

Whatever interpretation is advanced by the different delegations, the central problem in the discussions appears to be linked with the lack of consensus on two fundamental questions, one being the definition of space weapons and weapon systems, and the other agreed boundaries which would clearly define what constitutes military and military-related space activities.

Defining Space Weapon Characteristics

In attempting to focus on the verification of a treaty to ban space weapons and in the absence of a comprehensive and clear-cut definition of such weapons, it is necessary to seek to determine their likely characteristics in a generic sense.[2] To this end, it is useful to consider a recent research report conducted by a group of experts under the auspices of UNIDIR, in which a definition of a space weapon is advanced, casting some light on this somewhat complex and obscure concept:

> A space weapon is a device stationed in outer space (including the Moon and other celestial bodies) or in the earth environment designed to destroy, damage, or otherwise interfere with the normal functioning of an object or being in outer space, or a device stationed in outer space designed to destroy, damage or otherwise interfere with the normal functioning of an object or being in the earth environment. Any other device with the inherent capability to be used as defined above will be considered as a space weapon.[3]

One major element in this and any other definition of space weapons is therefore their basing modes. Figure 1 depicts the methodology which might be applied to identify the platforms upon which space weapons could be mounted. As shown in the Figure, an object in space - and in different manners on Earth can be threatened or attacked by

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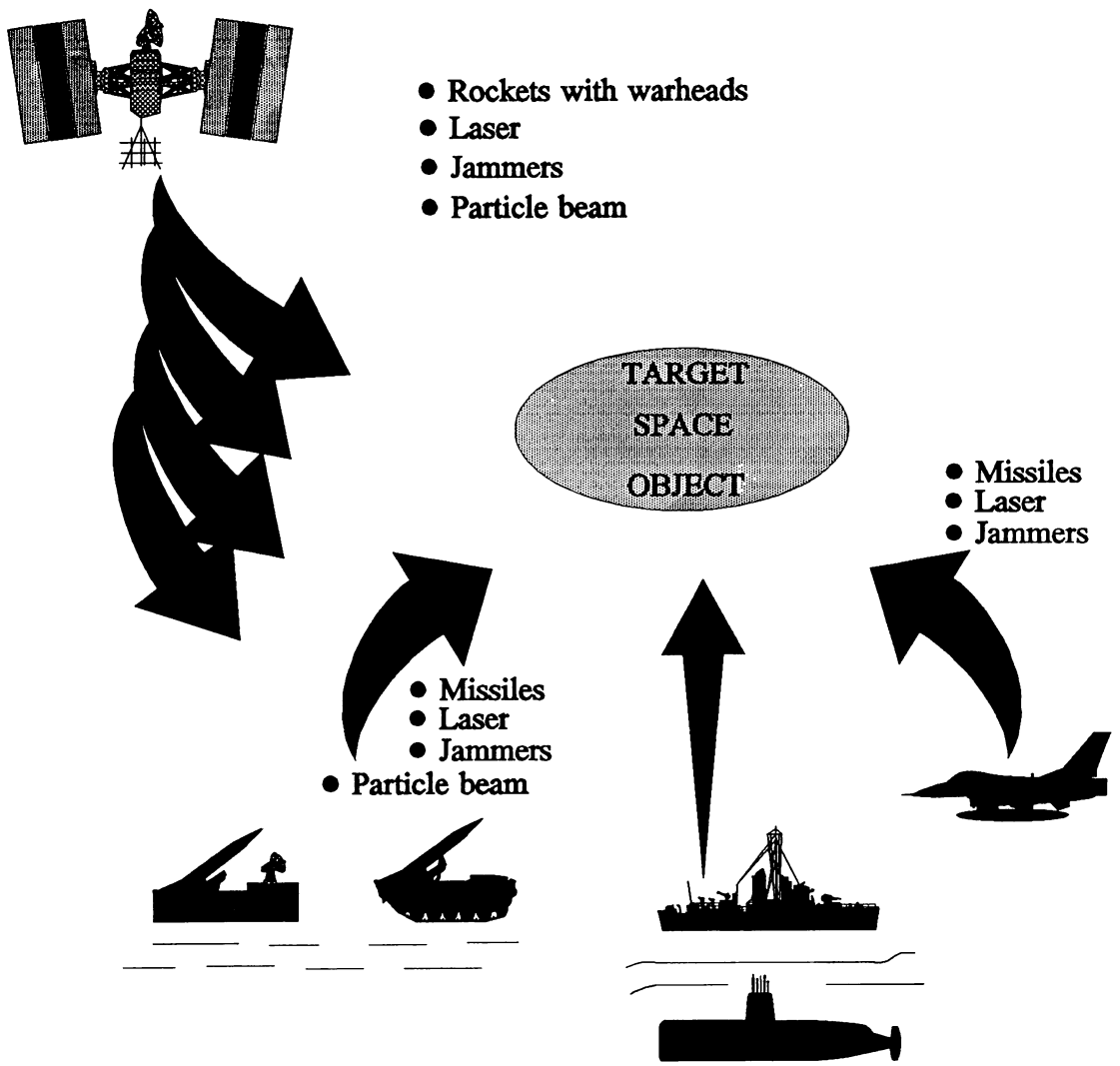
[2] Some delegations to the *Ad Hoc* PAROS Committee have presented different definitions of this term; see, for example, "Space Strike Weapons", working paper submitted by Venezuela to the *Conference on Disarmament*, CD/709/Rev.1, 22 July 1986. For other Venezuelan proposals on the definition of space weapons, see "Letter Dated 31 March 1989 Addressed to the Secretary-General of the Conference on Disarmament from the Permanent Mission of Venezuela Transmitting a List of Existing Proposals on the Prevention of an Arms Race in Outer Space", submitted to the *Conference on Disarmament*, CD/908, 31 March 1989; see also "ASAT Components and Ways of Verifying Their Prohibition", working paper submitted by German Democratic Republic to the *Conference on Disarmament*", CD/927, 26 June 1989.

[3] *Peaceful and Non-Peaceful Uses of Space: Problems of Definition for the Prevention of an Arms Race*, Bhupandra Jasani (ed.), New York: Taylor & Francis, 1991, p. 13.

Figure 1: Basing Modes and Damage Capabilities of Potential Space Weapons



Source of Damage/Interference

- Missiles and Rockets (Kinetic Kill)
  - Direct Impact
  - Nuclear Explosion
- Jammers (Electomagnetic Waves)
- Particle Beam (Directed Energy)
  - Neutron Particle Beams (NPBs) (Neutral Beams)
- Laser Beam (Directed Energy)
  - High-Energy Lasers (HELs)
    - Chemical Lasers (Cls)
    - Eximer Lasers (Els)
    - Free Electron Lasers (FELs)
    - X-ray Lasers (XrLs)
  - High-Power Radio-Frequency (HPRF)
  - Nuclear-Driven Directed Energy (NDE)

weapons in various platforms and based upon different operating principles. Clearly, this proposed definition covers dedicated space weapons specifically designed to strike targets either in outer space or from that environment. However, it also includes non-dedicated weapons, or weapon systems which are not weapons as such but which have some inherent weapon capabilities and that could therefore be converted and used as space weapons.[4]

A next step in such a general review, associated with verifying conformity with or violation of arms control agreements, could be to prepare an accurate list of the various ways a space weapon might be configured. Preparation of such a list would constitute a straightforward exercise in identifying the basic forms or genre of the weapons themselves and the choice of platforms on which they could be based or from which they could be launched. This list could then become the foundation for an analysis of what is distinctive about each threat configuration and what effective surveillance and detection methods can be identified. Nevertheless, the development of such a list is beyond the scope of this paper and is generally a source of controversy in negotiations and other fora.[5]

Developments in Outer Space Activities

There have been many developments in military space-related activities, R&D on weapons specifically designed to strike objects in outer space, and non-dedicated space weapons in the past 30-40 years. Knowledge of the impact of present and foreseeable military activities in outer space is a prerequisite to the formulation of any international law and technical procedures to verify an agreement on that environment. Therefore, it is felt that some consideration should be given here to the various types of military space activity presently under way and the latest developments in dedicated space weapons and weapon systems.

Early Developments

Although there are no known space-based weapons systems in orbit, both the USSR and the USA have demonstrated ASAT capability against Low Earth Orbit (LEO) targets using ground and air-based systems.[6] The existence of Soviet ground-based ASATs has been known for more than a dozen years. The detailed characteristics of ASAT weapons can be estimated by using unclassified information. From the late 1960s to the early 1980s, the USSR performed as many as 20 test flights of its coorbital ASAT interceptor - a space mine - with varying degrees of success. The

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[4] *Ibid.*, p. 14.

[5] However, some working papers have been presented to the CD and the *Ad Hoc* PAROS Committee on this issue. For example, the delegation of the former German Democratic Republic has suggested divisions and subdivisions of a definition of conventional space-strike weapons including: space and ground-based chemical rockets, mass accelerators and space mines, and collision bodies. See CD/927, *Op. cit.*

[6] It is generally believed that after the dissolution of the USSR this capability has been inherited by Russia.

technique was to achieve either a rendez-vous or moderate accuracy flying of a target satellite with detonation of a conventional mine device at close range.[7]

The best known and most well-developed US system is the air-launched (from an F15 type aircraft) hypersonic Miniature Homing Vehicle (MHV) infra-red (IR) guided missile, tested during the mid-1980s.[8] While a few tests were carried out using IR sources (stars) as targets, only one operational mode test was conducted, and it resulted in the successful destruction of the target satellite. In addition to demonstrated ASAT capability is the conjecture that both the USSR and USA ABM technologies are ASAT-capable. However, no known operational space-based weapon or weapon system for space-to-space/Earth operation has yet been developed in outer space, nor does such a weapon capability appear to exist at present. Thus, there is still a considerable amount of uncertainty as to what specific devices any such system would constitute and how a space-based system would be configured for optimal performance. This is particularly important because verification of a treaty on space weapons would not be limited to the identification of a weapon or weapon system alone, but probably to that of components and sub-components as well.[9]

Outer Space Today and Tomorrow

The 1983 announcement of the Strategic Defence Initiative (SDI) has been seen by some as a marker and turning point in the debate concerning the role which outer space is likely to play in the maintenance of international security. Certainly SDI has served to focus that debate. With the quickly evolving security equation in Europe, and the significant changes which have occurred in the superpowers' strategic relationship, perceptions and requirements for space-based defense systems have altered. This is more evident in the 1992 US budget and the refocusing of the SDI programme towards the concept of *Global Protection Against Limited Ballistic Missiles Strikes* (GPALS).[10] At least in the public mind, the Gulf War has strongly affected this refocusing. Nevertheless, the basic question remains as to whether or not a defense against ballistic missiles is feasible. That answer is due in the mid-1990s. If a system is feasible, the basic question then becomes that of whether only space-based support assets such as navigation, guidance, and detection systems will need to be space-based or if weapons themselves will need to be deployed in outer space. In this context,

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[7] For a discussion, see Pierre Lellouche (ed.), *Satellite Warfare: A Challenge for the International Community*, IFRI/UNIDIR, New York: United Nations Publications, 1987.

[8] *Ibid.*

[9] For a discussion on components of space weapons which could be subject to verification, such as platforms, kill mechanism, energy systems, Surveillance, Acquisition, Tracking, and Kill Assessment (SATKA) system, and Command, Control, Communication, Intelligence (C^3I) system, see Stanislav N. Rodionov, "Verification of a Ban on Space Weapons", J. Altmann and J. Rotblat (ed.), *Verification of Arms Reduction: Nuclear, Conventional and Chemical*, Springer-Verlag: 1989, pp. 121-124.

[10] See *Briefing On The Refocused Strategic Defense Initiative*, Washington D.C.: Strategic Defense Initiative, Department of Defense, 12 February 1991; *1991 Report to the Congress on the Strategic Defense Initiative*, Strategic Defense Initiative Organization, Washington D.C., May 1991.

preliminary discussions do take into consideration the deployment of space-based kinetic-kill and directed energy-kill devices in different phases of SDI and GPALS, among which is the so-called Brilliant Pebbles interceptor concept for space-based kinetic-kill of ICBM/SLBM in the boost or post-boost flight stages (see Figure 2).

As a consequence, outer space is destined to become one of the dominant multilateral arms control issues in the 1990s. Like the nuclear weapons issue, outer space will have significant implications for national and international policy determinations. Clearly, while it will continue to be an issue with overriding superpower considerations, there will also be important multilateral dimensions to address. The bilateral and multilateral aspects of this issue need not be seen as being mutually exclusive. In either context, the ability to verify compliance with any future outer space agreement will be pivotal to the success of discussions or negotiations. The challenge facing the international community is not so much to control an arms race in outer space as to seize the opportunity to prevent one.

Attention will be turned to the USSR/USA discussion and negotiation on outer space, the Defense and Space Talks (DST), a component of the Geneva-based Nuclear and Space Talks (NST) negotiations.[11] The USSR has frequently stated that its interest in this negotiation is centred on developing further assurances that limits established in the ABM Treaty are strictly observed. In contrast, US policy has been clearly defined as to "...free space-based ABM radars and their substitutes from outdated ABM Treaty limits", thus ensuring the future deployment of space weapons and components designed for defence against ballistic missiles.[12]

From the multilateral aspect of arms control, discussions in the CD and the *Ad Hoc* PAROS Committee consider a number of steps that could be taken in developing a constructive approach to the outer space issue. The first involves basic research on political, technical, and legal aspects of space activities. For example, issues which might be usefully researched and assessed include:

- Terminology and definitions for such key concepts as *military use, militarization, weaponization, peaceful uses, boundary of outer space, space objects*, etc.;
- What constitutes a threat and legitimate self-defence, as well as an arms race in outer space;
- The role of custom and State practice in the development of space law;
- The impact of technological change on the development of space law;
- How efforts to improve confidence and increase transparency among States should be pursued;
- Whether there is a need to agree immediately on a comprehensive legal regime concerning arms control in outer space or whether such a regime should evolve in an incremental manner.

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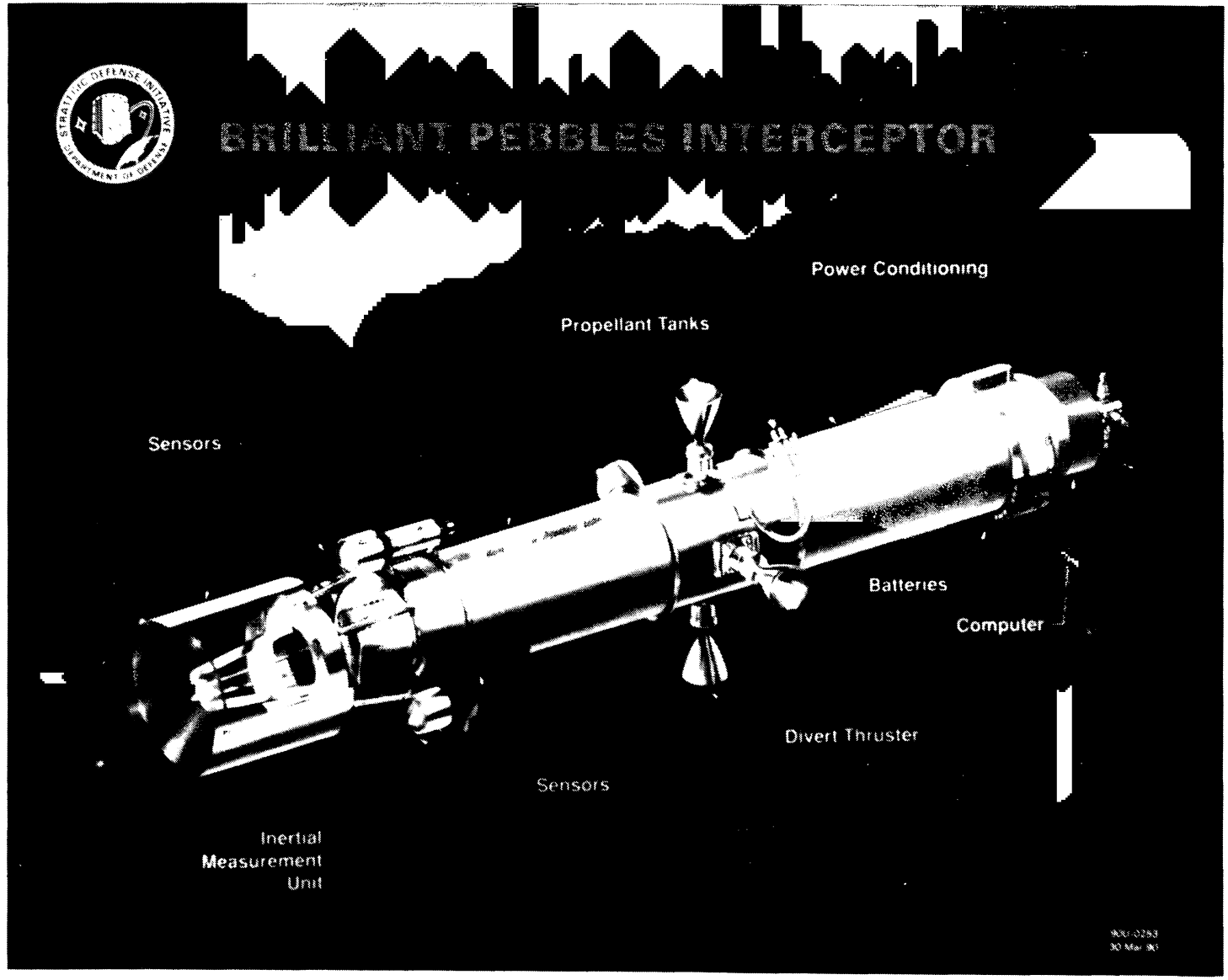
[11] The Nuclear and Space Talks (NST), or Defence and Space Talks (DST), are Geneva-based bilateral negotiations on intermediate and strategic nuclear forces, plus defence and space matters. However, the Soviet Union does not use the term "defence" and its statements on space and space-related discussions with the United States are made under the general heading of NST. Russia has replaced the USSR in these Talks and there has been no sign of any change with respect to this position.

[12] "Statement submitted by the United States to the Conference on Disarmament", CD/PV 553, 19 April 1990, pp. 7-10; see also an article by David J. Smith entitled "The Defence and Space Talks: Moving towards Non-nuclear Strategic Defences", in *Nato Review*, No. 5, October 1990, pp. 17-21.

Figure 2

Conceptual Design of Brilliant Pebbles Interceptor (Components)

Artist's conception of a Brilliant Pebbles interceptor. Brilliant Pebbles is a boost and post-boost interceptor likely to be deployed as a space-based layer (low orbit) of SDI Phase I/GPALs. The interceptor's components include integrated sensors, propellant tanks, divert thrusters, batteries, and power conditioning, inertial measurement unit, guidance, control, a computer, battle management and several thousands of singlet metal pebbles.



(Courtesy of SDIO/USDoD)

A treaty-specific instrument may prohibit or place limits on a particular weapon and/or weapon system or on the placement of such devices in particular orbits, or even the use of force in the space environment. For example, one idea is to declare prohibitions on ASAT weapons, or to establish the immunity of space devices in low-Earth orbits or in higher orbits such as the geostationary orbit.[13] This type of prohibition is supported by States that advocate the protection of artificial Earth-orbiting objects, especially satellites playing a role in the maintenance of strategic stability and other satellites to monitor arms control. A limited agreement on outer space may also constitute the legal immunity of satellites. A comprehensive agreement, however, as discussed in different fora dealing with outer space matters, would include prohibitions of space weapons, their systems, and the use of force in the outer space environment.

Nevertheless, both of the above possibilities would require far-reaching verification machineries. In addition, given the nature of space weapons and the environment in which they would be based or employed, it is not certain that verification procedures in one approach would be too different from the other. They may vary in scope but will probably be based on the same elementary technical requirements.

Space Weapons and Verification

It appears appropriate here to review the present status of space weapons' verification procedures. This review will throw some light on the technical requirements eventually necessary to ensure adequate verification.

Present Verification Provisions

There are at least a dozen treaties and conventions which are of relevance to the arms control aspect of outer space.[14] From the multilateral perspective, two are of particular significance. The 1963 Partial Test Ban Treaty specifically prohibits nuclear weapons testing in space. The 1967 Outer Space Treaty, generally regarded as the cornerstone of international space law, establishes a legal framework for general space exploration and utilization. Although the Outer Space Treaty was not designed to be an arms control agreement, Article IV of the Treaty does prohibit the emplacement of nuclear weapons or other weapons of mass destruction in Earth orbit. The Treaty also bans the

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[13] See a discussion in Péricles Gasparini Alves, *Prevention of an Arms Race in Outer Space: A Guide to Discussions at the Conference on Disarmament*, New York: UNIDIR, 1991, pp. 100-03.

[14] For a detailed description of these treaties, see "Arms Control and Outer Space", *Conference on Disarmament*, CD/320, 26 August 1982; "Survey of International Law Relevant to Arms Control and Outer Space", *Conference on Disarmament*, CD/618, 23 July 1985; "Survey of International Law Relevant to Immunity and Protection of Objects in Space and to Other Basic Principles of Outer Space Activities", *Conference on Disarmament*, CD/933, 13 July 1989; Gasparini Alves, *Op. cit.*; Shuhua Du, "The Outer Space and the Moon Treaties", *Verification of Current Disarmament and Arms Limitation Agreements: Ways, Means and Practices*, UNIDIR, New York: Taylor & Francis, 1991.

establishment of military installations and fortification as well as the testing of any type of weapon on celestial bodies.

Although bilateral in nature, the 1972 ABM Treaty also serves as a significant milestone in multilateral discussions on positive law of outer space. In particular, since many of the modern ASAT technologies are almost identical to ABM technologies, this Treaty has effectively limited ASAT development, especially space-based activity.

At present, verification provisions in existing multilateral and bilateral agreements related to outer space are not too stringent. On the multilateral level, for example, in the case of the Outer Space Treaty, verification procedures established under Articles 10 and 12 are based on the principle of consideration of requests to observe the launch flight of space objects and on mutual agreements and not on any mandatory obligations. As regards the bilateral ABM treaty, however, verification is based on NTMs which should be conducted in a manner consistent with general recognized principles of international law (Article 12). Table I regroups the present status of verification with respect to international agreements containing military or military-related provisions having a bearing on outer space.

Table I: Status of Verification Provisions
in International Agreements/Treaties dealing with Outer Space Activities

Weapons, Weapon Systems, or Military Activities	Type of Environment or Platform§		
	Outer Space§§	Moon and Other Celestial bodies (in general)§§§	Other Celestial bodies (within the solar system)§§§
• Registration of the launching of space objects	Non-existent	Non-existent	Non-existent
• Threat or use of force	Non-existent	Non-existent	Non-existent
• Use of satellite for military purposes	Non-existent	Non-existent	Non-existent
• Interference with satellites	Consultations[B]	Non-existent	Non-existent
• Military activities & bases	Non-existent	Reciprocal basis[M]	Reciprocal basis[M]
• Testing of weapons or weapon systems	Non-existent	Voluntary basis[M]	Voluntary basis[M]
• Placing of weapons or weapon systems in orbit (includes launching)	Voluntary basis[M]	Reciprocal basis[M]	Reciprocal basis[M]
• Environmental modification	Cooperative basis[M]	Cooperative basis[M]	Cooperative basis[M]
• Use of weapons/weapon systems	Non-existent	Mandatory basis[M]	Mandatory basis[M]

§= The Moon Agreement has created a specific legal régime for celestial bodies other than the Moon within the solar system; §§= Including Earth orbit; §§§= Including around or other trajectory to; **B**= Bilateral Agreement/Treaty; **M**= Multilateral Agreement/Treaty.

An eventual agreement on space weapons would necessitate a more comprehensive and stringent verification machinery than that shown in the Table. It would require on-ground procedures to verify both the non-production of space-weapons and their non-placement in outer space. In addition, verifying such an agreement would also call for monitoring procedures of space objects transiting and stationed in outer space with the use of various ground and space-based technologies.

Potential Methods of Verification

While there is much literature on potential space weapon characteristics and proposed arms control in outer space, there is relatively little on verification relevant to an outer space treaty, and the inadequacy of verification provisions in existing treaties discussed above is symptomatic of this. Table II shows how development of a verification process can be approached in a relatively simple manner, and areas in which verification methods could conceivably be applied (in/near-factory, launch-site, and in-orbit) and identifies some of the basic procedures likely to be involved.

The following discussion will further elaborate on specific aspects of *in situ* inspection procedures and remote-sensing devices which are liable to be in the centre of future debates on verification of an agreement on outer space. With respect to *in situ* inspection procedures, emphasis is placed on the implications of their practical implementation and operational costs. In the case of remote-sensing devices, attention is devoted to the need to differentiate between categories of ground/space based sensors - optical, infra-red, and microwave devices - necessary to meet specific requirements for the verification of arms control agreements on outer space, either limiting/prohibiting space weapons or certain military activities in that environment.

In-Factory Verification

The basic objectives of *in-Factory* verification to be implemented in a future agreement on outer space would be to detect, recognize, identify, and describe potential space weapons, their components, tests, or any other space weapon-related activity. The efficiency of verification would, to a large extent, depend on the level of intrusiveness of inspection operations. Intrusiveness is mainly assessed by the means of observation available (e.g., camera, electronic detectors, etc.), display of the object to be inspected, and the freedom of movement of inspectors within and in the periphery of the site to be inspected. Few are the arms control agreements which offer experience in in-factory procedures of verification. Among such agreements are, for example, the modified Brussels Treaty of 1954 establishing verification on German non-production of chemical weapons.[15] Bilateral agreements such as the INF and START have incorporated a different type of in-factory inspections in the form of near-factory

[15] Other instruments include the UN Security Council resolution 687 on the destruction of Iraqi chemical weapons capabilities. See discussion by Chantal de Jonge Oudraat and Frank R. Cleminson, Chapters VII and VIII respectively.

Table II: Potential Methods of Verification

Location	Description	Mode of operation
IN-FACTORY	**In-Factory** • Inspection of components • Testing of components • Observation of component-level and subsystem-level test • Observation of spacecraft integration and testing **Near-Factory** • Monitoring of production output	**On-site** - Visual: on-site inspectors - Optical: camera and other monitoring devices - Optical: camera and other monitoring devices
ON-LAUNCH SITE	**Pre-Launch** • Inspection of spacecraft • Testing of fluids/gases loaded into spacecraft tanks • Observation of spacecraft integration and testing **On-Launch** • Continuous observation of spacecraft and access to it during pre-launch to the launching stage	**On-site** - Visual: on-site inspectors - Optical: camera and other monitoring devices **On-site/Space-to-Ground** - Visual: on-site inspectors - Optical: camera, telescope Radars
IN-ORBIT	**On flight to/from Orbit** • Monitoring of spacecraft position and velocity to and from predefined orbits **In-Orbit** • Observation of in-orbit checkout, repair and refurbishment • Monitoring of spacecraft position and velocity • Observation of spacecraft in orbit • Inspection of spacecraft in orbit	**Ground-to-Space** - Visual : on-site inspectors - Optical tracking: camera, telescope - Radars - Radio tracking devices **Space-to-Space** Visual : on-site inspectors - Optical: Satellite observation - camera, telescope and other monitoring devices

inspections, the so-called *Portal-Perimeter Monitoring (PPM)*, the primary objective of this monitoring method being to provide continuous surveillance of the output of key production facilities. PPM may involve a series of procedures including the fencing of production facilities, the establishment of sensors such as X-ray devices to inspect the contents of containers passing through gates, and tag systems to deter/detect clandestine production. In the case of a weapon-related outer space agreement, any PPM would be directed to monitor the production lines for both launchers and payloads. Verification procedures, at least in the case of the former, need not be overly intrusive and would involve the monitoring of general characteristics such as manoeuvrability and thrust engines potential of launchers and platforms. In contrast,

verification of payloads may have to be more complex. PPM would have to inspect and detect potential Kinetic Energy (KE) and Directed Energy (DE) payloads varying from conventional and nuclear to directed energy (laser beams), kill mechanisms, and energy supply. In the latter case, for example, one idea is to monitor the brightness of ground-based laser beams propagated into the atmosphere via procedures which would require full power demonstration during the development and test stages of laser systems.[16]

As is the case in the INF and START Treaties, one of the first challenges lying ahead of in-factory procedures of an eventual outer space treaty would be to ensure the detection of space weapons built and assembled in the factory, as well as disassembled components which would be leaving the factory by different means. In this context, the increasing tendency to pre-package spacecraft suggests that observation of spacecraft integration and testing might be an element of much discussion. One other challenge to in-factory procedures would be the inspection of SATKA and C^3I devices. While SATKA and C^3I hardware may be relatively easy to detect and recognize, identification and description may prove to be very difficult, especially as these devices could be used for civil purposes and attribution of such capabilities to military use would be presumptuous at this stage.

However, PPM poses other practical problems for the verification of an agreement on outer space. One is the need to prevent industrial espionage and sensitive information. For example, X-ray machine inspections have reportedly proven to be contentious at times under the INF Treaty.[17] Another is the fact that the experience gained so far with this type of verification procedure concerned the inspection of well-defined weapons in specific weapons' facilities. For example, in the INF Treaty, portal-perimeter and other in-factory monitoring procedures were limited to the SS-20 missile final production site at Votkinsk, and Pershing II boosters facilities in Utah. PPM in START is largely based on this principle, although some differences of assembling and deployment sites have been taken into consideration. Major fundamental questions could be raised in the case of an outer space agreement. How would a space weapon factory be defined? Would PPM have to be installed in or near SATKA and C^3I factories? Moreover, how would PPM verify that computer software, an essential component of space weapon systems, has not been created for the guidance of space weapons and space battlefield management?

One other aspect which deserves attention here is the cost involved in PPM for a future agreement on outer space. In the case of bilateral USSR/USA treaties, for example, estimations made by the US have indicated the annual cost of PPM of SS-20 final assembly site under the INF Treaty to be 10 to 20 million 1990 US dollars, while

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[16] See a discussion by George E. Brown, "New Technologies and the Search for Security: Prospects for a Post-Cold-War Era," *Science and Technology and Their Implications for Peace and Security*, Topical Paper 2, 1990, pp. 34; see also a short article discussing this possibility in "Laser Verification Programme," *Trust and Verify*, No. 12 July 1990, p. 3.

[17] *U.S. Costs of Verification and Compliance Under Pending Arms Treaties*, Washington, D.C.: Congress of the United States, Congressional Budget Office, September 1990, p. 15.

PPM of Pershing II booster factories at US sites would be 20 to 30 million dollars. Estimates for PPM under START at Soviet sites (SS-24 and SS-25 factories) are between 25 and 75 million and 55 to 135 million dollars at US sites (MX or Peacekeeper and Midgetman factories).[18] PPM procedures in a multilateral agreement would increase expenses for personnel - military person and private contractor, travel, food, and lodging associated with individual inspection, and the number of factories and other sites to be inspected. Given the above estimates, the total cost for PPM in a space weapon-related agreement of universal adherence would probably be prohibitive.

Launch-Site Verification

While attractive in concept, verification of an agreement on space weapons via on-site inspections is likely to be difficult in application. One general question concerns whether or not on-site inspection teams can be deceived. Other questions quickly follow regarding the technical and human resources infrastructure essential for the functioning of a team. Beyond that, a myriad of additional detailed issues emerge. For example, verification procedures would have to be considered for the inspection of spacecraft, their integration and test, and actual monitoring of launch during both *Pre-Launch* and *On-Launch* stages. In both stages, inspectors would face similar challenges to those discussed for in-factory/near-factory verification with respect to the detection, recognition, identification, and description of potential space weapons. Needless to say, these objectives would not be easily reachable without a clear definition of space weapons and weapon systems.

One other subject that merits attention is the possibility of using satellites for the verification of arms control agreements. Indeed, space-based remote sensors have become an indispensable tool of modern society for both civil and military purposes and many of the same types of equipment are used for both. However, at present, only bilateral USSR/USA agreements have benefited from space-to-ground monitoring for verification under the principle and practice of NTMs, although in the future, the potential use of space-to-ground verification of conventional arms within the context of the CFE Treaty may prove to be a useful experience to draw on. Regardless of that, it seems appropriate here to briefly analyze the practical implications for space-to-ground verification in the event of an agreement on outer space.

The type of arms limitation/prohibition, satellite type and technical capabilities are major factors in determining the use of remote sensors in an eventual agreement. For example, while verification of weapons prohibition could benefit from photo reconnaissance and radar-imaging satellites, electronic broadcast-monitoring satellites could detect weapons' flight tests. In the first example (photo reconnaissance satellites), an essential technical requirement is that the satellite's ground resolution and military

[18] *Ibid.*

remote sensors have generally been designed for much higher resolutions than their civil counterparts.[19]

Some reports claim that the most advanced military space surveillance systems have a ground resolution in the order of 10 cm. Photo reconnaissance satellites such as the US KH-11 [Key Hole-11] series have a ground resolution of 15.24 cm and are equipped with IR night capable devices.[20] A more advanced series, the KH-11+/KH-12, have thermal-imaging and light-enhancement capabilities enabling them to take pictures at night, as well as instant transmission imaging and refuelling capabilities. Their resolution is suspected to be better than 15.24 cm. Little is known on Soviet photo reconnaissance satellites, although it is believed that they operate space-based remote sensors of similar ground resolutions. Among other countries' military photo reconnaissance satellites that should be mentioned here is the French Helios observation satellite to be launched in 1993. Helios' ground resolution has not been published but it is expected to be far better than 10 m. Indeed, some observers expect Helios' resolution to be in the order of one to one and a half meters.

Other types of satellite to be considered for verification of arms control are radar-imaging satellites, one example being the US Lacrosse series which carries night/cloud cover capable devices and which are reported to have ground resolutions of 60 cm to 3 m.

In contrast to military optical and radar satellites, the best ground resolution of current commercial satellites is about 10 m.[21] There are three major sources of commercial satellites imagery available today that might be considered to have some verification potential. The French Spot Image Corporation markets imagery acquired by the SPOT (Satellite pour l'observation de la terre) satellite system. The French SPOT-1 satellite has two High Resolution Visible (HRV) sensors, which provide three channel multispectral images with a resolution of about 20 x 20 or single-channel panchromatic images with 10 x 10 m approximate resolution on the ground. Considerably better resolutions are expected from SPOT-4. Imagery from the US Landsat satellite system is marketed by EOSAT, the Earth Observation Satellite Company. The US Landsat 5 has two primary imaging sensors: the Multispectral Scanner (MSS) and the Thematic Mapper (TM). Both sensors are capable only of vertical viewing, effectively restricting the satellite to 16-day revisit capability assuming no cloud cover. Imagery acquired by several Soviet imaging satellite systems is being marketed by Soyuzkarta. Soyuzkarta offers satellite imagery acquired using

[19] Resolution is related to the size of the smallest object a sensor can distinguish and it is determined by the focal length of the sensor, its distance from the object being viewed, and the size of the *picture element* or pixel of the sensor's recording medium.

[20] For a discussion on the technical capabilities of US military satellites, see *U.S. Costs of Verification and Compliance Under Pending Arms Treaties, Op. cit.*

[21] As discussed below, some of the Soviet commercial imagery is an exception to this statement.

KFA-1000 and MK-4 cameras. Both have a reported spatial resolution of close to 5 m.[22]

Among other civil optical and radar satellites are: the Indian IRS-1A and IRS-1B which have about 70 m and 36 m resolution devices, respectively; the Japanese MOS-1 (50 m resolution), JERS-1 to be launched in 1992 with a VNIR [Visible and Near Infra-Red] ground resolution of 25 m and 18 m for its SAR [Synthetic Aperture Radar] spatial resolution; and the Canadian Radarsat to be launched in 1994 with a VNIR ground resolution of 30 m, as well as a 8 to 10 m SAR ground resolution.

For some arms control verification tasks, it may be sufficient to merely detect an object or activity, while other tasks may require identification which is more demanding in terms of resolution. As an example, a resolution of 4.5 m is necessary to detect an aircraft using optical sensors, while 0.9 m is needed to identify.[23] In this connection, it has been reported that US Lacrosse satellite resolution is "...enough to detect all CFE and START treaty-limited items, but not necessarily adequate to distinguish and classify CFE treaty items".[24] In the case of space weapons' limitation/prohibition, photo reconnaissance and radar-imaging satellites would have to monitor Earth-based (ground-based, air and sea-launched) missile sites. Since space weapon systems are likely to require a combination of several large ground and space-based structures, verification of the presence of DE weapons/transmission/tracking facilities would initially be made from space-based photo reconnaissance and radar-imaging sensors. Given the ground resolutions required to detect and recognize these types of military structures, not only military satellites but also some civil satellites have adequate resolution capabilities for certain verification purposes. However, the question of observation capability, adequate coverage, and cost would arise for the verification of an agreement on outer space using space-to-Earth remote-sensing.

With respect to coverage, verification of the presence of space weapons on the ground may call for much orbital manoeuvring to place satellites in optimal observation positions, but manoeuvring a fuel-propelled satellite decreases its life-span which, in turn, has a bearing on both the choice of suitable satellites and the cost. Moreover, there are probably not enough military and civil satellites in space at present

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[22] The imagery from these cameras is reportedly recorded on to photographic firm. Digital images are produced by digitizing the first-generation films. Both systems provide 60% north-south overlap between scenes, permitting stereoscopic viewing of the imagery.

[23] For a discussion of commonly accepted parameters involving detection, recognition, identification, and description of military assets for the purposes of treaty verification, see "The Implications of Establishing an International Satellite Monitoring Agency", Report of the Secretary-General, Department of Disarmament Affairs, *Study Series*, No. 9, New York: United Nations Publication, 1983, p. 30.

[24] See *U.S. Costs of Verification and Compliance Under Pending Arms Treaties, Op. cit*, p. 64. CFE: detection of battle tank, armoured vehicle, and armoured vehicle launched bridge may require a minimum of 1.5 m resolution, while description of these same treaty items may require 0.5 m resolution; artillery items would probably require a minimum of 0.9 resolution for detection and 0.5 m resolution for description. START: detection of fixed ICBMs are generally believed to be feasible. In contrast, resolution requirements for the description of both ICBMs and SLBMs in general seem to scape present technical capabilities.

to ensure continuity of coverage for multilateral purposes, nor is the use of these satellites in a multilateral verification machinery politically and economic viable.[25]

Yet another fact is that the cost of remote-sensor verification systems would inevitably be linked to satellite lifetime in years, and the lifetime of satellites suitable for the verification of arms control can vary considerably.[26] For example, one KH-11 satellite may last 3 to 4 years and cost 1.25 to 1.75 billion 1990 US dollars. Lacrosse satellites have a life-span of 3 to 8 years and cost 0.5 to 1.0 billion dollars. An estimate of satellite capital cost made by the Canadian government for the purchase of a network of two radar and optical satellites (excluding operational costs) is reported to be about 774 million US dollars.[27] Although the exact final cost of a French Helios satellite is not known, it is expected that it will have a lifetime of about 4 years - requiring a replacement satellite to be launched and fully operational a few months prior to that period.

Signal intelligence (SIGINT) remote sensors such as the US Magnum, Jumpseat, and White Cloud satellites, which could serve to interpret electronic and communications signals by monitoring electronic broadcasts to detect jamming and other satellite interferences, generally have a longer lifetime and are cheaper than optical and radar-imaging sensors. For example, signal satellites such as the Magnum type have a lifetime of 5 to 10 years and cost 0.25 to 0.75 billion dollars.[28]

Consequently, it is not surprising that, for several reasons, there is renewed interest in Nuclear Power Source (NPS) for satellites. First, the innate survivability of its necessarily *hardened* construction is preferable to the extremely vulnerable solar arrays. Second, its *baseload* or housekeeping power of at least 300 kW is in a compact, mobile, and independent format. Third, its *Alert Burst Mode* capacity, for instant increased power output in an emergency, is unlikely to be matched by any other current technology. Two programmes have been set up in the USA in the search for more powerful and efficient nuclear power systems. One of these, the SP-100 programme, has been operational for some time and is working towards the development of a 300 kW reactor for general military and civil use by the middle of the present decade. However, the second programme, known as the Multi-Megawatt (MMW) programme, is still in the early stage. Given the renewed interest in the USA and the unflagging Soviet NPS programme, there is no doubt that the strategic context

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[25] Another problem is all-weather monitoring coverage. The Gulf conflict has demonstrated how technical and financial constraints can affect a monitoring scheme. For a short discussion, see "Lessons of the Gulf War," *Thrust and Verify*, No. 18, March 1991, pp. 1-2.

[26] The real cost of such systems would have to include expenditure for both ground (control station, receiver/relay station, etc...) and space segments (unit cost, refuelling, replacement, etc...).

[27] This figure includes the purchase of one SAR and one optical satellite (US$ 246 million each), their launch (US$ 230 million), the establishment of two receiving stations (US$ 11 million), two image processing systems (US$ 8 million), telemetry, tracking, and control (US$ 33 million). For a discussion and references, see *Study on the Role of the United Nations in the Field of Verification*, Department for Disarmament Affairs, Report of the Secretary-General, New York: United Nations Publication, 1991, p. 62.

[28] *U.S. Costs of Verification and Compliance Under Pending Arms Treaties*, *Op. cit.*, p. 46.

of this issue will be debated in the foreseeable future and will have a significant influence on space-based verification requirements and capabilities.

In-Orbit Verification

Apart from *in loco* inspection, verification of an object in orbit can be twofold: either from a space-based platform or from ground-based equipments. As shown in the discussion below, while these procedures may provide important data for verification, both have serious technical and financial constraints.

Space-to-Space Verification

There is considerable basic research to suggest that *in-orbit* observation of an object in space can determine the role or function of the object, particularly if it constitutes a weapon or is part of a weapon system. The high degree of optimization inherent in the design of all spacecraft and in orbital parameters, together with the nature of signals to and from a given spacecraft, can provide highly significant data as to a given spacecraft's function. The fact that military-related space missions cluster in limited portions of space simplifies the problem of space-based observation. In this connection, operational requirements of potential space-based weapons would permit a viable observer spacecraft design. The most useful way of determining a spacecraft's function by means of a space-based observation system would be to co-orbit and keep station with the target over a reasonably lengthy period of time.

Space-to-space observation techniques for the verification of the presence of weapons in outer space include the use of cameras, telescopes, and infra-red devices on board satellites. For example, the devices in the Infra-red Astronomical Satellite (IRAS) launched in 1983 are reportedly capable of detecting objects of 1 mm diameter at a range of 100 km and of 1 cm diameter at a range of 1000 km.[29] In addition, space-based telescopes are also known to be capable of supplying information on space objects' trajectories.[30]

Discussions at disarmament fora have referred to the fact that space-based telescopes are believed to be able to monitor external features of space platforms for the presence of small rockets, rail guns, particle beam accelerators, and other kill mechanisms.[31] Mention has also been made of other on-board satellite devices which could monitor the detection of electromagnetic radiation emanating from rail-guns or particle beam accelerators, as well as the chemical or electrical energy supply of space-

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[29] D.A. Olmstead, "Orbital Debris Management: International Cooperation of a Growing Safety Hazard", G.W. Heath (ed.) *Space Safety and Rescue: 1982-83*, Proceedings of the 15th and 16th International Symposia on Space Safety and Rescue held in conjunction with the 33th and 34th International Astronautical Congresses (San Diego, CA: Univelt, 1984), pp. 241-43.

[30] See D.J. Kessler, "Earth Orbital Pollution," E.G. Hargrove (ed.), *Beyond Spaceship Earth: Environmental Ethics and the Solar System*, San Francisco: Sierra Club Books, 1986, pp. 48-49.

[31] See CD/927, *Op. cit.*; *Monitoring Testing of ASAT Functions*, paper presented to the *Ad Hoc* Committee on Prevention of an Arms Race in Outer Space, Torleiv Orhaug, National Defence Research Establishment of Sweden, Permanent Mission of Sweden to the Conference on Disarmament, Geneva, 6 August 1991 (unpublished).

based DEWs.[32] It has been estimated that Neutral Particle Beam Weapons (NPBWs) might need fuel supplies of 50 to 100 tons while high power microwave weapons would need an enormous amount of electrical energy.[33] Attention has also been paid to the detection of large mirrors in outer space, the presence of which may be an indication of the deployment of laser weapon systems in that environment. Nevertheless, some technical and other drawbacks of practical implementation still remain (see Figure 3) and other potential space weapons could pass undetected. For example, unless potential space weapon platforms contain KE-kill mechanisms (carrying ammunition such as metal pellets), manoeuvrable collision bodies would be difficult to identify from space as space weapons.

Ground-to-Space Verification

Unlike other monitoring techniques, ground-to-space observation has not received much attention in the literature on arms control, most of the references being centred on the astronomic roles these techniques play in the detection and tracking of space debris.[34] In verifying an agreement on outer space, a number of different ground-to-space techniques can be used in tracking and listening operations by employing either passive (optical) or active (radar) devices.[35] Passive devices are mostly used by observatories and the military establishment in the United States, the Soviet Union, and certain countries in Western Europe. On the other hand, apart from a few sites operating active devices for the tracking of civil satellites, active devices have been almost exclusively operated by the armed forces for both military and civil satellite tracking and for conducting measurements of missile trajectories.

Among the organizations known to be operating ground-to-space devices suitable for detecting and tracking space objects are the US National Aeronautics Space Agency (NASA) and the North American Aerospace Defense Command (NORAD), the International Telecommunications Satellite Organization (Intelsat), and the European Space Agency (ESA). All of these organizations detect and track satellites, expended rocket bodies and debris fragments. Most of them operate case-specific surveillance by tracking their own satellites (i.e., detecting a radio beacon emitted by their orbiting satellite) or by monitoring their satellites from the ground/space with optical/radar

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[32] *Ibid.* However, there appears to have been little discussion on the possible deployment of nuclear-powered space-based weapons.

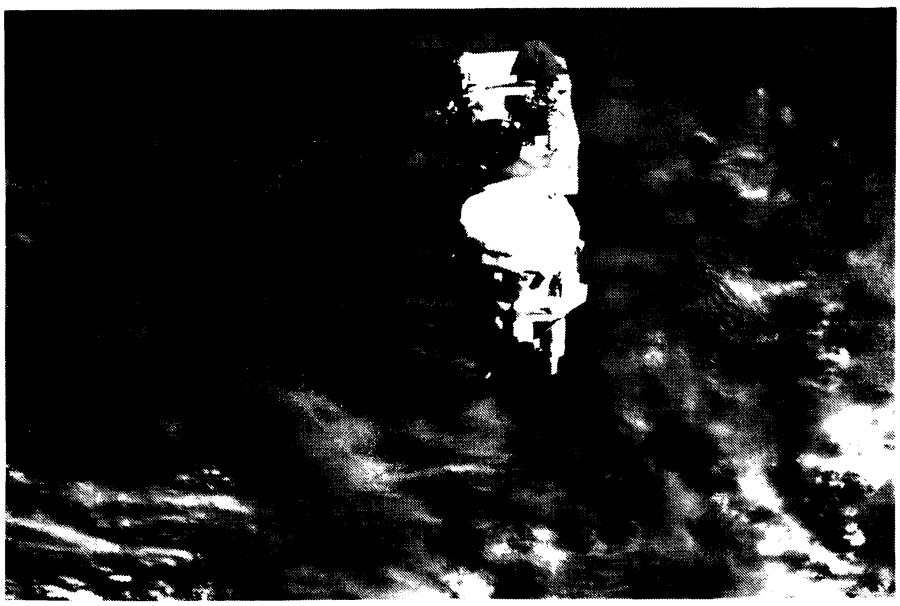
[33] *Monitoring Testing of ASAT Functions, Op. cit.*

[34] See, inter alia, Nicholas L. Johnson and Darren S. McKnight, *Artificial Space Debris*, Malabar: Orbit Book Company, 1987; *Space Debris Report*, Space Debris Working Group, European Space Agency, July 1988; Andreas Howell, "The Challenge of Space Surveillance", *Sky & Telescope*, June, 1987, pp. 584-88. Exceptions are a short Canadian study entitled "The Role of Astronomical Instruments in Arms Control Verification", *Arms Control Verification Studies, No.2*, by Chris A. Rutkowski, Department of External Affairs: Ottawa, 1986 and a paper by Luciano Anselmo, Bruno Bertotti and Paolo Farinella, "International Surveillance for Security Purposes," *Space Policy*, August 1991, pp. 184-98.

[35] Example of *passive sensors* are optical (camera) and electro-optical (telescopic camera). *Active sensors* include mechanical steerable dish (radar), phased array radar (automatic), and radar fence (radio beam).

Figure 3: Space-to-Space Photographs taken during Rendez-vous Operations

A

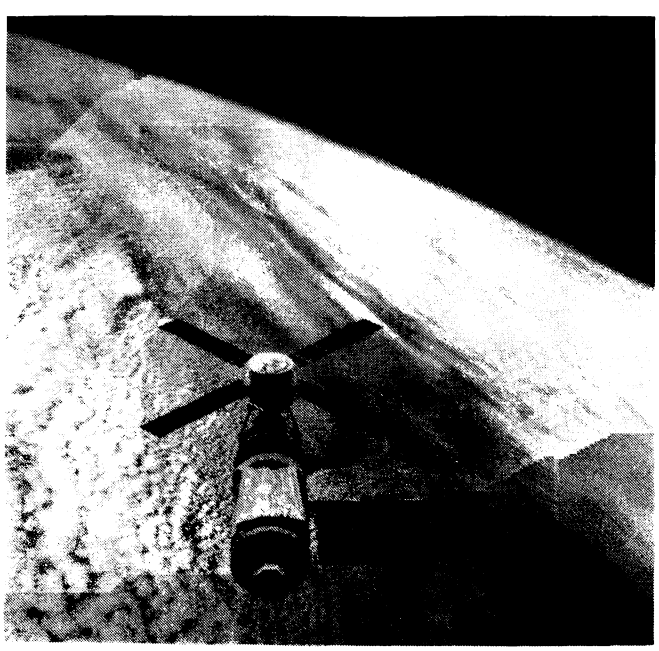


Onboard Scenes:

A. This photograph shows the Strategic Defense Initiative Organization (SDIO) Shuttle Pallet Satellite (SPAS-II) as it approaches the remote manipulator system (RMS) end effector following a period of free-flight and data collection. (The target grappling apparatus on SPAS is clearly seen near the bottom centre of the frame.)

B. This photograph shows the Skylab space station as photographed from Skylab 4 Command and Service Modules (CSM), by a 70 mm hand-held Hasselblad camera. This close-up view shows that a micrometeroid shield and a solar panel (left side) of the Skylab are missing.

B



(Courtesy of NASA)

Examples of Photograph Interpretation for Verification

- Photographs A and B illustrate advantages and disadvantages of using space-based optical systems to verify (1) the presence of space-capable weapons in outer space, on the ground, and in air space, and (2) damage caused to satellites in orbit.

•• **Space-to-Space Mode:**

••• Photograph A displays detailed information in pictures obtained by optical systems such as the one used in the STS-39 (35 mm camera) scene during *rendez-vous* operations. Dedicated cameras or telescopes mounted on space platforms would tend to be more powerful then the camera used in this SDIO mission. This photograph also shows that *Fly-by* procedures alone may not be sufficient for reliable verification. An observer spacecraft may therefore have to keep-station with the targeted object and make several manoeuvres to photograph the space object from various angles.

••• Photograph B illustrates that verification of damage caused to satellites is, to some extent, feasible. However, unless assisted by ground-based instruments such as tracking devices, space-based optical systems would probably not supply enough data to distinguish between damage caused by ASAT or other activity.

•• **Space-to-Ground Mode**: Photograph A shows a huge blanket of white clouds obscuring identifiable points on Earth, nearly 300 statute miles away. Cloud penetration imagery is at present not possible to obtain with space-based optical systems in the visible light band of the electromagnetic spectrum.

means. However, NORAD Command's Space Surveillance Center (SSC) monitors several thousand orbiting objects independent of ownership on a continuous basis.[36]

Monitoring can be effected with different techniques such as radar signature, visible-light photometry, infra-red radiometry, and photographic imaging. Space objects can therefore be identified through their capacity to reflect sunlight and radar signals, and with certain instruments, space objects greater than 1 cm can be detected from the ground. However, accurate detection requires regular computation of satellite orbital parameters because an object may change its orbital elements during its lifetime in outer space either advertently, as a result of ground-based oriented manoeuvres, or inadvertently because of certain physical laws.

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[36] NORAD's SSC is located in the Cheyenne Mountains in central Colorado. Its function is to alert the re-entry of an intercontinental ballistic missile. However, it also detects, identifies, tracks, and predicts orbital paths/planned trajectories/manoeuvres and re-entry trajectories of satellites, space debris, and certain air missiles through a variety of detector networks around the globe. Its activities also include the management of collision avoidance manoeuvres and the observance of satellite launches. See discussions in Jay H. Payne, "A Limited Antiballistic Missile System," Ohio: Department of the Air Force, Air University, Air Force Institute of Technology, *Defense Technical Information Center*, 1990, pp. 2.13-2.24; Andrew Richter, *North American Aerospace Defence Cooperation in the 1990s: Issues and Prospects*, Department of National Defense, Canada, Operational Research and Analysis Establishment, Extra-Mural Paper No. 57, July 1991; *Space Debris Report*, *Op. cit.*, pp.4-5; also see Nicholas L. Johnson and Darren S. McKnight, *Op. cit.*, pp. 25-31; Rutkowski, *Op. cit.*, p. 2; Howell, *Op. cit.*, pp. 584-88.

Relevant optical systems include the Baker-Nunn cameras which were developed in 1957 and are known to track objects of 4 cm in diameter at altitudes of less than 400 km, and objects of 2.5 m in diameter in geostationary orbit.[37] However, Baker-Nunn cameras will soon be phased out and replaced by Ground-based Electro-Optical Deep Space Surveillance (GEODSS) systems. GEODSS, which is already part-operational, is known to be capable of detecting objects of 1 cm in diameter in low Earth orbit (400 km and below) and 20 cm in diameter in geostationary orbit, and to be used for tracking objects between 5.000 and 35.000 km.[38] The technology for close-up photography of satellites is reportedly operational within the framework of intelligence gathering.[39]

As for active devices, radar sensors for precision tracking and other military operations were developed in the late 1970s and early 1980s. One example is the Perimeter Acquisition and Attack Characterization System (PARCS) which is deployed to detect objects of about 8 cm in diameter in low Earth orbit.[40] The Soviet Union is believed to have the technology for the radio and radar ground-based detection and tracking of satellites in low Earth orbit, as well as for the tracking of satellites in higher orbits. In addition, official US sources have advanced that Soviet radars designed for early-warning, anti-ballistic missile systems, and new phased array systems, can be used to detect, track, and characterize satellites in low orbit.[41]

Given the present state of technology, both passive and active ground-based sensors could be envisaged for the verification of an agreement on outer space. Nevertheless, the efficiency of this type of verification would be determined by the size of the object being monitored, its distance from the ground, the instrument used for monitoring, and the type of data required by the verification. Unlike the monitoring of space debris, which demands very fine resolutions to detect objects in outer space (i.e., objects of about 10 cm between 800 and 1200 km), the minimum size of active satellites to be detected for verification purposes would be in the order of a few meters (this would probably include the detection and identification of Brilliant Pebbles-like space-based interceptors). Special ground-based telescopes could be used to obtain images using reflective light systems. Other possibilities for ground-to-space verification include the

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[37] See Howard A. Baker, *Space Debris: Legal and Policy Implications*, Dordrecht: Martinus Nijhoff Publishers, 1988, pp. 27-31. For discussion and references, see also Rutkowski, *Op. cit.*, p. 2; *Space Debris Report*, *Op. cit.*, pp.4-5; Nicholas L. Johnson and Darren S. McKnight, *Op. cit.*, pp. 25-31; Joel Powell, "Satellite Tracking with GEODSS", *Spaceflight*, Vol. 27, March 1985, pp. 129-30; Anselmo, *Op. cit.*

[38] *Loc. cit.*

[39] See a discussion in Powell, J., "Photography of Orbiting Satellites," *Space Flight*, Vol. 25, February 1983, pp. 82-83; also see *Space Debris Report*, p. 5; Powell, "Satellite Tracking with GEODSS," *Op. cit.*, p. 129.

[40] *Loc. cit.*

[41] See *Anti-Satellite Weapons, Countermeasures, and Arms Control*, U.S. Congress, Office of Technology Assessment. Washington, D.C.: U.S. Government Printing Office, OTA-ISC-281, September 1985; *Soviet Military Power*, U.S. Department of Defence, Washington, D.C.: U.S. Government Printing Office, March 1986. Both of these sources are quoted in *Space Debris Report*, *Op. cit.*, p. 5.

detection of radioactive emission and/or leakage from orbiting satellites by GEODSS.[42]

However, as far as identification and description of potential space weapons is concerned present-day technology is not so reliable. For instance, the optical data provided by ground-based devices with respect to, say, the Soviet Mir station with a known location (about 400 km in altitude), orbital path, and measurements (about 30 m long and 3-4 m in diameter) would probably detect and recognize the Mir station in outer space, but not a potential weapon or any other military device attached to its cargo. Optical sensors are limited by cloud cover and light conditions, atmospheric interference, and observation period.[43] For instance, passive sensors such as ground-based telescopes are limited to night-time operation, while active sensors such as ground-based radars are limited to low orbit observation. Other technical constraints, such as the time required to develop films and the speed of tracking in mechanically steerable Baker-Nunn type cameras, could also prove to be drawbacks in a crisis. Furthermore, satellites may be painted in black or dark colours to diminish their reflective capability or designed so as to absorb radar signals, thereby reducing the radar signature they echo back into outer space. (See major monitoring techniques and their basic constraints in Figure 4.)

Despite reports that PARCS is capable of tracking a debris cloud formed by satellite fragmentation, it would also be difficult to follow the trajectory of collision bodies and space mines.[44] Furthermore, ground-based verification would also be needed to distinguish between physical damage caused to solar cells, optical systems, and platforms by meteorites and space debris from Kinetic-kill or Directed Energy-kill ASAT activities.

However, the CD discussions have considered other ground-tracking options, including the use of *passive* and *active* tags.[45] In both cases, a device would be placed on a space object to facilitate its monitoring, but passive tags would mainly be used for identification e.g., bar code tags for a conventional weapons' agreement - while active tags would probably be used to gather information on the space object's path and orbital changes. Tagging is therefore another likely subject of future debate following improvements to the Registration Convention, the creation of databases on space objects, and the tracking of their trajectories/manoeuvres. Additionally, the development of new ground-to-space observation techniques (e.g., phased array and other highly accurate detection and tracking devices) will probably influence the verification of any agreement on outer space.

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[42] For a discussion and references, see Rutkowski, *Op. cit.*, p. 12.

[43] For a discussion on unsuccessful attempts to photograph the US *Columbia* Orbiter, see Powell, "Photography of Orbiting Satellites", *Op. cit.*, p. 82.

[44] N. L. Johnson, "History and Consequences of On-orbit Break-Ups", 5 Advances in Space Research, 11, pp. 14.

[45] See *Monitoring Testing of ASAT Functions*, *Op. cit.*; Peter C. Hughes, *Satellites Harming Other Satellites*, Arms Control Verification Occasional Paper No. 7, Ottawa: Arms Control and Disarmament Division, External Affairs and International Trade, Canada, July 1991, pp. 41-43.

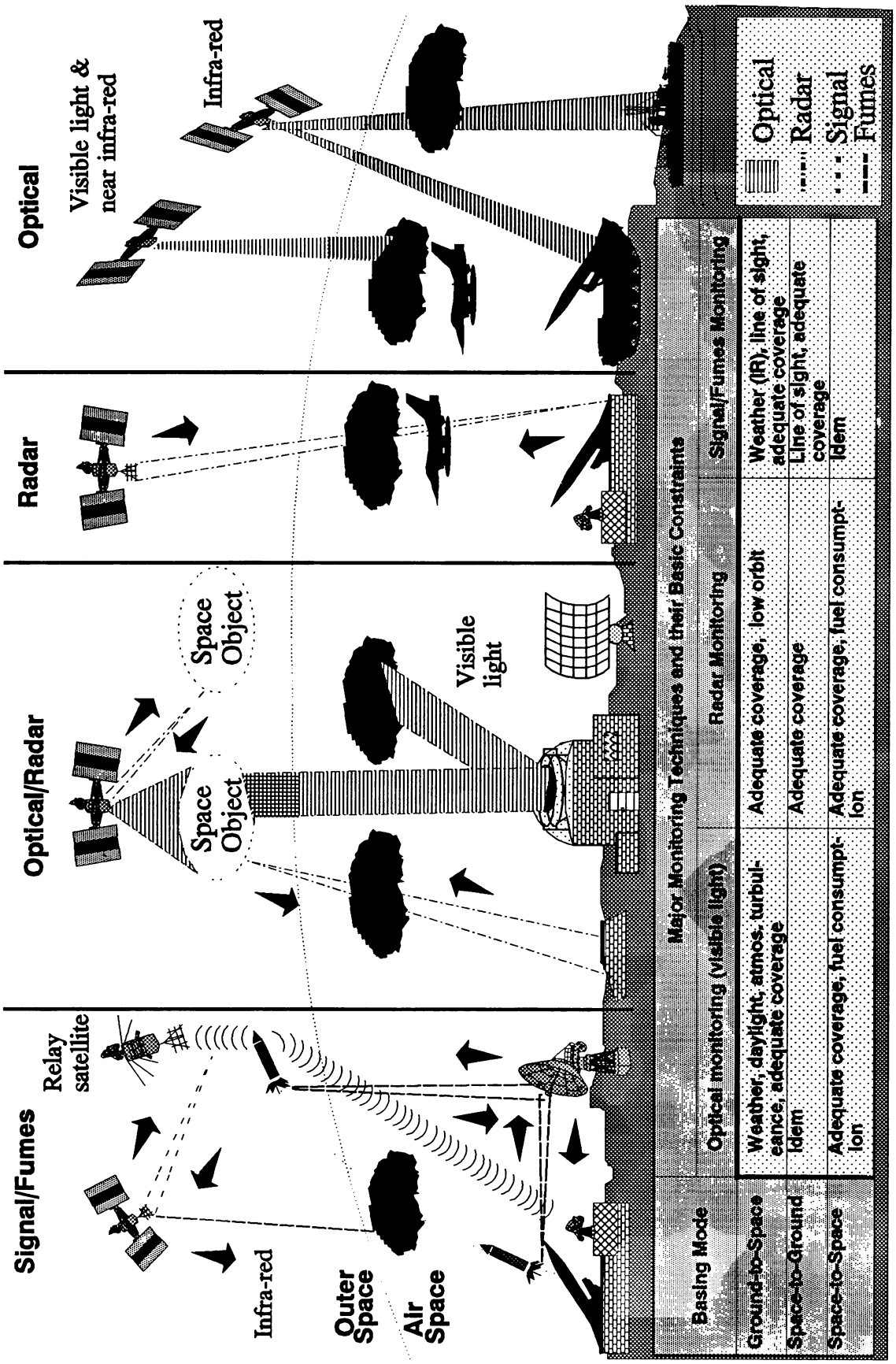

Figure 4: Potential Ground/Space-Based Modes and Techniques for the Verification of an Agreement on Outer Space

Proposals for Multilateral Means of Verification

Proposed institutional arrangements for the verification of an agreement on outer space include the International Satellite Monitoring Agency suggested by France in 1978 (the French ISMA); the Canadian PAXSAT A concept of 1986; the International Space Inspectorate (ISI) put forward by the USSR in 1988; and the International Space Monitoring Agency (the USSR ISMA) proposed by the USSR in 1988.[46] The French and Soviet ISMA proposals would rely on data supplied by NTMs for space-to-Earth verification and would not call on space-to-space monitoring techniques. However, both envisage R&D of ISMA satellites and ground stations for ground, air, and outer space applications at a later stage. While not mentioned in either ISMA proposals, technological developments in the field of optics and radars would presume that the development of ISMA satellites carrying space-to-space observation devices would be conceivable - although such a move away from the original proposals would require a political decision.

Of the four proposals, only PAXSAT A and ISI are specifically directed to a weapon-related agreement on outer space. PAXSAT A calls for the creation of a space-to-space verification satellite for case-specific treaties, but it is not clear whether PAXSAT A satellites would be able to detect and identify interference such as jamming. However, the existence of space objects having such a capability is believed to be verifiable, although detection would depend on various elements related to monitoring procedures (e.g., the timing and approach used by PAXSAT A satellites to enter the field of view/detection of the target space object). Remote-sensing techniques are not foreseen in the Soviet ISI proposal, which suggests *in loco* inspection at launch-sites instead. However, the Soviet Union has offered little information beyond the actual ISI proposal.

Table III illustrates the potential of these four proposals to verify different weapon activities in relation to outer space. While no procedures for in-factory inspection or Earth-to-space monitoring have been proposed to date, it is possible that on-site inspection and in-orbit observation may become less effective with technological advance and economic constraints. Unlike the verification of the USSR/USA bilateral

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[46] See "Note verbale dated 30 May 1978 from the Permanent Mission of France addressed to the Secretariat, "*Official Records of the General Assembly*", A/S-10/AC.1/7, June 1978 (French ISMA); "Survey Report of the Outer Space Workshop held in Montreal on 14-17 May 1987", submitted to the *Conference on Disarmament*, CD/773, 20 July 1987, and the "PAXSAT Concept: The Application of Space-Based Remote Sensing for Arms Control Verification", External Affairs, Canada, *Verification Brochures*, No. 2, 1987 (Canadian PAXSAT); "Letter Dated 17 March 1988 from the Representative of the Union of Soviet Socialist Republics addressed to the President of the Conference on Disarmament transmitting the text of a Document entitled 'Establishment of an International System of Verification of the Non-Deployment of Weapons of Any Kind in Outer Space'", CD/817, 17 March 1988 (Soviet ISI); *Official Records of the United Nations*, A/S15/34, 8 June 1988 (Soviet ISMA). For a description of these proposals, see Gasparini Alves, *Op. cit.*, pp. 119-37. Other proposals include the creation of a regional verification agency in "Observation Satellite - a European Means of Verifying Disarmament", Symposium, Rome, 27th-28th March 1990. Assembly of the Western European Union, Technological and Aerospace Committee, 1990.

Table III: Verification Potential of Proposed Institutional Arrangements Related to Outer Space

Verification Methods of Present and Proposed Space-Related Limitations/Prohibitions	PROPOSED INSTITUTIONAL ARRANGEMENTS			
	ISMA§ (French) 1978	PAXSAT A (Canada) 1986	ISI (USSR) 1988	ISMA§ (USSR) 1988
***In-situ* on the Ground**				
• Registration of the launching of space objects	-	-	√	
• Military activities & bases	-	-	-	-
• Testing of weapons or weapon systems	-	-	-	
• Placing of weapons or weapon systems in orbit (launching)	-	-	√	-
Earth-to-Space				
• Threat or use of force§§	-	-	-	-
• Military activities & bases	-	-	-	-
• Interference with satellites§§	-		-	-
• Testing of weapons or weapon systems	-	-	-	-
• Environmental modification	-	-	-	-
• Use of weapons and/or weapon systems	-		-	-
Space-to-Earth				
• Testing of weapons or weapon systems	√	-	-	√
• Placing of weapons or weapon systems in orbit (including launching)	√	-	-	√
Space-to-Space				
• Interference with satellites§§	-	√	-	-
• Military activities & bases	-	√	-	
• Testing of weapons or weapon systems	-	√	-	-
• Placing of weapons or weapon systems in orbit		√	-	-
• Environmental modification		√	-	-
• Use of weapons and/or weapon systems	-	√	-	-

√= Proposed application; §= These proposals are primarily aimed at the creation of monitoring institutions. However, they also contain specific clauses for the verification of arms limitation and disarmament agreements under special arrangements; §§= Possibly including ASAT activities; **French ISMA**= International Satellite Monitoring Agency; **PAXSAT A**= Peace Satellite; **ISI**= International Space Inspectorate; **USSR ISMA**= International Space Monitoring Agency.

agreements and multilateral agreements such as the CFE Treaty, verification of an outer space agreement would not necessarily be limited to specific types of well-known weapons, weapon systems, or regions. In view of the variety of feasible monitoring techniques and the need for highly effective verification mechanisms, it is essential that a package of multilateral reinforcement verification methods and procedures be adopted. The most suitable strategy may therefore be the so-called *Layered Approach*

(LA), whereby more than one verification technique would be used to ensure compliance.

Confidence-Building Measures (CBMs) on Space-Related Activities

In the absence of any agreement on outer space, delegates to the CD and the *Ad Hoc* PAROS Committee frequently emphasized the need for confidence-building measures (CBMs) as a step towards achieving greater transparency in space-related activities. This is seen as a pragmatic approach, in view of the bilateral discussions between the USSR and the US. However, it is legitimate to ask what effect CBMs might have on the verification of any agreement on outer space.

Bilaterally, CBMs are multifarious. In one approach, US officials briefed Soviet NST negotiators on the activities and progress of the SDI.[47] In another instance, CBMs include *predictability measures* in the form of mutual visits to research laboratories working on advanced defence technology.[48] Thus, in 1989 Soviet experts visited laboratories engaged in SDI research, namely, the BEAR Neutral Particle Beam at the Los Alamos National Laboratory in New Mexico and the ALPHA chemical laser at the TRW Test Center in San Juan Capistrano, California.[49] The purpose of these visits was to demonstrate that SDI related-research complied with the ABM Treaty, but there is no record of American scientists having visited Soviet laboratories. A third approach consists of proposals such as the "Free-Standing Agreement" (FSA) and the "Dual Pilot Implementation" (DPI). The FSA calls for an agreement on "... annual exchange of representative programmatic data on research, development, testing, deployment, modernization, and replacement activities in the field of strategic ballistic missile defence".[50] DPI, on the other hand, has been designed to enable the United States to demonstrate its proposed Infra-red Background Signature Survey (IBSS) experiment, in which both countries are to participate. Concomitantly, the Soviet Union (now Russia) is to demonstrate a project of its own choice, in which again both countries are to take part.

No agreement on predictability measures has been concluded between the USSR and the USA, but the practice of laboratory visits has provided some transparency in respect of present and projected space weapon and weapon system development. This exchange of experience may also prove fruitful when drafting in-factory and similar verification procedures for an outer space agreement.

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[47] See CD/PV 533, *Op. cit.*, pp. 7-10; Smith, *Op. cit.*, pp. 17-21.

[48] *Predictability measures* are intended to provide openness and make "...the strategic relationship [between the USSR and the USA] predictable, averting miscalculation and surprise...". It includes briefings, visits to laboratories, and observation of tests, notification of the placement of the ABM test satellite into orbit, orbital changes, and de-orbiting. See "The Defense and Space Talks", *U.S. Delegation to the Nuclear and Space Talks*, September 1990, pp. 3-5.

[49] *Loc. cit.*

[50] "The Defense and Space Talks," *Op. cit.*, p. 2.

For multilateral purposes, it has been suggested that CBMs should be used (1) to strengthen existing international legislation and (2) as a structural part of new institutions on the peaceful uses of outer space. One such suggestion was that CBMs could be used to augment Article 4 of the Registration Convention, under which problems can be encountered with regard to the timing and content of reports on objects launched into outer space. The present Convention has no provision for the creation of an accurate database on the original and successive orbital elements of an object launched into space, although such a database is essential for optimizing ground tracking of objects in space, particularly the so-called *Data Acquisition Phase* (DAP) when many calculations have to be made to locate and predict orbital paths.

Proposals on CBMs by new institutions have been made in the case of the *Space Code of Conduct*, the *International Trajectography Centre*, and the *Satellite Image Processing Agency*.[51] A *Space Code of Conduct* (or *Rules of the Road)* could provide the background to the verification of an agreement on *Keep-out-Zones*, *Fly-by* activities, and the re-entry of objects into the Earth atmosphere.[52] These new institutions could also establish common means of observation to enable trajectories and manoeuvres to be monitored, which is vital for the verification of space mine and other ASAT activities.

It is widely accepted by the international community that *contracted* CBMs could provide greater openness as far as outer space activities are concerned,[53] especially since they would also enable such vital components as data interpretation and staff training to be tested. However, it seems that it is the *non-contractual* CBMs which have the better chance of being implemented in the foreseeable feature, because CBMs of this kind could call on all states to act in conformity with outer space law and urge them to consider signing international instruments to which they are not yet party. Similar measures would include voluntary briefings on activities having military or military-related functions and/or notification to multilateral disarmament and other fora of space object launchings and the acceptance of observers in certain military or military-related space activity.

Unlike the contractual CBMs mentioned above, voluntary/reciprocal CBMs have the characteristic of being measures whose substance, timing, and frequency are determined

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[51] See, inter alia, "Letter Dated 20 July 1989 from the Representative of France Addressed to the Secretary-General of the Conference on Disarmament Transmitting a Working Paper Entitled 'Prevention of an Arms Race in Outer Space: Proposals Concerning Monitoring and Verification and Satellite Immunity'", CD/937, 21 July 1989; "Letter Dated 1 August 1989 from the Representative of France Addressed to the Secretary-General of the Conference on Disarmament Transmitting a Working Paper Entitled 'Space in the Service of Verification: Proposals Concerning a Satellite Image Processing Agency'", CD/945, 1 August 1989. Another CBM suggestion has been advanced in the *Ad Hoc* PAROS Committee under the heading of *Open Outer Space*, whereby confidence would be built-up step-by-step via the so-called "Stockholm Approach".

[52] For a concise discussion on certain characteristics of *Keep-out-Zones* and *Fly-by*, see Hughes, *Op. cit.*, pp. 37-40.

[53] The role that CBMs could play in achieving arms control has been recognized by the UN General Assembly in its request that the Secretary-General undertake a study on specific aspects of the application of CBMs in outer space activities. See "Prevention of an Arms Race in Outer Space", *Official Records of the United Nations*, A/RES/45/55, 13 December 1990.

by individual states and not by a legal obligation or institution. This self-regulating mechanism of voluntary CBMs appears to be politically more acceptable to states which, while mindful of the need to prevent suspicion of military developments in outer space, are clearly not ready to undertake negotiations on a specific agreement in that environment. At the same time, it should not be overlooked that the self-regulating mechanism of voluntary/reciprocal measures also has practical implications, particularly because of its non-frequent and non-mandatory character, whereby inaction by a state may increase suspicion of space military-related activity. In the case of such increased suspicion, CBMs would be ineffective for verification and for international security. This theoretical ramification may constitute a serious obstacle to states' engagements in the practice of voluntary CBMs.

Conclusions

The task of negotiating an agreement on outer space, be it multilateral or bilateral, weapon-specific, activity-specific, or comprehensive, will be considerable. The first obstacle is the lack of common agreements on definitions of space weapons and space weapon systems and their activities. A second obstacle is the lack of resolution on what the international community perceives to be a deserving priority for negotiation. Political decisions must be taken to establish guidelines for the negotiation of potential agreement(s) within manageable proportions, and without such a consensus, discussion on the verification of an agreement on outer space will remain conjectural and academic.

The fact that satellites and ground-based devices are used either to monitor certain arms control agreements (within the NTMs framework) or to observe the Earth's surface or objects in outer space does not necessarily mean that an agreement on outer space is verifiable. Nor does it mean, *ipso facto*, that existing technology is readily accessible to any agency that might be charged with the task of such verification. In addition to political and legal difficulties, there are also technical and economical constraints and these must be adequately evaluated before verification can be considered feasible.

Proposed institutional arrangements for the verification of an agreement on outer space do not include all possible technical means of monitoring compliance. When the time to negotiate an agreement comes, the planned verification machinery will have to integrate various methods and procedures. For example, ground-to-space monitoring complements space-to-space, space-to-ground, and in-factory monitoring procedures. Similarly, optical and radar systems complement each other and could therefore jointly produce more data than if only one of these system is retained. Accordingly, in-depth studies of present and foreseeable technical feasibility, economic viability, and practical applicability of remote sensing (including ground-to-space observation means) should be undertaken.

In the meantime, bilateral and multilateral CBMs stand as the most viable means to (a) provide more transparency in space and space-related activities, (b) facilitate

progress in future negotiations, and (c) develop knowhow and common practice in different inspection methods and procedures which could contribute to the creation of future mechanisms to verify an outer space agreement.

Chapter 8
International Organizations and Verification

Chantal de Jonge Oudraat

Introduction

The idea of international armament monitoring or disarmament verification organizations regularly surfaces in disarmament debates. Despite the great number of more or less detailed proposals made in the post-World War II period, only a few verification/monitoring organizations (*i.e.* organizations exclusively devoted to this purpose) have emerged. The Agency for the Control of Armaments (ACA) of the Western European Union and OPANAL, the organization established under the treaty concerning the prohibition of nuclear weapons in Latin America, are the two notable examples.

Notwithstanding this meager historical record, the idea of multilateral and international organizations dedicated to, or operative in the field of, the verification of arms control agreements is currently receiving renewed and heightened interest under the impetus of the CFE, CSCE, and CW negotiations, as well as the Iraqi war settlement.

Various factors may be put forward to explain this renewed interest in the role of international organizations. In the first instance, increased importance is being attached to the verification of disarmament agreements. Verification methods and procedures have become more elaborate and co-operative. The "multilateralisation" of the disarmament process, following the end of the Cold War, could also be mentionned. Indeed, in a world where the proliferation of weapons of all sorts is increasing rather than decreasing, the importance of universal adherence to multilateral disarmament agreements parallels the importance of the need to operationalize the political principle of indiscriminate and equal access to verification capabilities. Put differently, it parallels the need to effectively implement the requirement that "all States have equal rights to participate in the process of the international verification of agreements to which they are parties".[1] International control, *in casu*, the international organization is to palliate the existent uneven access to the technical means of verification, as well as the very uneven distribution of human expertise and resources in this field.

The institution-building process is also considered to have a high confidence-building potential; by fixing and capturing in a more permanent form a spirit of co-operation, it may ensure more universal treaty adherence and better compliance.

Economic considerations may motivate advocacy of involvement of international organizations. Arguments of cost-effectiveness and efficiency are often more valid,

[1] This is the 10th principle of the 16 principles of verification elaborated by the Disarmament Commission in 1988. See UN document A/S-15/3 (1988), or A/43/42 (1988).

however, in cases where a limited, like-minded, and like-resourced group unites, as for example in Western Europe. In universal multilateral contexts, where the discrepancies in means, both technical and financial, are great, the cost factor is often quickly considered to be of a prohibitive nature. Indeed, those States with the strongest financial and technical means end up paying for a collective effort without any notable or concrete returns. The proposals for the establishment of a United Nations-operated International Monitoring Agency is an example in this regard.

Calls for the establishment or involvement of an international organization in the field of verification may also be inspired by a wish to deny access. For instance, the American proposal for an International Atomic Control Authority, the so-called Baruch Plan, was aimed, even if not exclusively, at denying the USSR access to atomic weapons. Similarly, the Armaments Control Agency of the WEU had an essentially political aim, namely, denying Germany the right to produce atomic, biological, chemical and certain conventional weapons.[2] The most recent example is the Special Commission established by UN Security Council Resolution 687 (1991), denying Iraq possession of weapons of mass destruction.

Frequently, however, the involvement of international organizations in the field of the verification of disarmament agreements is also strongly opposed. Apart from economic arguments (*i.e.* the alleged high costs of operating an international verification organization) the problem of the confidentiality of data is stressed. The idea that the internationalization of verification procedures may not be capable of sufficiently safeguarding legitimate demands for preserving confidentiality of commercial and/or military data is, in this respect, not to be casually disregarded. Internationally managed monitoring techniques might indeed be insufficiently discriminate in their information gathering. The international sharing of information collected with national means is similarly problematic. Nations are hesitant to share their sources and seek to protect their intelligence means. Evaluation and assessment of data without having knowledge of its *provenance* or source may be difficult and might easily generate misinterpretations.

Another major objection is related to the political and legal qualification element of the verification process. No State is very eager to delegate decisions which concern compliance to a third party or to an international body. There is a fine line between factfinding and the political qualification of facts in an international co-operative environment. The integrative character of the international organization, with its potential for autonomous actions, is particularly feared in this respect. In a world with diverging interests, questions of national security remain closely guarded, and national sovereignty is highly cherished. States are extremely hesitant to invest international secretariats with responsibilities in this field.

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[2] More generally the creation of the Agency had as aim "to ensure against militarism on the part of any member" Assembly, WEU document, No.973, May 1984, p.11, or put differently at bringing Germany into the defence system of Western Europe without arousing fears among the member countries. The Federal Government had to be given an opportunity to prove that its rearmament was justified and in the interest of the seven European countries. Assembly, WEU document, No. 197, March 1961, p.1.

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For the purposes of this paper we have defined an *International Organization* as *a permanent structure established by agreement by two or more States for the common management of certain activities.* The Organization may have a varying degree of institutionalization, depending on the number and diversity of the organs which compose the permanent structure - in other words, on the existence and/or diversity of its inter-State and/or integrated organs.[3] The definition includes bilateral or multilateral mechanisms devoid of integrated organs such as the Consultative Commissions or the Meeting of Contracting Parties established by the Antarctic Treaty of 1959. Diplomatic conference mechanisms such as review conferences are excluded, however, because of their non-permanent nature. The Organization may have varying degrees of authority and autonomy in the management of its activities, depending on the competence attributed to the organs of the organization and on their decision making procedures (*e.g.* unanimity versus majority vote).

Different practices and proposals related to the involvement of international organizations in the field of the verification of arms control agreements will be examined in this chapter. In **the first part**, practices and proposals with respect to verification-dedicated organizations will be reviewed. In **the second part,** the verification and monitoring functions conferred on, or proposed for, international organizations with broader mandates will be examined. In each part, particular attention will be given to the functions the organization is to perform, the methods at its disposal, its level of institutionalization, and its degree of autonomy.

In terms of functions, the following three may be distinguished: *fact-finding* (*i.e.* the collection of information and data, as well as their analysis); *political and legal qualification of facts*; and *enforcement* (*i.e.* responses, including possible sanctions). While the latter function is controversial and usually not included in definitions of verification, it seems of particular relevance for the study of the role of international organizations in the field of verification. Ensuring a higher and more visible degree of treaty compliance, which is one of the rationales for involvement of an international organization is all the more credible if the organization can invoke procedures in case of non-compliance.[4]

With respect to methods, the following two categories may be retained: *intrusive methods* (*i.e.* methods implying the physical presence of either a human or an instrument on a State's territory) and *non-intrusive methods* (such as different remote-

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[3] The distinction between inter-state and integrated organs is based on the composition of the organ. The inter-state organ is composed of representatives of member states. The integrated organ is composed of representatives of the organization as such, their members have no obedience to a particluar member state.

[4] On the issue of compliance and enforcement see, for instance, Serge Sur, *A legal approach to verification in disarmament and arms limitation*, New York, United Nations, 1988, UNIDIR Research Papers No. 1.; Kenneth Adelman, Why verification is more difficult and (Less important), *International Security*, vol. 14, no. 4, Spring 1990, pp.141-146; and Robin Ranger and Dov S. Zakheim, More than ever, arms control demands compliance, *Orbis*, vol. 34, no. 2, Spring 1990, pp.211-226.

sensing techniques, particularly observation by satellites, as well as other non-intrusive fact-finding methods such as perusal of scientific literature). One might further distinguish between so-called *hard/objective methods* (*i.e.* information collected by technical means such as satellites, on-site inspection or documentary control) and *soft methods* (*i.e.* information collected through political consultation mechanisms). While the hard/objective methods are restricted to fact-finding, the soft methods (*i.e.* consultation) may also have a political/legal qualification function. Although the latter is not necessarily true, consultation may indeed be restricted to simple authentication of facts.

Finally, the level of institutionalization and autonomy refers to the number and diversity of the organs and the degree of independent action and means at the disposal of the organization (*i.e.* What integrated - as opposed to inter-State - bodies is it comprised of? With what statutory competence have these bodies been provided? How are the decision-making procedures organized? Who triggers the verification methods? What are its budgetary means?, etc.).

Verification-Dedicated Organizations

Of the 24 arms control agreements currently in force, or recently signed, three have provided for the establishment of international organizations with the specific aim of verifying compliance with the agreement: The Modified Brussels Treaty of 1954, establishing the Western European Union and the now defunct Arms Control Agency, the Treaty of Tlatelolco establishing OPANAL, and the Guadalajara Agreement between Argentina and Brazil establishing the Argentine-Brazilian Agency for Accounting and Control of Nuclear Materials (ABACC).

The bilateral (US-USSR) Treaties, as well as the multilateral CFE Treaty, opted for a less institutionalized mechanism, namely, the Consultative Commission. Mention should also be made of the Meeting of Contracting Parties established by the Antarctic Treaty.

The vast majority of the multilateral agreements however, do not provide for the establishment of an international organization or mechanism dedicated to verification, even though some of the agreements leave open the possibility for the creation of such a mechanism, through a clause permiting resort to "appropriate international procedures". (See Tables 1 and 2 in the Annex)

Proposals for verification-dedicated organizations and mechanisms may be treaty- or non-treaty-specific. In the first category, the Chemical Weapon Organization will be examined, as well as the Nuclear Testban Organization proposals. Among the non-treaty specific proposals particular attention will be given to the Satellite Monitoring Agency proposals.

Past and Recent Practices

All existing verification-dedicated organizations are treaty specific. They will be examined following criteria of chronology and the degree of institutionalization.

Agency for the Control of Armaments (ACA)

Created by Protocol IV of the modified Brussels Treaty of 1954 and directly answerable to the Council of the Western European Union, the Agency was given the following tasks:

> (*a*) to satisfy itself that the undertakings set out in Protocol No.III not to manufacture certain types of armaments mentioned in Annexes II and III to that Protocol are being observed;[5]
> (*b*) to control, in accordance with Part III of the present Protocol, the level of stocks of armaments mentioned in Annex IV to Protocol No. III held by each member of Western European Union on the mainland of Europe. This control shall extend to production and imports to the extent required to make the control of stocks effective.[6]

The control (verification) functions were carried out by way of a questionnaire sent out on a yearly basis.[7] The information thus gathered was in turn validated through (*a*)

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[5] *Id est* that Germany not produce: atomic, chemical and biological weapons (Annex II); long-range missiles, guided missiles and influence mines (Some proximity fuses and short-range guided missiles for anti-aircraft defence were excluded from the prohibition); warships of more than 3,000 tons displacement, submarines of more than 350 tons displacement and all warships which are driven by means other than steam, diesel, or petrol engines or by gas turbines or by jet engines; bomber aircraft for strategic purposes; (Annex III). Assembly, WEU document, No. 973, May 1984. The list of Annex III has frequently been amended by the Council. By the end of 1991 only the atomic, chemical and biological weapons non-production prohibition remained in force.

[6] This initial list (Annex 4) comprised the following weapons held by WEU members *on the mainland* of Europe: Atomic, chemical and biological weapons; artillery guns of more than 90 mm calibre together with ammunition for these weapons; guided missiles of all types and other self-propelled missiles of a weight exceeding 15 kg.; mines of all types except anti-tank and anti-personnel mines; tanks and other armoured fighting vehicles of an overall weight of more than 10 tons; warships powered by means other than steam, diesel or petrol engines or gas turbines (excluding nuclear energy); small aircraft; aircraft bombs of more than 1000 kg.; certain components of these weapons. While the restrictions on the holdings applied to all forces on the mainland of Europe, only those under national command were subject to ACA inspections. Forces and depots under NATO command were precluded from ACA inspections.

With respect to the level of atomic, chemical and biological weapons the Council was to determine the level of stocks *only after "effective production" had started.* This provision was, as far as nuclear weapons were concerned, never applied. Indeed, when the French Minister for Armed Forces announced in November 1963 that the manufacture of atomic bombs had passed the experimental stage, no action was taken by the Council or the Agency. Controls were applied to aircraft and non-strategic missiles capable of carrying nuclear bombs and nuclear warheads (for instance, the Lance and Pluton). However, in 1979, the Assembly of the WEU was informed that the French Pluton tactical nuclear missile had been withdrawn from the Agency controls. Agreement that weapons qualified as strategic would not be subjected to control had earlier been reached in the Council and had already exempted other French weapons from control. No other European mainland country has declared possession of strategic forces. Assembly, WEU documents, 808 (1979), 833, 836 (1980) and 973 (1984).

[7] The questionnaire contained detailed questions on the armaments subject to control. Statements were to be furnished annually on: (a) the total quantities of armaments of the types mentioned in Annex IV to Protocol No. III and required in relation to its forces; (b) the quantities of such armaments currently held at the beginning of the control years; (c) the programmes for attaining the total quantities mentioned in (a) by: (i) manufacture

comparison with other documentary sources, particularly budgetary and statistical information,[8] and (*b*) field controls (*i.e.* on-site inspections). Results were then presented to the WEU Council, who would, in turn, inform the Assembly through its annual report.[9]

The Agency carried out its control (verification) functions of conventional weapons from 1956 to 1985. A Council decision taken in Rome on 26 October 1984 abolished all conventional armament controls as of 1 January 1986. At that meeting, the Council also decided that "the commitments and controls concerning ABC weapons would be maintained at the existing level and in accordance with the procedures agreed up to the present time."[10]

Controls on biological and nuclear weapons have, however, never been applied.[11] Controls on chemical weapons have been applied, even though no need was ever felt to carry out any quantitative controls (*i.e.* on-site inspections) in the six countries not having renounced the right to produce chemical weapons. Their negative answers to the question whether production of chemical weapons had passed the experimental stage and entered the effective productive stage made questions related to the level of stocks irrelevant. Hence, no need ever arose for the Council to fix levels of stocks, which in turn gave the on-site inspections no objects or sites to inspect. The non-production control provisions concerning ABC weapons in Germany remained in force, although such controls were only carried out for chemical weapons.[12]

The Agency is often hailed as an example. An unclassified study by the Paris staff of the WEU on *Past experiences of verifying restrictions on conventional forces and armaments* states:

> It may be concluded from the working of the above-mentioned procedures for more than thirty years and the fact that no anomalies worth mentioning were observed during this very long period that the methods used were highly effective. (...) The experience acquired is a sound precedent, even in a situation of less confidence, for it made it possible, in specific

in its own territory; (ii) purchase from another country; (iii) end-item aid from another country.

[8] The Agency also had frequent recourse to open sources of information. See for instance: WEU, *Past Experiences of verifying restrictions on conventional forces and armaments*, Paris, WEU, March 1988, p. 24. (AG I (88) D/8).

[9] In some cases the Council would also resort to providing information on a confidential basis. For instance, from 1966 onwards, the annual reports of the Council provided data only for the total number of on-site inspections being carried out. Under a subsequent agreement the Committee on Defense Questions and Armaments was informed, on a confidential basis, of the breakdown of the number of inspections as far as quantitative controls and non-production controls were concerned. Assembly, WEU document, 1116, November 1987.

[10] Assembly, WEU document 1158, page 10.

[11] See also note 12. The Council did establish a list of biological agents that would be subject to controls if they were to be applied. The Agency also did carry out a number of Technical Information Visits (TIV's) to biological laboratories. These TIV's are, however, not to be confounded with inspections.

[12] See, Assembly, WEU document, 536, 5 May 1971, p.6. See also, Assembly, WEU document, 1019, 20 May 1985, p.8.

cases, to validate methods for verifying levels of armaments in a realistic and objective way.[13]

While lessons may certainly be learned from ACA's experience, its shortcomings should not be forgotten. In the first instance, it may be noted that complete controls, and in particular on-site challenge inspections (*i.e.* inspections based on the principle of "anytime, anywhere"), could never be carried out. The "due process of law" Convention, which would have permitted such inspections, never entered into force.[14] Furthermore, 1957 Council resolution stipulated that inspections were limited to depots and production plants whose names had been declared.[15]

For its random on-site inspections of those notified facilities the Agency had to obtain prior agreement from the firms concerned. A few weeks' notice usually had to be given. It was also understood that the inspectors were not to take any samples of materials during such visits.[16] Concealment would thus have been relatively easy.

The fact that the provisions with respect to the level of atomic weapons were never applied has already been mentioned, as has the fact that inspections of forces and depots under NATO command were precluded.

It may also be mentioned that the list of items over which controls could be exercised would be reduced over the years (*i.e.* items would be cancelled). Never has there been an attempt to update the obviously increasingly-obsolescent list of 1954. Indeed, the political reasons for the establishment of the Agency (*i.e.* denying Germany access to a certain category of weapons) gradually disappeared. The discriminatory provisions of the Treaty were becoming less politically-acceptable and a number of multilateral disarmament agreements, in particular the NPT and the BW Convention, dealt with some of the prohibitions in a far more politically-acceptable way.

ACA functions have been restricted to fact-finding. The legal political qualification was left to the Council of the Western European Union. No enforcement measures (*i.e.*

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[13] WEU, *Past Experiences of verifying restrictions on conventional forces and armaments*, Paris, WEU, March 1988, p. 23. (AG I (88) D/8).

[14] France never ratified the "*Convention concerning measures to be taken by Member States of Western European Union in order to enable the Agency for the Control of Armaments to carry out its control effectively, and making provisions for due process of law in accordance with Protocol No. IV of the Brussels Treaty as modified by the Protocols signed at Paris on 23rd October 1954*" Under the terms of this Convention, member States undertook to adopt the necessary legislative measures or regulations to permit the enforcement of the control measures undertaken by the Agency. The Convention further provided for the establishment of a tribunal to hear claims for damages against WEU that might arise out of inspection procedures, and, at the request of the Agency, to issue directions for the enforcement of access to plants or depots subject to inspection by officials of the Agency.

[15] See note 12, page 20. If the Director of the Agency, under whose authority inspections were carried out, were to consider that inspections had to be extended to non-notified establishments, he would have to make a request to the national authorities or to the Council. The procedure has never been invoked.

[16] Assembly, WEU document, 973, 15 May 1984, p. 12. Indeed without the "due process of law" Convention a problem existed with respect to the legal liability in case of an accident. For instance, who would be responsible for an epidemic caused by a spilt sample in transport? This question was raised in particular with respect to Biological controls. The fact that no samples could be taken in the chemical non-production controls was not considered an obstacle. Among one of the main criteria which were retained, in the latter, was the level of security which a plant would have adopted.

sanctions), were provided for in the Treaty.[17] The methods at the disposal of the Agency were in principle of a highly intrusive nature; however, as pointed out above, they never became fully operational.

The most interesting aspect of the WEU verification scheme lies in the fact that it was an integrated, international organ which actually carried out the verification. Most noteworthy in this respect are its experiences in the field of data exchanges (a practice which has encountered a great number of difficulties, particularly where the procurement of reliable, comparable, and exact figures of military budgets are concerned), and in the field of random inspections. This latter technique has recently been proposed both in the context of the CW negotiations and in the Fourth Review Conference of the Non-Proliferation Treaty. The latter proposal called for the IAEA to explore new safeguards approaches along the lines of random inspections.[18]

It has been asserted that the Agency has, over the years, been a relatively independent and autonomous body, even with regard to the Council.[19] Nonetheless, ever since 1984, when Member States decided to reactivate the WEU and to abolish all conventional controls by 1986, the status of the ACA has become unclear.[20] A Director was supposed to be appointed in 1988 but never was.[21] Apparently the Council annual reports no longer include Agency activities[22], and the Agency has *de facto* ceased to exist. A great number of ideas have been put forward concerning new tasks for the Agency and the WEU. The proposals relate primarily to the verification of compliance with agreements concluded outside the WEU context, such as the CFE agreement or the forthcoming CW Convention. More general proposals for setting up a European verification centre[23] or a Western European satellite monitoring agency within the WEU context are also being submitted. All these proposals are to be seen

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[17] The treaty provides, in case of dispute, for (optional) referral to the International Court of Justice (Article 10).

[18] For the proposal in the CW negotiations see the German document in CD/869 (1989). For the proposals made at the NPT Review Conference, see NPT/CONF.IV/MC.II/1 (1990). Concerning the interest of random on-site inspections schemes as opposed to comprehensive or choke point verification schemes see for instance, Steven B. Davis, Verification and Compliance for Arms Control, *Comparative Strategy*, Vol. 9,No. 4, 1990, pp. 403-413.

[19] Assembly, WEU document, 990, 30 October 1984, p.11. The Agency has always been a relatively small Agency. For instance in 1971 it had a staff of 52, including 21 of officer grade and annual budget of Frs. 3,900,000. Assembly, WEU document, 536, 5 May 1971, p. 4. The staff of the Agency has the same status as the staff of NATO and is governed by NATO's Code of Security.

[20] Assembly, WEU document, 1138, 9 May 1988, p. 11. The platform of the Hague adopted in 1987 outlining the principles governing the activities of the WEU was not any clearer on this point.

[21] Assembly, WEU document, 1163, 10 November 1988, p. 10. See also, Assembly, WEU document, 1138, 9 May 1988, p. 11. The Arms Control Agency has not officially been disbanded. Indeed one chemist remains in place at the WEU offices in Paris to supervise the chemical weapon non-production controls imposed on Germany and he is as of 1987 the *de facto* Director of the Agency.

[22] Assembly, WEU document, 1185, 3 May 1989, p. 12.

[23] Assembly, WEU document, 1223, 24 April 1990, pp. 10-11.

in the light of the changing European security context and the European political integration process (see below).[24]

Agency for the Prohibition of Nuclear Weapons in Latin America (OPANAL)

Compared to the ACA the *Agency for the Prohibition of Nuclear Weapons in Latin America* is a far more institutionalized and autonomous (integrated) international organization. It has received very specific and broad powers. The Agency, better known under its Spanish acronym, *OPANAL,* was set up by Article 7 and was charged with being:

> responsible for the holding of periodic or extraordinary consultations among Member States on matters relating to the purposes, measures and procedures set forth in this Treaty and to the supervision of compliance with the obligations arising therefrom.

The three main organs of the Agency are the General Conference (Article 9), the Council (Article 10) and the Secretariat (Article 11).

The General Conference is the supreme organ of the Agency. It is composed of all Parties to the Treaty and holds regular sessions every two years. The Conference establishes procedures for the control system and elects the Members of the Council and the General Secretary. Questions related to the control system and compliance questions are decided by a two-thirds majority of the members present and voting.

The Secretariat, *in casu,* the General Secretary, ensures the proper operation of the control system under supervision of the Council. The latter is composed of five members and decides by simple majority.

Fact-finding methods at the disposal of the Agency to verify compliance include the following:

- *semi-annual reports by the parties* incorporating statements that "no activity prohibited under the Treaty has occurred" (Article 14);
- *special reports by the parties* which may be requested by the General Secretary with the authorization of the Council (Article 15);
- *special reports or studies* by either the General Conference, the Council or the General Secretary (Article 9. 2(f); Article 10.6; and Article 11.5.)
- *special inspections* carried out by the Council (Article 16).

Routine inspections are carried out under a safeguards agreement negotiated by each party with the IAEA (Article 13).

The legal and political qualification of facts is left to the General Conference. Article 20 stipulates that the General Conference is to take note of cases in which parties are not complying with the obligations under the Treaty and make any recommendation it deems appropriate. The Conference would then refer such cases, if

[24] For proposals concerning the revision of the modified Brussels Treaty, see for instance the Assembly's reply to the annual report of the Council. Assembly, WEU document, 1185, 3 May 1989.

they are judged to constitute a violation which might endanger peace and security, to the UN Security Council, the UN General Assembly, the Council of the Organization of American States and the IAEA. The treaty also contains a provision for the optional settlement of disputes by the International Court of Justice (Article 24).

The treaty has entered into force for 23 Latin American countries.[25] OPANAL was established in 1969 and is centered in Mexico. The Agency has a very small international staff[26] and an annual budget of US$ 316,251.[27]

The Agency has thus far not performed any special inspections, nor has it set up any machinery which could carry them out (*i.e.* hired qualified inspectors or developed a methodology, a set of guidelines). It has also not used its prerogative to request any of the member States for special reports, nor has the possibility of carrying out independent reports and studies ever been utilized.[28]

A *Good Offices Commission* was established in 1985 by the ninth session of the General Conference with the task of solving the problems of interpretation which have arisen concerning the scope of Article 18 (Explosions for peaceful purposes), the drafting of the safeguards agreements, the scope of the special inspections referred to in Article 16, the declarations made by certain nuclear powers and the protection of industrial secrets.[29]

The General Conference has, since 1985, called for the convening of a workshop-seminar to discuss the difficulties which have prevented the countries which are not parties to the NPT from concluding safeguard agreements in accordance with Article 13, (*i.e.* "without limiting peaceful nuclear developments or leaving open the possibility

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[25] For Brazil and Chile the Treaty has not yet entered into force, even though they have signed and ratified it. They did not grant the waiver provided for in Article 28.2. Argentina has signed but not ratified the treaty. Besides its objections that the Treaty does not contain verification provisions for the Protocols and that some outside powers do not fully respect the Treaty, Argentina's main point of contention has to do with the safeguards provisions. It requests a Tlatelolco specific safeguards agreement which would *i.a.* allow for peaceful nuclear explosions. See for instance, Emma Perez Ferreira, Argentina and the Non-Proliferation Policies, *UNIDIR Newsletter*, vol.3, no.3, September 1990, pp.10-12. Cuba is the only major Latin American country that has not signed the treaty.

[26] Agency staff and the General Secretary are considered international officials (*i.e.* they have the same status as UN officials, and shall not seek or receive instructions from any Government). See Article 11.6 and 11.7.

[27] OPANAL's budget for the period 1990-1991 amounts to US$ 613,452 (US$ 297,201 for 1990 and US$ 316,215 for 1991). Mexico is the greatest contributor with 25 %, followed by Venezuela 20.65%, Columbia 9.59%, Peru 5.03%, Uruguay 3.55%, Guatemala 2.52% and all others with 1.98%. Cf. CG/res 257 (XI) Corr 1, 27 April 1989. and CG/res 256 (XI) Corr 1, 26 April 1989.

[28] The Agency has been requested studies by the General Conference. For the verification aspects see also, Miguel E. Estrada Oyuela, The Tlatelolco Treaty, in: Serge Sur, ed., *Verification of Current Disarmament and Arms Limitation Agreements: Ways, Means and Practices*, Aldershot, Dartmouth, 1991, pp. 149-165. (A UNIDIR Publication)

[29] *Cf.* Memorandum of the General secretariat of OPANAL prepared for the 4th Review Conference of the Treaty on Non-Proliferation. NPT/CONF.IV/PC.III/14, 27 February 1990, pp.6-7. See also General Conference Resolutions 208 (IX), 9 may 1985, 215 (X), 29 April 1987 and 243 (XI), 27 April 1989.

of introducing nuclear weapons from other States into the territory of Latin America and the Caribbean"). As yet, however, this seminar has not been held.[30]

Little is published on the workings of OPANAL, and the proceedings of its General Conference are not widely disseminated. The comprehensiveness - both in terms of functions assigned to it and in terms of procedures and methods it is capable of invoking - as well as the international nature of the organization stand somewhat in contrast to its known activities. The fact that it has not yet had to implement any special procedures such as inspections or requests for special reports seems to be a positive sign. Nonetheless it should not be forgotten that for the major countries of the region, the Treaty has not yet entered into force.

As in the case of ACA, political reasons preclude OPANAL's fully exercising its theoretically far-reaching powers. Ultimately, however, OPANAL will continue to function and might become a real policy instrument for Latin American countries, depending on an Argentine and Brazilian ratification, which will probably come about in the near future.

Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC)

Since 1985, Brazil and Argentina have been engaged in a process to devise a joint accounting and control system of their nuclear activities which could be proposed as a model for a joint safeguards agreement with the IAEA. Ideally, such an agreement would supercede the current individual safeguard agreements with the IAEA and be operative for the Treaty of Tlatelolco.[31] The Agreement between Argentina and Brazil for the exclusively peaceful use of nuclear energy, signed on 18 July 1991 in Guadalajara, Mexico, is to be seen in this context. It provides for the establishment of the ABACC.[32] The Agency has as task to administer and implement the Common System of Accounting and Control of Nuclear Material (SCCC), which is to verify that the nuclear materials in all nuclear activities of the Parties are not diverted to nuclear weapons or other nuclear explosive devices.

The ABACC is made up of a Commission of four members (two from each state) and a Secretariat headquartered in Rio de Janeiro (Brazil). The Secretary of the ABACC is appointed by the Commission and is a national of one of the two states,

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[30] *Ibid.* p.4. See also CG/res 243 (XI)

[31] See in this respect the Argentine-Brazilian Joint Declaration on Nuclear Policy of Foz do Iguaçú (1985), Brasilia (1986), Viedma (1987), Ipero (1988), the Joint Satement of Buenos Aires (6 July 1990) and the Argentine-Brazilian Declaration on Common Nuclear Policy of Foz do Iguaçu of 28 November 1990. For the Agreement to be operative for the Treaty of Tlatelolco, the latter would need to be changed, particularly the text of those articles detailing verification and compliance procedures."The adjustments concern the need to harmonize the provisions aimed at establishing the peaceful uses of nuclear energy with the need to preserve confidential information of a technological and industrial nature." See Statement of Brazil in CD/PV 584 of 21 Feb. 1991.

[32] See the unofficial translation of the Agreement in: *PPNP Newsbrief*, No. 15, Autumn 1991, pp. 15 - 16. (Published by the Programme for Promoting Nuclear Non-Proliferation, Mountbatten Centre for International Studies, Southampton, UK) will also be published in 1992 as a Conference on Disarmament Document.

alternating every year. Professional staff are appointed by the Commission. The latter also prepares a list of qualified inspectors upon which the Secretariat may draw to carry out on-site inspections. Inspectors are responsible exclusively to the Secretariat, with the understanding that inspectors of Argentina control Brazilian facilities and *vice versa*. It is also the Secretariat which makes the actual decision of when and where an inspection will take place under the guidance of a *General Procedures and Implementation Manual* which is to be elaborated and approved by the Commission.

A notable feature of the agreement is the fact that the ABACC is designated to represent both States to third parties with respect to the implementation of the SCCC.

Negotiations with the IAEA on full scope safeguards are currently under way. It is proposed that under an IAEA safeguard agreement the ABACC would do the accounting for the materials and the equipment and report to the IAEA in a way similar to that of Euratom.

It is clear that a major consideration for institutionalizing both parties' nuclear non-proliferation commitment was aimed at the outside world and in particular at the parties to the Treaty of Tlatelolco. Indeed, linkage to the Tlatelolco Treaty has been present in the minds of the negotiators ever since both States embarked on the process. In the near future, therefore, it is conceivable that the ABACC would invite observers from other Latin American countries and might ultimately have its system adopted by OPANAL.

Conflict Prevention Centre (CPC)

The Conflict Prevention Centre was established by the *Charter of Paris for a New Europe* signed in November 1990.[33] The Center assists the equally-newly created Council of CSCE Ministers in reducing the risk of conflict and gives support to the implementation of the CSBMs, as stipulated in the *Vienna Document 1990*[34]. It is, in particular, to support the

- Mechanism for consultation and co-operation as regards unusual military activities;
- Annual exchange of military information;
- Communications network;
- Annual implementation assessment meetings;
- Co-operation as regards hazardous incidents of a military nature.

Other functions may also be attributed to the Centre, for instance, in the field of dispute settlement. The Centre is endowed with a Consultative Committee, composed of representatives from all CSCE States, and a small Secretariat. The latter is given the express task of establishing and maintaining a data bank, compiled on the basis of the

[33] Text reproduced in CD/1043, 17 January 1991. See also, Victor-Yves Ghebali, Une institution europeenne nouvelle: Le Centre de la CSCE sur la prevention des conflits en Europe, *Le Trimestre du Monde*, No.1, 1991; et Victor-Yves Ghebali, La Charte de Paris pour une nouvelle Europe, *Défense Nationale*, mars 1991, pp. 73 - 83.

[34] The Vienna Document supersedes the Stockholm document. Text reproduced in CD/1070, 4 March 1991.

exchanged military information under the agreed CSBMs (*i.e.* a data bank with information on military organization, manpower, major weapon and equipment systems and on military budgets). It is interesting to note that the military budget exchange will be based on the *Instrument for Standardized International Reporting of Military Expenditures* as elaborated by the United Nations. On the basis of this information the Secretariat is also to publish yearbooks, thereby resuming an exercise carried out by the League of Nations from 1925 to 1938. Secretariat staff are on secondment from their respective Governments, with an average term of office of 3 to 2 years. As a result, they, do not have the international civil servant status of OPANAL or UN staff.

While it is still too early to make any definite comments on the Conflict Prevention Centre, two different visions of the CPC seem to exist. On the one hand, the Centre's technical character is stressed, with the idea that it might eventually evolve into a technical agency which could assist States in the verification of not only CSBMs, but possibly a future CFE II agreement as well.[35] On the other hand, the political nature of the CPC is emphasized (*i.e.* its consultation and settlement of possible dispute functions).[36]

For many, the CPC was to be the embryo of a European verification agency and was to reequilibrate, particularly after the dissolution of the WTO, the imbalances in capabilities of assessing compliance with the CFE and CSCE agreements. The recent Yugoslav crisis, which demonstrated the weaknesses and fragility of the new CSCE institutions, as well as the uncertain course of the CFE negotiations, do not augur well for an immediate expansion of the role of the CPC.[37]

Among the other CSCE institutions mention should also be made of the Assembly, which might well become an active place for the various pan-European lobbies.[38]

Another aspect of the CSCE enterprise which warrants closer scrutiny, particularly because of its institution-building and integrative potential, is its modern telecommunication techniques. Although the Centre has not received any tasks with respect to the CFE control regime, it is conceivable that the communications network to be set up under the CSCE/CSBM regime might use similar hard and software as that set up under the CFE regime, technically speaking, therefore, the two networks could easily be merged into one system. The use and impact of these computerized communications networks should not be underestimated. They will probably greatly increase not only information exchange, but also information demand. They will

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[35] CFE II regime which would include all CSCE Member States.

[36] The CPC would, hence, eventually also encompass the urgency mechanism established in June 1991 and based in Berlin.

[37] Similarily one could point to the difficulties the CPC encounters in publishing its yearbooks. Thus far (February 1992) no agreement could be reached on the contents of these yearbooks.

[38] The establishment of the Assembly is provided for in the Paris Charter and was decided upon on 4 April 1991 in Madrid. The first meeting of the 245 CSCE members of parliament will take place in the first week of June 1992 in Prague. While the Assembly will only have a consultative role, it may be expected that its influence will go well beyond its statutory powers. The Assembly will meet once a year for 3 to 5 days. It would also establish a small parliamentary secretariat (10 persons), the seat of which is yet to be decided. (*US Daily Bulletin*, Geneva, No.75, 23 April 1991).

definitely increase the quality of the data exchange and, hence, its value as a method of verification. The political implications of the adoption of a common computerized communication network may well go beyond what is currently foreseen. It may well have a far greater (non-intended) integrative function. Computer-aided communication techniques may in some ways far surpass the traditional international organization. The utter absence of studies evaluating the political impact of such systems is illustrative of the lack of knowledge in this field.

Consultative Commissions

The Consultative Commissions, such as those initially set up within the context of bilateral US/USSR arms control agreements, have a very low level of institutionalization. Devised in the Cold War period and in an East-West context, these Commissions are characterized by a high degree of confidentiality and flexibility.

The confidential character of the Commissions is illustrated by the fact that its deliberations are private, while its flexible character is illustrated by the fact that it has no designated or permanent staff or specified meeting times.[39]

So far, the following have been set up: a Standing Consultative Commission (SCC[40]) for the ABM Treaty; a Joint Consultative Commission (JCC) for the Peaceful Nuclear Explosions Treaty; a Bilateral Consultative Commission (BCC) for the Protocol to the Threshold Test Ban Treaty; a Special Verification Commission (SVC) for the INF Treaty; a Joint Compliance and Inspection Commission (JCIC) for the START Treaty; and a Joint Consultative Group (JCG) for the multilateral CFE Treaty.[41]

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[39] The SCC, for instance, called for representation by a Commissioner, a deputy commissioner and such staff as deemed necessary. The post-SCC Consultative Commissions have, however, no designated staff and neither has the multilateral JCG. With respect to meeting times it may be noted that, contrary to the SCC, which met "at least twice a year", the new bilateral Consultative Commissions JCC, BCC, SVC and JCIC meet on request.

The inflation of the bilateral consultative commissions has recently led to questions whether they should not be merged into one single body. Already during the debates on the ratification of the INF Treaty some members in the US Congress concluded

> ... that there appear to be numerous advantages, and no noteworthy disadvantages, to a consolidation of the functioning, leadership, and staffing of the SCC and the SVC. Such a consolidation will be particularly important if current negotiations to achieve significant reductions in strategic nuclear weapons reach fruition.

The non-linkage argument put forward by the US Administration at that time was of course in view of the INF negotiating history of particular relevance; nonetheless, one reason for resisting such centralizing tendencies might be the desire not to create a strong agency, in order to keep more easily political control over the process.

[40] The SCC is also operative for the SALT agreement and the 1971 Accidents Agreement.

[41] The joint Commissions set up by the second Sinai agreement of 4 September 1975 and by the 1979 Egyptian-Israeli peace treaty were modelled along the lines of the Consultative Commissions. For general accounts on the workings of the bilateral Consultative Commissions see for instance: Jane Boulden, Bilateral Nuclear Agreements: The Standing Consultative Commission and the Special Verification Commission, in: Ellis Morris, ed., *International Verification Organizations*, Toronto, Center for International and Strategic Studies, York University, February 1991, p. 201-225; Don Caldwell, The Standing Consultative Commission: Past Performance and Future Possibilities, in: William C. Potter, ed., *Verification and Arms Control*, Lexington, Lexington Books, 2d printing 1987, pp.217-229.; James Schaer, Compliance Diplomacy in a Multilateral Setting, in: Michael Krepon and Mary Umberger, eds., *Verification and Compliance: A problem solving approach,*

With the exception of the JCC, the BCC, and the JCIC, which also received tasks concerning the conduct of on-site inspections[42], the Commissions' main tasks lie not in fact finding or in the collection of data, but in providing a forum in which parties may meet, discuss questions arising after data collection and data analysis, and through which they may clear up ambiguities. In theory, the Commissions have no authority whatsoever with respect to the political and legal evaluation of compliance. Formally, they do not make any decisions in this field. Nevertheless, with the antagonism between the US and the USSR retreating into the background, compliance issues lose their explosive political character and compliance assessment becomes hence more dependent on objective and technical factors. The change of name of the consultative commission in the START Treaty to *Joint Compliance and Inspection Commission* is illustrative in this respect.

The CFE Treaty, while a multilateral treaty, proceeds from an East-West logic and thus has naturally followed the bilateral practice and established a Consultative Commission, called the Joint Consultative Group (JCG). The Group, like the other Commissions, has no fact-finding functions nor does it make any judgments concerning compliance. It is a deliberative body within the framework of which the States Parties shall

> (*A*) address questions relating to compliance with or possible circumvention of the provisions of the Treaty;
> (*B*) seek to resolve ambiguities and differences of interpretation that may become apparent in the way this Treaty is implemented;
> (*C*) consider and, if possible, agree on measures to enhance the viability and effectiveness of this Treaty;
> (*D*) update the lists contained in the Protocol on existing types, as required by Article II, Paragraph 2;
> (*E*) resolve technical questions in order to seek common practices among the States Parties in the way this Treaty is implemented;
> (*F*) work out or revise, as necessary, rules of procedure, working methods, the scale of distribution of expenses of the Joint Consultative Group and of conferences convened under this Treaty and the distribution of costs of inspections between or among States parties;
> (*G*) consider and work out appropriate measures to ensure that information obtained through exchanges of information among the States Parties or as a result of inspections pursuant to this Treaty is used solely for the purposes of this Treaty, taking into account the particular requirements of each State Party in respect of safeguarding information which that State Party specifies as being sensitive:
> (*H*) consider, upon request of any State Party, any matter that a State Party wishes to propose for examination by any conference to be convened in accordance with Article XXI; such consideration shall not prejudice the right of any State Party to resort to the procedures set forth in Article XXI; and

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London, MacMillan, 1988, pp. 259-281.

[42] The Protocols provide for the establishment of Coordinating Groups of the JCC and the BCC in case of on-site inspections. Apart from the SALT II Treaty, the exchange of data is usually not foreseen for the Commissions. In the more recent agreements it is the Nuclear Risk Reduction Centers, established in September 1987, which are specifically entrusted with that task.

(*l*) consider matters of dispute arising out of the implementation of this Treaty.[43]

Decisions or recommendations are made by consensus, and deliberations are private. All the so-called *hard/objective* fact-finding methods (*i.e.* notification and exchange of information (Article XIII) and on-site inspections (Article XIV)) are on a Party-to-Party basis, although possibilities for setting up and carrying out inspections through co-operative verification mechanisms (*i.e.* multinational technical means) is not excluded (Article XV).

It should perhaps also be pointed out that the JCG, like the JCIC, started functioning right after the signature of the Treaty, and did not need to await treaty ratification.

How the multilateral JCG will evolve is difficult to foresee. The absence of any independent or joint fact-finding methods and the very unequal distribution of fact-finding means might sooner or later create a number of problems. While no institutional linkages exist between the JCG and the CPC, the evolution of the latter could well have a decisive influence on the JCG, notably by providing a framework in which verification assistance could be given. Similarly, "Open Skies" might palliate some of the existing inequalities in verification capabilities.[44] Recently France proposed that the CPC "should shift towards a transparency function, in particular through the use of the data generated by an 'Open Skies' agreement and by satellite images."[45]

Meeting of Contracting Parties

The Meeting of Contracting Parties was established by Article IX of the Antarctic Treaty and has been operative since 1961. It is composed of the original signatories[46] and of those States which accede to the Treaty and who demonstrate their interest in Antarctica by conducting substantial scientific research activity in the region, such as the establishment of a scientific station or the dispatch of a scientific expedition.[47]

Only members of the Meeting are entitled to verify compliance with the Treaty. Verification (*i.e.* aerial observation and on-site inspections) may be carried out unilaterally or jointly, and possibly also through the Meeting, which is, *inter alia,* tasked with recommending measures regarding "the facilitation of the exercise of rights

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[43] The Treaty is reproduced in CD/1064, p.21.

[44] The March 1991 issue of *Trust and Verify* reports on informal discussions in Vienna and Brussels whereby former WTO members would be willing to work with NATO in verifying Soviet compliance with the CFE Treaty. Ideas to set up a system whereby all signatories would share information gathered during on-site inspections are being advocated by Hungary, the Czech and Slovak Federal Republic and Poland. On Open Skies see also in this volume Chapter IV by Ellis Morris.

[45] See CD/1092, 1 August 1991, p.6.

[46] Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, the Union of South Africa, the USSR, the UK and the USA.

[47] Have been admitted as members of the Meeting: Poland (1977); FRG (1981); Brazil (1983); India (1983); China (1985); Uruguay (1985); GDR (1987); Italy (1987); Spain (1988); Sweden (1988); Peru (1989); Republic of Korea (1989); Finland (1989). 14 other States have acceded to the Treaty, but are not eligible for membership of the meeting of contracting parties.

of inspection provided for in Article VII of the Treaty". The Meeting convenes at regular intervals and is also the place where consultations take place and where data is exchanged.

The verification mechanism installed by the Antarctic Treaty (*i.e.* the Meeting of Contracting Parties) is of a highly discriminate character and runs counter to the principle that all States have equal rights to participate in the verification of the agreement to which they are parties. The very liberal attitude of the United States in disseminating inspection results is partly explained by its desire to maintain the privileged status it enjoys within the Antarctic system. As was recently pointed out:

> This dissemination has the effect of reducing political pressure from other States which would like to achieve this status or else actively challenge it. The result is therefore a subtle interplay between the dissemination of information and the desire to retain a privileged position.[48]

Possible Practices

Appropriate International Procedures

A number of multilateral disarmament agreements provide possible recourse to *"appropriate international procedures within the framework of the United Nations and in accordance with its Charter"*.[49] The formula first appeared in 1971 in the Seabed Treaty:

> Article III.5
> Verification pursuant to this article may be undertaken by any State Party using its own means, or with the full or partial assistance of any other State Party, or through appropriate international procedures within the framework of the United Nations and in accordance with its Charter.

This paragraph was inserted as a compromise formula. Those who urged verification by an international agency or the United Nations[50] met with strong opposition from the US and the USSR, who advocated verification based on consultation, co-operation and reciprocity. The latter two States, outnumbered and under pressure from the majority, conceded to the formula of section 5, even though the USSR asserted that it was not to be interpreted as including the good offices of the Secretary General of the

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[48] Serge Sur, Conclusions: Round table, in: Sur, Serge, (ed.), *Verification of Current Disarmament and Arms Limitation Agreements, Ways, Means and Practices*, Aldershot, Darthmouth, 1991, p. 377. (A UNIDIR Publication). See also Chapter 2 on the Antarctic Treaty by Gilles Cottereau, pp. 67 - 94.

[49] On this issue see also: Howard Mann, An International Verification Organization and the United Nations: some legal issues, in: Ellis Morris, ed. *International Verification Organizations*, Toronto, Center for International and Strategic Studies, York University, February 1991, pp. 227-252.

[50] States advocating international machinery included: Argentina, Brazil, Burma, Canada, India, Italy, Japan, Netherlands, Sweden, Yugoslavia. See also Ellis Morris, *The Verification Issue in United Nations Disarmament Negotiations*, New York, United Nations, 1987, pp. 23-30. (A UNIDIR Publication)

United Nations in providing assistance to States not possessing satisfactory means of their own and desiring such assistance.[51]

The formula is subsequently found in the Biological Weapon Convention of 1972:

> Article V
> The States Parties to this Convention undertake to consult one another and to co-operate in solving any problems which may arise in relation to the objective of, or in the application of the provisions of, the Convention. Consultation and co-operation pursuant to this article may also be undertaken through appropriate international procedures within the framework of the United Nations and in accordance with its Charter.

In the ENMOD Convention of 1977:

> Article V.1
> 1. The States Parties to this Convention undertake to consult one another and to co-operate in solving any problems which may arise in relation to the objectives of, or in the application of the provisions, of the Convention. Consultation and co-operation pursuant to this article may also be undertaken through appropriate international procedures within the framework of the United Nations and in accordance with its Charter. These international procedures may include the services of appropriate international organizations, as well as of a Consultative Committee of Experts as provided for in paragraph 2 of this article.

And in the Agreement on Celestial Bodies of 1979 (Moon Treaty):

> Article 15.1
> 1. Each State Party may assure itself that the activities of other States Parties in the exploration and use of the Moon are compatible with the provisions of this Agreement. (...) In pursuance of this article, any State Party may act on its own behalf or with the full or partial assistance of any other State Party or through appropriate international procedures within the framework of the United Nations and in accordance with its Charter.

The concept of *appropriate international procedures* has evolved over the years, particularly through the discussions and final declarations of the different Review Conferences, taking the following forms:

- **A consultative mechanism of technical experts with fact-finding missions.** One example is the Consultative Meeting of Experts provided for in the ENMOD Treaty, as well as the declaration of the Second Review Conference of the Seabed Treaty in 1983, which stated:

  > The Conference stresses the importance of co-operation between the States Parties with a view to ensuring effective implementation of the international consultative procedures provided for in Article III of the Treaty, having regard also for the

[51] A/C.1/PV 1748 (2 November 1970). See also the statement of the USSR during the first review conference in 1977, SBT/CONF/25, part III (SBT/CONF/SR.8).

concerns expressed by some States Parties that they lack the technical means to carry out the verification procedures unaided.[52]

- **A consultative mechanism along the lines of the Consultative Commissions where States can meet and discuss compliance issues.**
  The ideas forwarded at the BW Review Conferences exemplify this form of "appropriate international procedure". The First and Second Review Conferences have indicated that the consultation referred to in Article V of the BW Convention is to be interpreted as a consultative meeting which should be promptly convened if requested by a State party. The Third Review Conference, held in September 1991 in Geneva, emphasized, on the initiative of the United Kingdom, the importance of consultation mechanisms, and elaborated on conditions for the convening a consultative meeting.[53]
  In preparation for the Third Review Conference, suggestions for establishing Implementation, Interim, Inter-sessional, or Oversight Committees were also put forward.[54] Such Committees would be equipped with or without small secretariats, would have limited or unlimited membership, and would be given mandates along the lines of the Consultative Commissions, although the fact-finding aspect and the possibility of convening meetings of technical experts is not precluded. No agreement could, however, be reached on this issue during the Third Review Conference.

While resort to *appropriate international procedures* does not exclude resort to an existing international organization - for instance, to the investigative powers of the UN Secretary General - it has of late tended to be interpreted more along the lines of the establishment of new mechanisms through which consultations on compliance issues can take place.

Through the mechanism of the Review Conference, the formula of *appropriate international procedures* is gradually evolving and increasingly being used to set up verification-dedicated mechanisms.

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[52] SBT/CONF.II/20, Article III.

[53] See BWC/CONF.III/22/Add.2, 27 September 1991, Article V, p. 8-9.

[54] See, for instance, Jozef Goldblat and Thomas Bernauer, *The Third Review of the Biological Weapons Convention: Issues and Proposals*, New York, United Nations, 1991, 76p. UNIDIR Research Paper No.9; FAS, *Implementation of the Proposals for a Verification Protocol to the Biological Weapons Convention*, Washington DC, FAS, February 1991, Report of the FAS Working Group on Biological and Toxin Weapons Verification, 21p. and Nicholas A. Sims, *Reinforcing Biological Disarmament: Issues in the 1991 Review*, London, the Council for Arms Control, Faraday Discussion Paper No.16, January 1991, 28p. See, for instance, also the statements and proposals of the Twelve, Dutch and French at the Third Review Conference of the BWC in September 1991.

Proposals

The Treaty Specific Organization

Proposals for Treaty-specific verification or monitoring Organizations abound. The increasing complexity of disarmament negotiations and verification provisions tends to push towards the increased institutionalization of the process. Nonetheless, States resent giving away political control over the verification process and are generally hesitant to invest an international organization with any powers in this field.

The most elaborate and serious proposal is presently being negotiated in the CD in Geneva and concerns the establishment of an *Organization for the Prohibition of Chemical Weapons*. Also meriting mention are the recently-tabled Swedish draft proposal and the proposal by Indonesia, Mexico, Peru, Venezuela, Yugoslavia and Sri Lanka, both of which provide for the establishment of an international organization to verify a Nuclear Test Ban.

Chemical Weapon Organization

The Chemical Weapon Organization, as currently being negotiated in the Geneva-based Conference on Disarmament, would consist of three main organs - a Conference of States Parties, an Executive Council (with limited membership) and a Technical Secretariat.[55]

Thus far, the CW Organization has only been assigned fact-finding tasks. With respect to the legal/political qualification of facts, it is notable that the USA has expressed the view that neither the Conference of States Parties nor the Executive Council could put to a vote the report of a fact-finding inquiry, nor take a decision as to whether a Party is complying with the provisions of the Convention. The triggering of a challenge-inspection would be the prerequisite of a State Party. Neither the Conference of States Parties nor the Technical Secretariat would have authority to request a challenge-inspection, even though the latter would carry out such an inspection. No agreement exists as yet on possible responses (*i.e.* "measures to redress a situation and to ensure compliance, including sanctions").

The Conference of States Parties would be the principal organ of the Organization. The political weight of the Organization, however, would be vested in the Executive Council, though it would not play so predominant a role as does the Board of Governors of the IAEA. The Executive Council would be responsible to the Conference of States Parties and would have the mandate to:

(*a*) Promote the effective implementation of, and compliance with, the Convention;
(*b*) Supervise the activities of the Technical Secretariat;
(*c*) Co-operate with the appropriate national authorities of States Parties and facilitate consultations and co-operation among States Parties at their request;
(*d*) Consider any issue or matter within its competence, affecting the Convention and its implementation, including concerns regarding compliance, and cases of non-compliance,* and

[55] See the rolling text contained in CD/1108 of 27 August 1991.

as appropriate, inform States Parties and bring the issue or matter to the attention of the Conference of States Parties. In its consideration of doubts or concerns regarding compliance and cases of non-compliance, including *inter alia*, abuse of the rights provided for by the Convention, the Executive Council shall consult with the States Parties involved and, as appropriate, request the State Party to take measures to redress the situation within a specified time. To the extent that the Executive Council considers further action to be necessary, it shall take, *inter alia*, one or more of the following measures: (i) inform all States Parties of the issue, (ii) bring the issue to the attention of the Conference of States Parties, (iii) make recommendations to the Conference of the States Parties regarding measures to redress the situation and ensure compliance. The Executive Council shall in cases of particular gravity and urgency, bring the issue, including relevant information and conclusions directly to the attention of the United Nations General Assembly and the United Nations Security Council. It shall at the same time inform all Sates Parties of this step.
(*e*) Consider and submit to the Conference of the States Parties the draft programme and budget of the Organization;
(*f*) Consider and submit to the Conference of the States Parties the draft report of the Organization on the implementation of the Convention, the report on the performance of its own activities and such special reports as it deems necessary or which the Conference of the States Parties may request;
(*g*) Conclude agreements with States and international organizations on behalf of the Organization, subject to approval by the Conference of States Parties, and approve agreements relating to the implementation of verification activities, negotiated by the Director General of the Technical Secretariat with States Parties;
(*h*) Conclude agreements with States Parties in connection with Article X[56] and supervise the voluntary fund for the purpose of this Article; (i) Meet for regular sessions. Between regular sessions it shall meet as often as may be required for the fulfilment of its functions; ((ii) Elect its Chairman); (iii) Elaborat and submit its Rules of procedure to the Conference of the States Parties for approval; (iv) Make arrangements for the sessions of the Conference of the States Parties including the preparation of a draft agenda.

* Subject to the afore mentioned US reservation.

So far no agreement has been reached on the decision-making procedures of the Executive Council or its composition. The difficulty with respect to the composition and size of the Council lies in the fact that it should be small enough to be effective and operative, but also large enough to include all major interest groups and hence ensure sufficient treaty adherence. Proposals on the size of the Executive Council range from 15 to 35. The criteria for selection will probably be one the latest issues on which negotiations will focus. Proposals concerning the composition of the Council focus on geographical criteria and criteria related to industrial capabilities.

Closely related, equally sensitive, but somewhat less controversial are the decision-making procedures of the Council. The essence of this problem has to do with the functions with which the Organization (*i.e.* the Council) would be invested. Are they to be limited to fact-finding or will they include some legal/political qualification (*c.q.* enforcement) functions?

[56] Article X has to do with Assistance and protection against Chemical Weapons.

Finally, the Technical Secretariat, headed by a Director General and provided with an Inspectorate, would mainly be tasked with assisting the political bodies of the Organization with data exchanges and verifying through routine on-site inspections singular statements about chemical weapon stocks, chemical weapon production facilities and their destruction. Challenge-inspections would be carried out by the Technical Secretariat, but not triggered by it. Uncertainty surrounds the proposed *ad hoc* inspections (*i.e.* verification of non-production). If they evolve along the lines of the German proposal, they would need to be triggered by the Secretariat due to their random character. If, however, the *ad hoc* inspections are to be challenge-inspections in disguise, then power to trigger such inspections will probably remain vested in States Parties.

Cost estimates for the operation of the Organization are to be handled with extreme care. As long as the exact scope of the verification system is not known, particularly the scope of its inspections, it is difficult to estimate the type of equipment as well as the number of inspectors required. Moreover, the location of the Organization may make a difference. Countries which have offered to host the Organization have also offered collateral advantages they will, for instance, provide the Organization with a building, laboratory facilities, and/or office equipment.[57] Two studies recently circulated among the negotiators, however, attempt a rough estimate of the price tag of a Chemical Weapon Organization.

A Canadian study estimates that the Organization would need a total of 603 inspectors (340 would supervise the destruction phase of the CWC as well as the permitted production of schedule 1 chemicals for protective purposes, and 138 would carry out challenge inspections). It was further estimated that the organization would require a support staff of some 400, making a total of 1000. Total costs were estimated at 120 million $ US.[58] A recent US study estimates costs for the Technical Secretariat to amount to a little over 160 million US $.[59]

Test Ban Organizations

The Swedish proposal for a Comprehensive Nuclear Test Ban Organization is modelled along the lines of the CW Organization. It comprises a Conference of States

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[57] See for instance the Dutch offer CD/532 of 6 February 1990 and CD/PV 575 of 21 August 1990. See also the Austrian offer to host the organization.

[58] The estimates are calculated on the basis of the rolling text from February 1990, CD/961. Canada, *The Chemical Weapon Convention and the International Inspectorate: A quantitative study*, Ottawa, Verification Research Unit, External Affairs and International Trade, August 1990, 66p.

[59] See the US Working Paper CD/CW/WP.364 of 21 August 1991, *A Chemical Weapons Convention: Staffing and Cost Estimates for a Technical Secretariat.* The breakdown of the total costs (163,548,185 $US) is as follows: Equipment costs 1,843,500; Field equipment costs 3,241,000; Outside laboratories 2,180,000; Travel costs 52,200,000; Labour costs (with a total estimated staff of 1225 persons) 104, 083, 685. In the estimate labour costs breakdown as follows: The Executive Office (25 persons) 2,007,646; The Administrative Directorate (55 persons) 3, 133, 746; The Comptroller Directorate (25 persons) 1,479,368; The Security Directorate (56 persons) 3, 140, 996; The Inspectorate (986 persons) 89,067,800; The Information Systems (78 persons) 5,254,129.

Parties composed of all Parties, a limited Executive Council, and a Technical Secretariat.[60]

The Executive Council would comprise 25 States Parties who would serve for a period of two years. The duties and functions of the Executive Council are restricted to fact-finding and consultation. No qualification of facts is provided for. On-site inspections are triggered by request of a State Party; results of such an inspection are reported not only to the Council, but to all States Parties.

Cases of non-compliance may be discussed in the Executive Council or may be put directly before the Conference of States Parties. Only the latter may take measures to ensure compliance.[61] Any State Party may also lodge a complaint with the UN Secretary-General or with the UN Security Council. However, there seems to be some confusion in the draft text with respect to who would carry out the investigation following such a complaint and on what basis the Secretary-General would carry out an investigation. Would this be on the basis of Article 99 of the UN Charter, or on the basis of a UN Security Council resolution?

The test ban organization proposal by Indonesia, Mexico, Peru, Venezuela, Yugoslavia and Sri Lanka was tabled within the context of the Test Ban Amendment Conference.[62] The proposal is interesting in that it illustrates how non-discriminatory and egalitarian principles could translate into institutional form. It is also the only proposal which would formally give a political/legal qualification function to the verification organization.

The Organization would aim to:

> ... assist in the verification of compliance with the Treaty.
> compile information and make observations pertinent to the Treaty, and (...) report the information and observations to each Party to the Treaty. (Article I)

The proposed Organization would have two main bodies, an Assembly and a Secretariat. Contrary to the ideas developed in the Chemical Weapon Negotiations, or in the Swedish proposal, this proposal does not provide for an Executive Council or Committee. The Assembly is, in addition to the usual functions of budget approval and election of the Secretary-General, provided with direct policy-making functions. It is stated that

> the Assembly shall establish the policies and practices of the Organization.

In order to assist it in this work the Assembly shall create a Technical Committee and different sub-Committees. Membership is open to all parties. The Technical Committee is charged with reviewing and evaluating the performance of the Secretariat, as well

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[60] See CD/1089, 31 July 1991.

[61] One of such measures would be suspension

[62] The text is contained in CD/1054 of 4 February 1991. See also CD/PV 581. The proposed amendment consists of extending the ban on tests to all tests, *i.e.* including underground tests. See CD/852

as assessing the information submitted to it (*i.e.* to qualify the information). The qualification process could be executed with only a majority of voters. What would happen after the Assembly had qualified a violation is not clear.

The Secretariat, headed by a Secretary General, is given extensive functions in the field of fact-finding. Its task is not only to collect the data, but also to analyze it. The methods at its disposal range from the non-intrusive perusal of literature to highly intrusive on-site inspections. The Secretariat is given extreme free reign in deciding upon on-site inspections. Article II of Annex 3 even provides for the possible inclusion of "public or journalistic members on the inspection team".[63] A comprehensive network of permanent and temporary seismic stations is also provided for.[64] On the basis of the submitted text it is arguable that the Secretariat has the authority to qualify the information collected. That is, it may pass judgment as to whether a violation has occurred.

The Non-Treaty-Specific Organization

Proposals to establish non-treaty-specific but verification- or monitoring-dedicated organizations are numerous.[65] They have been made within the context of various multilateral negotiating mechanisms, the United Nations, and more recently within the context of the Western European Union. The most recent and elaborate proposals in this field have focused on the possibilities of using satellites for the verification of disarmament agreements and more general crisis management.

The French proposal for the creation of an International Satellite Monitoring Agency (ISMA), made at the First Special Session of the UN General Assembly devoted to disarmament in 1978, is exemplary in this respect. The comprehensive study subsequently undertaken by a group of governmental experts under the auspices of the UN Secretary-General, while focusing on the technical possibilities of setting up such an Agency, has also crystallized thinking on the subject in broader terms.[66]

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[63] Usage of the press has been quite common in the past, particularly in connection with compliance issues. Never before however, has it been proposed to internationally institutionalize their involvement.

[64] Each non-nuclear State party would host at least one "quality -2" station (i.e. a nine-element broad-band and three-component low-noise seismometers). Eight non-nuclear States would host more stations in proportion. The Nuclear Weapon States would host "Quality -1" stations (i.e. a three-component broad-band borehole seismometer supplemented by four single-element outstations and a three component surface seismometer at the top of the borehole. One such station is envisaged for the UK, 20 for the US and 38 for the USSR. Finally 33 "Quality 1" stations would be placed in international territories, in particular the ocean areas. The permanent stations would be operated by personnel of the host country, but with immediate access at all times for the Secretariat. The cost of the network would amount to approx. 50.8 + 66 + 33 million = $US 149.8 million. Stations would be provided and paid for by the Organization.

[65] See for instance, the Dutch Swedish, Japanese, USSR, and Six Nation Initiative, proposals. See also, Ellis Morris, International Verification Organizations: Proposals for General Overview Organizations, in: Ellis Morris, ed., *International Verification Organizations*, Toronto, Centre for Internatonal and Strategic Studies, York University, February 1991, pp.151-173.

[66] Report of the Secretary General, *Study on the implications of establishing an international satellite monitoring agency*, 6 August 1981, A/AC.206/14, 120p. On ISMA and the World Space Organization proposal by the USSR, see also, Lucy Stojak, International Verification Organizations for Arms Control in Outer Space, in: Ellis Morris, ed., *International Verification Organizations*, Toronto, Centre for International and Strategic

Since they are not *a priori* related to a specific agreement, such agencies can only exercise monitoring functions. Data-gathering is their sole function.

Mention should also be made of the more general 1988 Soviet proposal calling for the establishment of an International Monitoring and Verification Agency which "could co-ordinate and where appropriate monitor the fulfilment of obligations under arms limitation and reduction agreements, verify compliance with agreements on easing international tensions and monitor the military situation in areas of conflict"[67], as well as the 1988 French proposal calling for the establishment of a Satellite Image Processing Agency (SIPA), which would collect, process and disseminate data from existing civilian satellites for purposes of verification of disarmament agreements, crisis management or natural disasters.[68]

Canada and Sweden have also provided detailed technical analyses of how satellites could be used in the context of the verification of multilateral disarmament agreements with their respective PAXSAT concept[69] and Tellus project[70].

The usefulness of satellites for the verification of arms control agreements is universally recognized. As observed in the aforementioned ISMA study of 1981:

> From a technical point of view observations from satellites for the purpose of information gathering related to the verification of compliance with treaties and for crisis monitoring is both possible and feasible. (...)
> From a legal point of view, there is no provision in international law, including space law, that would entail a prohibition for an international governmental organization such as ISMA to carry out monitoring activities by satellites.[71]

At present only the USA and the USSR possess the type of satellite capable of carrying out verification tasks. France has launched the Helios programme in conjunction with

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Studies, York University, February 1991, pp. 125-150.

[67] See the Statement by Shevardnadze at the Third Special Session A/S-15/PV.12, p. 66. See also the Working Paper presented by Bulgaria, Czechoslovakia and the USSR A/S-15/AC.1/15, 13 June 1988. Another Soviet proposal concerning the establishment of an International Space Directorate was made in the CD in 1987. The USSR proposed that, without waiting for the conclusion of an appropriate agreement on space, a start should be made on establishing a system for international verification of the non-deployment of weapons of any kind in Outer Space. In this case, however, no use is being made of satellites. The proposal aims - mainly through on-site inspections at the launch sites - to verify that any objects to be launched into and stationed in Outer Space are not weapons and are not equipped with weapons of any kind. See CD/817 (CD/OS/WP.19), 17 March 1988.

[68] See Statement by the French Foreign Minister Roland Dumas at SSOD III, 2 June 1988.

[69] See F.J.F. Osborne, The Paxsat Concept: A study of Space to Space Remote Sensing, in: Maniaque, John, ed., *A proxy for trust, views on the verification issue in arms control and disarmament negotiations*, Ottawa, Norman Patterson School of International Affairs, Carleton University, 1985, pp. 89 - 100; *Paxsat Concept: The Application of Space-Based Remote Sensing for Arms Control Verification*, Ottawa, External Affairs Canada, 1987.

[70] See *Technical Study of a Verification Satellite: Project Tellus*, Swedish Defense Research Establishment, Final Report , Solna, September 1988.

[71] A/AC.206/14, (1981), paragraphs 17 and 18, p.14.

Spain and Italy, which should give those countries some capabilities in this field by 1993, when the first reconnaissance satellite is supposed to be in orbit.

The Gulf War has demonstrated the shortcomings of European observation capacities. It may partly explain the renewed French resolve to set up a European Satellite Agency. In their disarmament plan of 3 June 1991 the French authorities stressed their willingness to pass on any information they had to regional agencies, in the interest of transparency, and that they were particularly in favour of any European-held space-derived observations being transmitted to such regional agencies.[72] Pierre Joxe, the French Minister of Defence, reiterated these statements on 4 June 1991 before the WEU Assembly and pledged contributions from Helios to the soon-to-be-established WEU Satellite Centre. The WEU Satellite Data Interpretation Centre was established by a decision of the Council on 27 June 1991. It was given the task

> to train European experts in the photo-interpretation of satellite-derived data, to compile and process accessible data and to make those data available to member states, particularly within the framework of the verification of arms control agreements, crisis and environmental monitoring.

The Council also charged the *ad hoc* Sub-Group on Space to pursue studies on the possibilities for medium- and long-term co-operation on a European satellite observation system.[73]

How the WEU Centre will develop is far from evident. The question of membership remains open. Some have suggested that information could be shared with CSCE members, including former WTO countries, while others have advocated more restricted distribution of information. However, not all possible European partners have the same interests and resources, nor do they feel the same political need for independent verification capabilities. The political need may vary or even be non-existent, either because a State already possesses such capabilities, or because it has delegated the responsibilities for the verification of the agreement to another party, or even because existing capabilities seem appropriate. The greatly-varied spectrum of national interests and financial and industrial resources in Europe thereby makes such a co-operative effort difficult to implement, despite the numerous proposals. Co-operative efforts in this field are likely to continue on an *ad hoc* and contractual basis,

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[72] The French disarmament plan is contained in CD/1079 of 3 June 1991. See also the French Working Paper on *Prevention of an Arms Race in Outer Space: Measures to Promote Confidence and Transparency*, CD/1092 of 1 August 1991.

[73] See WEU document 1291 (1991) and WEU document 1285 (1991).The Centre will have its seat in Spain with a British Director (Mr. Barry Blades, MOD). What form Helios contributions will take is as yet unclear. Earlier views had stressed that Helios was to fulfull only military missions and that any verification-related missions would be excluded from the already-overloaded system. See, for instance, the remarks made at the WEU symposium, Assembly of Western European Union, Technological and Aerospace Committee, *Observation satellites - a European means of verifying disarmament*, Symposium, Rome 27th-28th March 1990. Paris, Office of the Clerk of Assembly of WEU, p. 60, p. 29. See also, Assembly, WEU document, 1230, May 1990, p. 10. Helios data would be distributed according to the financial participation, (*i.e.* Italy 14%, Spain 7%, and France 79%).

and priority will probably be given to defense-related projects, like the Helios project, which might then provide information on an unilateral basis to internationally operated centres.

One of the problems with the multilateral operation of satellites has to do with the fact that it collects information in a non-discriminatory way. Parties to a disarmament agreement might well be willing to share information concerning treaty-limited or prohibited objects, but are certainly not willing to agree to a non-discriminate sharing of defence-related information.

Even in a well-established close alliance like NATO, disgruntlement with respect to information-sharing abounds.[74] As was recently pointed out at the Western European Union symposium on "*Observation satellites - a European means of verifying disarmament*",

> Close though we like to think we work together and co-operate, we still have what are called our national interests where intelligence systems and intelligence communities are concerned. There are certain questions to be asked here - is the data to be shared in relation to the amount of funding that is put in? Do those who put in 40% of the funding get 40% of the data? Or is it done on a need to know basis, depending on geographic proximity to errors or faults revealed by the verification system, or do we let everyone have data on equal basis?[75]

Calls for an European satellite monitoring or verification agency have been heard for some time. It is, however, with the signature of the CFE Treaty in sight, and with the changing European security structure, including the foreseeable gradual withdrawal of American troops and the dismemberment of the WTO, that more serious attention is being given to such proposals and some action is being taken in this respect. Indeed, all these proposals have thus far been marked by the absence of any concrete need, or treaty, which would have justified the establishment of a space-based system. The costs of the development of such an independent verification capability are too high for any one country to take it on unilaterally, which naturally suggests collective and co-operative efforts.

Thus, while the multilateral and intergovernmental operation of satellites for verification purposes will be too costly for the majority of States, the availability of commercial satellite and other remote-sensing images will continue to increase. Even if these images do not provide the type of resolution desirable for the verification of arms control agreements, they still provide valuable information. Utilization of such images could be helpful in more general CBM or transparency regimes. The

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[74] See for instance the remark by the Dutch Defence Minister ter Beek at the above WEU symposium " *At present, the United States shares information obtained by satellite surveillance with its allies in a number of cases. For the last few years, however, it has become clear that the United States intends to make greater use of its satellite surveillance capability for its own purposes*", *Op. cit.* p.15

[75] *Cf.* Statement by the Rt. Hon. Sir Geoffrey Pattie, MP United Kingdom, in: Assembly of Western European Union, Technological and Aerospace Committee, *Observation satellites - a European means of verifying disarmament*, Symposium, Rome 27th-28th March 1990, Paris, Office of the Clerk of Assembly of WEU, p.76.

international use of data provided by such commercial services will be less costly and more easily manageable.[76] In this context, mention should be made of the European observation satellite programme SPOT. This is a civil and commercial project operated by France, Belgium and Sweden.[77]

The arguments developed within the European context may easily be transposed to the universal plane. The problems generated by divergent national interests and the variety and disparity of financial and industrial resources are merely multiplied and complicated to the *n*th degree. The universal, non-treaty specific and ISMA type proposals are, however, plagued primarily by the absence of a concrete requirement.[78]

Indeed, only general and complete disarmament would warrant the effective international control which a International Satellite Monitoring Agency could provide. The death warrant of the idea of international control - of an integrated, international, multilateral verification system - was recently signed by a group of governmental experts who, upon the request of the United Nations General Assembly, undertook a *Study on the role of the United Nations in the field of verification*[79]:

> Arms limitation and disarmament verification is agreement-specific and is the responsibility of States parties to such agreements, unless they explicitly consent to the involvement of other States or organizations in the verification process.[80]

It is therefore not astonishing that ideas for an integrated verification system receive scant attention in the study, and that the scope of the group's recommendations remain restricted to the exchange of already publicly available data, exchange between experts and diplomats, and support for existing fact-finding functions of the UN Secretary-General. The UN Disarmament Commission had, of course, already established these foundations in 1988. Among the 16 principles of verification the Commission adopted, the 13th principle stipulated the treaty specificity of arms limitation and disarmament verification.

Non-Verification-Dedicated Organizations

Involvement of non-verification-dedicated organizations and mechanisms in the field of the verification of arms limitation or disarmament agreements may concern organizations which have either a broader mandate in the field of international security and peace, such as, for instance, the United Nations, and such regional organizations

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[76] A number of proposals refer to such possibilities. In this respect, of particular interest are the proposals related to the establishment of Training Centres to teach people how to analyze satellite-generated data.

[77] While of interest, SPOT technology is not sufficient for CFE verification. For instance, SPOT has a resolution of 10 to 20 m, while Helios, in comparison, has a resolution of 1 m from an altitude of 800 km.

[78] The same is true for the "Regional Agencies responsible for transparency" as proposed by France. See CD/1092, 1 August 1991.

[79] *Cf.* A/45/372, 28 August 1990.

[80] *Ibid.*, paragraph 68, p.32.

as the Organization of American States (OAS), the Organization of African Unity (OAU), and the North Atlantic Treaty Organization (NATO), or organizations which have a specific technical or legal mandate, such as, for instance, the International Atomic Energy Agency (IAEA) and the International Court of Justice (ICJ). Organizations in this second category must derive their authority to intervene from a specific treaty, and - except in the case of the ICJ - this authority is usually confined to technical assistance or fact-finding missions. Organizations in the first category may derive their intervention authority from their statutory acts and their responsibility for questions of international peace and security.

Current and Possible Practices

Of the 24 arms control agreements currently in force, or recently signed, four provide for referral to the UN Security Council[81], one for referral to the UN General Assembly[82], and two for referral to the UN Secretary-General.[83] Three treaties make reference to the ICJ[84]. The conclusion of separate so-called safeguard agreements with the IAEA is provided for in three agreements.[85] Intervention of the South Pacific Forum is provided for in the Rarotonga Treaty and the OAS is referred to in the Treaty of Tlatelolco. Finally NATO, in connection with the modified Brussels Treaty, has been given verification functions for forces under its command.[86]

This section will briefly review the involvement of existing international organizations in the verification of arms control obligations, as provided for in the different existing agreements, or deriving from their more general mandates in the field of international peace and security.

The United Nations

Until recently, United Nations involvement with the verification of arms control agreements has been limited to providing assistance with respect to data exchanges and

[81] Treaty of Tlatelolco (Article 20, Measures in the event of a violation of the Treaty); the Seabed Treaty (Article III, para 4, in case of doubt of fulfilment of the provisions of the Treaty); the Biological Weapon Convention (Article VI complaint); ENMOD Convention (Article V, para 3, 4 and 5 complaint and response).

[82] The Treaty of Tlatelolco (will be informed of special inspections conducted under article 16 or in case of a violation which might endanger peace and security, Article XVI, para 6 and 8 and Article XX, para 2.)

[83] The Moon Treaty (functions of data exchange and settlement of disputes Article IX, para 1 and XV, para 2 and 3); The ENMOD Convention (Chairmanship of the Consultative Committee of Experts, Annex, para 3).

[84] The Modified Brussels Treaty (Article 10); the Antarctic Treaty (Article XI, para 2); and the Treaty of Tlatelolco (Article XXIV).

[85] The Tlatelolco Treaty (Article XIII); The Non-Proliferation Treaty (Article III); and the Rarotonga Treaty (Article 8, para c and Annex 2)

[86] 10 of the 21 treaties, however, do not provide for the intervention of an existing international organization: the Geneva Protocol, the Test Ban Treaty, the Stockholm Document, the CFE agreement, the CSCE (Vienna Document and Charter of Paris); and the bilateral treaties: ABM Treaty, TTBT, PNET, INF, START (SALT I and II never entered into force).

fact-finding.[87] Moreover, its involvement has been based not on the afore mentioned treaty provisions, which have never been invoked, but on (1) the more general and vague "*appropriate international procedures*" clause, (2) General Assembly or Security Council resolutions, and (3) implied powers.

Examples of UN involvement on the basis of the "*appropriate international procedures*" clause include the following:

- The 1989 Declaration of the Third Review Conference of the Sea-Bed Treaty, which requested the UN Secretary-General to report on technological developments relevant to the treaty and to the verification of compliance with the Treaty[88];
- The Second Review Conference of the Biological Weapon Convention, which requested the Secretary-General to render the necessary assistance with respect to data exchanges and to report on the implementation of the Confidence-Building Measures decided upon by the States Parties (*i.e.* the 1987 *Ad hoc* Meeting of Scientific and Technical Experts[89]); and
- The Third Review Conference of the Biological Weapon Convention, which requested the Secretary-General "to receive, compile, and make available to States Parties information related to the implementation of the Convention and of the decisions of the Third Review Conference."[90]

In the absence of any specific treaty mechanism the Review Conference has tended to become an instrument through which concerns about verification and compliance can be voiced. The increased requested assistance from the UN in organizing data exchanges and making material available to all member States has thus far been limited to providing distribution services (*i.e.* information received from Member States has

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[87] Other United Nations activities which could have a bearing on, or are of interest to the verification of arms limitation agreements include the United Nations peacekeeping operations as well as UN deliberations, in particular as carried out in 1988 in the Disarmament Commission. See UN document A/43//42 (1988). Conferences, research and study activities organized under UN or UNIDIR auspices could also be referred to in this respect. See also the Report of the UN Secretary General, *Study on the role of the United Nations in the field of verification*, 28 August 1990, UN document A/45/372.

[88] See also General Assembly resolution 44/116 O of 15 December 1989.

[89] See UN General Assembly resolution 44/115 C of 15 December 1989 and 45/57 B of 4 December 1990. More generally it may be noted that requests by the Review Conferences are followed up by General Assembly resolutions. It is pursuant to those resolutions that the Secretary General will carry out *i.e.* prepare reports. See also UN study para 123 - 126.

[90] See BWC/CONF.III/22/Add.2, 27 September 1991, Article V, p.7. The information covers the following 8 fields: 1. Declaration on *Nothing to Declare* or *Nothing New to Declare**; 2. Exchange of data on research centres and laboratories; and exchange of information on National Biological Defence Research and Development Programmes: 3. Exchange of information on outbreaks of infectious diseases and similar occurrences caused by toxins; 4. Encouragement of publication of results and promotion of use of knowledge; 5. Active promotion of contacts; 6. Declaration of legislation, regulations and other measures*; 7. Declaration of past activities in offensive and or defensive Biological Research and Development Programmes*; 8. Declaration of Vaccine Production Facilities*. (* = New Measures). The UN Secretariat is also requested to service the *ad-hoc* Governmental group on verification, which is to meet for a first time on 30 March - 10 April 1991 in Geneva.

been usually neither organized nor translated). However, he increase of these data exchanges and the consequent increase and complexity of information have become so cumbersome that it has triggered demands for more structured presentations of information.[91] The development of a computerized data bank was recommended by the group of governmental experts which studied the role of the UN in the field of verification.[92] Similarly, Sweden has proposed that the UN establish a data base within the framework of the data exchange under the BW Convention.[93] No work has started, as yet, on the establishment of such a data base or on its technical requirements.

With respect to involvement of the United Nations following Security Council resolutions or following implied powers of the UN Secretary-General, two cases come immediately to mind. On the one hand the CW use allegations and the resultant fact-finding missions and procedures, and on the other hand Security Council resolution 687 of 3 April 1991 which defined the terms of the Iraqi cease-fire, as well as the modalities for the verification of Iraqi disarmament.[94] Before reviewing these two cases the statutory terms of reference for involvement of the different UN bodies should be briefly recalled.

Security Council

Article 24 of the UN Charter gives the Security Council primary responsibility in dealing with matters of peace and security.[95] Chapter VI and VII, dealing respectively with "*Pacific Settlement of Disputes*" and "*Action with respect to Threats to the Peace, Breaches of the Peace and Acts of Aggression*" and in particular Articles 34 and 39, further specify the role of the Security Council in this field.

> Article 34: The Security Council may investigate any dispute, or any situation which might lead to international friction or give rise to a dispute, in order to determine whether the continuance of the dispute or situation is likely to endanger the maintenance of international peace and security.
> Article 39: The Security Council shall determine the existence of any threat to the peace, breach of the peace, or act of aggression and shall make recommendations, or decide what measures shall be taken in accordance with Articles 41 and 42, to maintain or restore international peace and security.

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[91] The Informal paper prepared by the Secretariat on the Implementation of the confidence-building measures agreed to in the Final Declaration of the Second Review Conference of the Biological Weapon Convention totals for instance not less than 797 pages. Information is in no way structured and is thus of little use to the majority of the delegations, who have neither the knowhow nor the manpower to exploit the gathered data.

[92] See UN document A/45/372, paragraph 262 - 266.

[93] See the statement, on 12 April 1991, by Ambassador Carl-Magnus Hyltenius at the meeting of the Preparatory Committee for the Third Review Conference of the BW Convention.

[94] The cease fire took effect on 11 April 1991, after acceptance by Iraq.

[95] Article 24: *1. In order to ensure prompt and effective action by the United Nations, its Members confer on the Security Council primary responsibility for the maintenance of international peace and security, and agree that in carrying out its duties under this responsibility the Security Council acts on their behalf. (...).*

Complaints of violation of a disarmament agreement, while not specifically mentioned, may be investigated if it is considered to constitute a threat to international peace and security. The Security Council may also qualify the facts and take measures to enforce its decisions. Whether the Security Council will seize verification compliance issues is a political question. The Council has in the past been a prisoner of the East-West divide and of its own decision-making procedures. The existence of the veto power by the five permanent members has often stopped short any initiative or action in this domain.[96]

General Assembly

The General Assembly derives its power to intervene in the field of verification from Article 11 of the UN Charter:

> 1. The General Assembly may consider the general principles of co-operation in the maintenance of international peace and security, including the principles governing disarmament and the regulation of armaments, and may make recommendations with regard to such principles to the Members or to the Security Council or to both.
> 2. The General Assembly may discuss any questions relating to the maintenance of international peace and security brought before it by any Member of the United Nations, or by the Security Council, or by a state which is not a Member of the United Nations in accordance with Article 35, paragraph 2, and except as provided in Article 12, may make recommendations with regard to any such questions to the state or states concerned or to the Security Council or to both. Any such question on which action is necessary shall be referred to the Security Council by the General Assembly either before or after discussion.
> 3. The General Assembly may call the attention of the Security Council to situations which are likely to endanger international peace and security. (...).

and from Article 14, which stipulates that

> ... the General Assembly may recommend measures for the peaceful adjustment of any situation, regardless of origin, which it deems likely to impair the general welfare or friendly relations among nations, including situations resulting from a violation of the provisions of the present Charter setting forth the Purposes and Principles of the United Nations.

The power conferred on the Assembly to consider general principles governing disarmament has been amply used ever since its first meeting. Questions of verification became more topical in the 1980's and in 1988, for instance, led to the elaboration by the Disarmament Commission of 16 principles governing verification and to the study by governmental experts on the role of the United Nations in the field of verification.

The Assembly may recommend certain actions, but it has no power of enforcement. Similarly, it may qualify behaviour, but its judgement has no legal

[96] Article 26 gives the Security Council more general responsibility with respect to disarmament. It is made responsible with the assistance of the Military Staff Committee (established by article 47) for formulating *plans to be submitted to the Members of the United Nations for the establishment of a system for the regulation of armaments.*

The Assembly may recommend certain actions, but it has no power of enforcement. Similarly, it may qualify behaviour, but its judgement has no legal consequences.

Secretary-General

Powers of the Secretary-General to get involved in the verification of arms control agreements derive from Charter Article 98, which makes the Secretary-General the executive organ of the Security Council and the General Assembly, and Charter Article 99, which specifies that

> The Secretary-General may bring to the attention of the Security Council any matter which in his opinion may threaten the maintenance of international peace and security.

The Secretary-General has an implied power of fact-finding. In order to put a certain issue on the agenda of the Security Council he first has to assess whether the "issue" may threaten the maintenance of international peace and security.

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The role of the United Nations Secretary-General in the investigation of alleged uses of chemical or biological weapons has currently acquired general acclaim.[97] The procedure has its origins in General Assembly resolution 35/144 C of 12 December 1980, which requested the Secretary-General to investigate, with the assistance of qualified experts, the alleged use of chemical weapons in South-East Asia and Afghanistan, and in General Assembly resolution 37/98 D of 13 December 1982, which aimed at institutionalizing the UN Secretary-General's investigative powers, notably through the development of technical guidelines and procedures for the investigation.[98] The international fact-finding mechanism established by resolution 37/98 D and reaffirmed in 1987 by resolution 42/37 C however, has, never officially been invoked during any of the fact-finding missions carried out by the UN Secretary-General.

Indeed, when in 1983 the Iranian Government requested the Secretary-General to investigate chemical weapon use by Iraq, the Secretary-General carried out his

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[97] For a comprehensive analysis see: Gilles Cottereau, The Geneva Protocol on Chemical and Biological Methods of Warfare (1925) and Related Procedures, in: Serge Sur, ed., *Verification of Current Disarmament and Arms Limitation Agreements, Ways, Means and Practices*, Aldershot, Dartmouth, 1991, Chapter 1, pp. 45 - 60.

[98] Following resolution 35/144 C of 12 December 1980, see the Secretary-General's report in UN document A/36/613, annex (1981). See also General Assembly resolution 36/96 C prolonging the mandate of the group and their report A/37/259, annex (1982). General Assembly resolution 37/98 D was initiated by France and adopted with 86 votes in favour, 19 against and 23 abstentions. See also the reports of the group of experts contained in documents A/38/435 (19 October 1983) and A/39/488 (2 October 1984). For a good case history of the procedure see: Henning Wegener, International Fact-finding as a substitute for verification: Political and practical problems, in: Haug, Rene, ed., *Verification of arms control agreements: the role of third countries*, Geneva, PSIS Occasional Papers, Number 2/85, October 1985, pp.58-70.

investigation under authority of Article 99 and in a spirit of "humanitarian concern".[99] Similarly, the investigations carried out in 1988 in both Iraq and Iran were undertaken on the Secretary-General's own authority.[100]

The fierce opposition to resolution 37/98 D (by the socialist States, that is), as well as a good deal of legal controversy may explain in part why the Secretary-General hesitated to invoke the General Assembly resolution. However, it may also be argued that the subsequent involvement of the Security Council precluded involvement of the General Assembly (*i.e.* referral to its resolutions).[101]

The legal arguments evolved around the more general question of the authority under which the General Assembly or the Secretary-General could intervene in the verification of disarmament obligations. The socialist States argued that the General Assembly resolution constituted a *de facto* revision of the Geneva Protocol; according to the 1969 Vienna Convention on the Law of Treaties, such revision may only be carried out by the States Parties. To this argument Western States retorted that a General Assembly resolution can be nothing more than a recommendation and can thus never constitute an amendment or revision of a treaty.[102] It was further pointed out that the resolution referred to international customary law. It was argued that the operative part of the resolution would be invoked by referral to international customary law and not by referral to the Geneva Protocol.[103] In response to the objection that the resolution conferred on the United Nations particularly the Secretary-General - a legal/political qualification function with which the Charter had not entrusted it, it

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[99] For the mission reports see Security Council reports S/16433; S/17127 and Add.1; S/17911 and Corr.1 and Add.1 and 2; S/18852 and Add.1, and S/19823 and Corr.1 and Add.1.

[100] See reports S/19823 (25 April 1988), S/20060 and Add.1 (20 July 1988), S/20063 (25 July 1988) and S/20134 (19 August 1988). For the last three reports see also the letters by the President of the Security Council requesting co-operation from the Secretary General.

[101] Article 12 of the Charter states:*"While the Security Council is exercising in respect of any dispute or situation the functions assigned to it in the present Charter, the General Assembly shall not make any recommendations with regard to that dispute or situation unless the Security Council so requests."* For Security Council involvement see: Security Council Resolutions 582 (1986) of 24 February 1986; 612 (1988) of 9 May 1988; and 620 (1988) of 26 August 1988. Resolution 620(1988) is of particular relevance in that it encourages investigations by the Secretary General and *"Decides to consider immediately, taking into account the investigations of the Secretary-General, appropriate and effective measures in accordance with the Charter of the United Nations should there be any future use of chemical weapons in violation of international law, wherever and by whomever committed."*(para 4).

[102] A similar discussion had taken place in 1969 around General Assembly resolution A/2603 A (XXIV). The resolution introduced by non-aligned countries stated that the Geneva Protocol embodied the prohibition of the use in international armed conflict of all chemical and biological agents, *i.a.* also of riot control agents and herbicides. The US was strongly against such a broad interpretation of the Geneva Protocol and took the position that the General Assembly was not allowed to interpret treaties. In its legal interpretation it was supported by both the United Kingdom and France. As pointed out by Serge Sur the reference to the Geneva Protocol was from a legal point of view not very skillful, since it risked creating confusion between treaty obligations and the object of the resolution. (Entre les relations conventionnelles et l'objet propre de la résolution), Serge Sur, La résolution A/37/98 D du 13 décembre 1982 et les procédures d'enquête en cas d'usage allégué d'armes chimiques et bactériologiques (biologiques), *AFDI*, 1984, p. 97.

[103] To add to the confusion it may be noted that for some States the Geneva Protocol has become part of international custom.

was argued that the resolution only provided for fact-finding. Charter Article 11, which confers on the General Assembly responsibilities in the field of disarmament, as well as Article 98, which makes the Secretary-General its executive organ, were also invoked.[104] Furthermore, it could be pointed out that the procedure as defined in the General Assembly resolution can be triggered only upon the request by a member State and not upon the Secretary-General's own authority.

Far from having resolved the delicate question concerning the authority of the United Nations (*i.e.* the Secretary-General) to become involved in the verification of disarmament agreements, and despite the fact that the actual investigations on alleged use of CW would be undertaken under authority of the Secretary-General and within the context of the Security Council, the General Assembly continued to fine-tune its fact-finding mechanism, on which consensus was reached in 1987.[105]

It is this relatively autonomous development of the fact-finding mechanism and its detachment from any legal/political qualification function or from any specific treaty which have permitted the currently widely-acclaimed support for the technique. By never officially invoking the General Assembly resolutions, the fact-finding mechanism would similarly not be tainted by the ineffectiveness of the investigations in terms of further actions or reactions by either the States concerned or by the international community (*i.e.* the Security Council).

The Gulf War and developments pursuant to Security Council resolution 687 (1991) however, tend to put the actual operation of the fact-finding mechanism under direct control of the UN Security Council.[106]

Involvement of the Security Council in the verification of the destruction and removal of Iraqi chemical, biological and nuclear weapons, and ballistic missiles with a range superior to 150 km, as well as in the verification of Iraq's undertaking not to use, develop, construct or acquire any of those weapons, is dealt with in detail in Chapter VIII of this volume. Suffice it to say that while Security Council Resolution 687 (1991) is of course not a disarmament agreement in the traditional arms control sense, it is still a legal instrument with unprecedented provisions for the UN in terms of international control (*i.e.* verification of the destruction and removal of weapons).

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[104] On the legal controversy see for instance: Serge Sur, La résolution A/37/98 D du 13 décembre 1982 et les procédures d'enquête en cas d'usage allégué d'armes chimiques et bactériologiques (biologiques), *AFDI*, 1984, pp. 93-109, and Howard Mann, Arms Control verification and the United Nations: The Chemical Weapons Experience of the 1980's, *The Canadian Yearbook of International Law/Annuaire canadien de Droit international*, Vol. XXVI, 1988, pp. 185 - 213.

[105] See General Assembly resolution 42/37 C of 1987 adopted by consensus and the report by the group of qualified experts contained in A/44/561 (1989). See also the 1989 Paris declaration which reaffirmed their full support for the Secretary-General in carrying out the investigations, and the UN study on verification, A/45/372, para 271.

[106] The Final declaration of the Third Review Conference of the Biological Weapon Convention held in September 1991 refers for instance to Security Council resolution 620 of 1988, and calls upon all States to co-operate fully with the UN Secretary-General in carrying out investigations in case of alleged use. Explicit reference is also made to possible UN Security Council enforcement measures. See the Final Declaration of the Third Review Conference of the Biological Weapon Convention, BWC/CONF.III/22/Add.2, 27 September 1991, Article V, p.11., see also note 100.

Although it is still too early to draw any definite lessons from the functioning of the Special Commission and assess its consequences in terms of the development of the concept of international control (*c.q.* verification) some preliminary observations may be in order.

The Gulf War and the ensuing operation of the Special Commission has demonstrated the crucial importance of intelligence and the huge discrepancy in intelligence capabilities between States. The lack of any indigenous UN information and data assessment capability vividly illustrates the limits of international verification.

The Special Commission greatly benefits from the work of the Conference on Disarmament. Its Executive Chairman has for a great many years participated in the negotiations in Geneva and was from 1984 to 1987 Chairman of the *Ad Hoc* Committee on Chemical Weapons. The experience gathered during all those tough negotiating years and during the numerous trial inspections is finally being put to actual test. The fact that a great number of the inspectors have been intimately associated with the chemical weapon negotiations, and often know one other personally, has definitely contributed to the cohesion of these inspection teams and may account for the fact that thus far no major breaches of security have occurred. On the other hand, the apparent low level of feedback to the Conference on Disarmament, and in particular to its Chemical Weapon Committee, might be deplored. The lack of feedback is of course all the more important for those countries not directly associated with the work of the Special Commission. The experience also suggests that more attention should be given to inter-organizational co-operation in the field of verification, and that it is important to avoid too sectoral a view. For example preoccupation with Iraqi chemical weapon violations would result in a prolonged obscuring of its activities in the nuclear and biological field. International organization co-operation is of course already highly topical in Europe with its mosaic of bodies and organizations involved in verification. Negotiatiors in Geneva might however do well to consider this aspect. What relations should the projected CWC organization maintain with the IAEA, with regional verification organizations, or still with informal study groups in other fields such as for instance the meeting convened by the third Review Conference of the BW Convention on verification.

The Iraqi operation clearly demonstrates that the United Nations, and in particular its Security Council, has far-reaching powers with respect to fact-finding, the qualification of facts, and enforcement. Whether it will be able to repeat such an exercise, especially within the context of a violation of any of the disarmament agreements that endangers international peace and security, depends on its capability of reaching a consensus between its five permanent members.

It is clear that the verification mechanism set up under operative paragraphs 8 to 13, can not be kept in force indefinitely. A very explicit link is made in the resolution with the goal of making the Middle East a zone free from weapons of mass destruction and from all missiles for their delivery. Ultimately, the functions of the Special Commission could, then, be handed over to a Middle Eastern "OPANAL" or a Middle

Eastern "Conflict Prevention Centre".[107] Within the more general objective of a global ban on chemical weapons, the mechanism established might perhaps also constitute the embryo of a regional Chemical Weapon Control Organization.

International Court of Justice (ICJ)

The modified Brussels Treaty, the Antarctic Treaty and the Treaty of Tlatelolco provide for referral to the International Court of Justice. However, referral is however always optional and has thus far never been invoked. The only disarmament related affair ever treated by the Court concerned the French nuclear tests.[108]

Specialized Agencies

Specialized Agencies may intervene in the verification of disarmament agreements only in so far as their involvement is explicitly provided for in the agreement. The only organization which has ever been referred to in any of the existing treaties apart from the IAEA is the World Health Organization.

The Second Review Conference of the Biological Weapon Convention considered that the Security Council could request the advice of WHO in carrying out the investigation of a complaint[109]. The Third Review Conference of the BWC furthermore considered that WHO could assist the United Nations by playing a co-ordinating role in providing assistance to a Party which "has been exposed to danger as a result of violation of the Convention".[110]

International Atomic Energy Agency (IAEA)[111]

Security Council resolution 687 has given the IAEA unprecedented tasks in the field of the verification of disarmament. Strictly speaking, the role of the IAEA in the verification of disarmament agreements has been nonexistent.

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[107] Proposals for the establishment of regional crisis management centres under the auspices of the United Nations have been made by several countries, including the Soviet Union. The Middle East Peace Conference might also address this issue.

[108] See the International Court of Justice Reports 1974. Australia v. France and New Zealand v. France, Judgement 20 December 1974. See also Serge Sur, Les affaires des essais nucléaires devant la CIJ, *RGDIP*, vol.79, 1975, pp.972-1027. Australia and New Zealand sought to stop French nuclear tests in the atmosphere, by arguing that these were illegal. The Court's ruling concerned, however, only questions of competence and receivability. Indeed in June 1974 the French declared that they would stop atmosphereic tests. The Court, noting that decision, considered that hence forth no difference existed between the parties and that no judgment over the legality of the tests was required.

[109] See BWC/CONF.II/13/II, 26 September 1986, Article VI, p.7.

[110] See BWC/CONF.III/22/Add.2, 27 September 1991, Article VII, p. 13.

[111] A great number of analyses on the IAEA exist. See for instance: James F. Keeley, The International Atomic Energy Agency and the Non Proliferation Treaty, in: Elllis Morris, ed., *International Verification Organizations*, Toronto, Centre for International and Strategic Studies, York University, February 1991, pp.175-200; Lawrence Scheinman, *The International Atomic Energy Agency and the World Nuclear Order*, Washington DC, Resources for the Future, 1987, 320p.; See also the IAEA brochures on IAEA Safeguards; IAEA/SG/INF/4, Arms, Limitations, Achievements (1983), IAEA/SG/INF/3, An introduction (1981). IAEA/SG/INF/4, and IAEA/SG/INF/5.

Indeed, its role in the NPT and the Treaties of Tlatelolco and Rarotonga is limited to the verification of the safeguards agreements that States Parties are to negotiate with the Agency. For the Non-Nuclear-Weapon States this means negotiation of an agreement with the Agency by which it undertakes to accept safeguards on "all source or special fissionable material in all peaceful nuclear activities." These safeguards are to confirm the peaceful nature of nuclear activities and possibly to sound the alarm in case of suspicious activities. They are, however, not designed to uncover such activities.[112] Task with which the Agency is now being charged for the first time, by virtue of the Security Council resolution.

The NPT-type safeguards carried out by the IAEA are more a confidence-building measure than a real verification procedure. Agency safeguards are only applicable to declared facilities, (*i.e.* they are based on information provided by the State). Safeguards do not verify the non-proliferation commitment, nor whether a State has declared all its nuclear material.

The safeguards system has three basic features - material accounting, containment and surveillance (through seals, automatic cameras and video tape recorders), and on-site inspections. Under the INFCIRC/153-type agreement, three kinds of inspections exist:

> *Routine Inspections* to verify that the information contained in reports submitted by the State is consistent with the accounting and operating records by the facility operator, to verify the location, identity, quantity and composition of safeguarded materials, and to verify information about the causes of shipper/receiver differences, book inventory uncertainties and material unaccounted for (para 72);
> *Ad hoc Inspections* to verify the initial report or changes in the situation since the initial report was made, and to identify and verify the nuclear material involved in international transfers (para 71);
> *Special inspections* to verify information presented in special reports or to collect additional information when the IAEA considers the information provided by the State or obtained through routine inspections to be inadequate for it to fulfil its responsibilities (para 73 and 77).[113]

The Agency, while it may qualify its findings, has no enforcement powers and only limited sanctioning powers. In case the Director General - and subsequently the Board of Governors decides that the IAEA is "*not able to verify that there has been no*

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[112] It might be argued that the special inspections provided for under paragraphs 73 and 77 of the model NPT safeguards agreement enable the IAEA to investigate suspected clandestine nuclear activities in NPT NNWS. See the UK proposal at the Fourth Review Conference of the NPT. In INFCIRC/153, para 28, the objective of safeguards is defined as "*the timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or of other explosive devices, or for purposes unknown, and deterrence of such diversion by risk of early detection*". Significant quantities have been defined in function of the amount needed to make one nuclear explosive device, i.e. 8 kg of plutonium, 8 kg of uranium U-233, and 25 kg of uranium U-235. See IAEA/SG/INF 4 (1983).

[113] See IAEA/SG/INF/6 (1985), p.14.

diversion of nuclear material required to be safeguarded"[114] the following sanctions may be decided upon: curtailment or suspension of assistance; call for the return of materials and equipment made available to the concerned State; and suspension of membership privileges and rights. Non-compliance is reported to all members of the Agency, and to the UN General Assembly and the Security Council. Iraq has been the first case of non-compliance reported by the Board.[115]

Regional Organizations

Regional organizations do not really intervene in the verification of disarmament agreements. The Pacific Forum, NATO, or EURATOM within the context of the negotiation of NPT type safeguards agreements with the IAEA, are real exceptions. The Organization of American States (OAS) and the Inter-American Atomic Energy Agency are mentioned in the Treaty of Tlatelolco, but their actual involvement is minimal.[116]

Under the Rarotonga Treaty, the Director of the South Pacific Bureau for Economic Co-operation (SPEC)[117] has a secretariat function with the tasks to ensure information exchange between parties and to convene the meetings of the Consultative Committee. The Consultative Committee - which contrary to its name may be assimilated to a General Conference or General Assembly of all Parties to the Treaty - meets upon request of a Party.[118] It has the authority to trigger on-site inspections and has also legal/political qualification functions. It will report any violations to the South Pacific Forum, which is recognized as the supreme political body for any compliance matters. No explicit sanctions are foreseen. Contrary to other, similar agreements, no referral to the UN Security Council or the General Assembly is provided for in case of non-compliance.

As was concluded in a recent UNIDIR study

> The verification system for the Treaty of Rarotonga is, on the whole, well-suited to the political, military and economic conditions of the South Pacific. It is lean, economical and relies heavily on the "Pacific way" of consensus-building and informality. Despite the hopes

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[114] See INFCIRC/153, paragraph 19.

[115] See the resolution adopted by the IAEA Board of Governors on 18 July 1991, IAEA Press Release 91 24, 18 July 1991, Vienna.

[116] The OAS is informed of the results of any special inspections carried out under Article 16 and in cases of non-compliance (Article 20). The International American Nuclear Energy Commission is explicitly mentioned in Article 19 as a possible technical resource organization for the Parties to the Treaty; thus far no use has been made of the Commission.

[117] SPEC is composed of a Secretariat, headed by a Director, and of a Committee, which is the Bureau's executive Board. The Committee meets twice a year before the meetings of the South Pacific Forum. The South Pacific Forum is not an international organization. It is a gathering of Heads of Government. The Forum has no written constitution or international agreement governing its activities, nor has it any formal rules relating to its purpose, membership, or conduct of its meetings.

[118] The term of Consultative Committee used to designate a General Conference or Assembly. See for instance: Nicholas A. Sims, *International Organization for Chemical Disarmament*, Oxford, Oxford University Press, 1987 (SIPRI Chemical and Biological Warfare Studies).

> of its negotiators it is not, however, pathbreaking, since its lacks some of the rigour of the Treaty of Tlatelolco and subsequent arms limitation agreements. (...) In addition, apart from the involvement of the IAEA in applying nuclear safeguards, it is an inward-looking system, perhaps suited to the "Pacific way" of managing conflict, but removed from the broader conflict resolution process of the international community.[119]

Proposals

The United Nations

Some of the recommendations of the governmental experts on the role of the United Nations in the field of verification, as well as a number of other proposals for further involvement of the world organization in this field, have already been referred to above. When examining such proposals, it is important to distinguish between proposals related to verification and proposals related to monitoring.[120] This chapter focuses is on the verification-related proposals. A further distinction should be made between treaty-specific proposals, aimed at improving existing procedures, and non-treaty-specific proposals.

A great number of the treaty-specific proposals are situated on the margin of the verification process and often have more of a confidence-building character. The assistance by the United Nations in data exchanges in the context of the Biological Weapon Convention is in this respect very illustrative. The recent Argentine proposal to make mandatory the data exchange under Article 11 of the 1967 Outer Space Treaty also merits mention.[121] These proposals are frequently based on a minimal effort, both in terms of verification and in terms of costs. The United Nations is a sort of "second best". Since most of these proposals are inspired more by confidence-building considerations than by verification requirements, the UN indeed offers a fairly cost-effective solution. However, as soon as these data exchanges are to become more meaningful instruments in the confidence building and verification fields, the consensus on having this function performed by the United Nations quickly evaporates and the cost factor resumes its mitigating effect.

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[119] Trevor Findlay, The Rarotonga Treaty (1985), in: Serge Sur, ed., *Verification of Current Disarmament and Arms Limitation Agreements, Ways, Means and Practices*, Aldershot, Dartmouth, 1991, p.301.

[120] The recent UN study on arms transfers, as well as the military budget reporting system, would belong more to the latter. The 1991 UN Study on *Ways and Means of promoting transparency in international transfers of conventional arms*, set up pursuant to UNGA resolution 43/75 I of 7 December 1988, recommends that "a universal and non-discriminatory arms transfer register under the auspices of the United Nations should be established as soon as possible" (para 916). See in this rsepect also the different transparency measures and proposals in the field of arms transfers and non-proliferation such as the meeting of the five, CD/1103 of 19 August 1991. The September 1991 expert meeting of the five was supposed to discuss and propose a consultation or information exchange mechanism concerning arms transfers to the Middle East. No agreement could be reached, however.

[121] See CD/1015 of 18 July 1990 and CD/PV 566 of 19 July 1990. Under Article 11 of the Outer Space Treaty, the States parties agree to inform the UN Secretary General of any activities taking place in Outer Space or on the Moon.

The second category of proposals concerns the non-treaty-specific proposals. Particularly interesting in this category, apart from the proposals for computer-assisted perusal of literature, are the proposals for the development of so-called multi-purpose verification techniques that is, techniques, methods or procedures which could be used by States Parties in different circumstances and on a voluntary *ad hoc* basis. As seen above, the fact-finding mechanism of the UN Secretary-General has evolved into a more-or-less independent mechanism, which could be used in the context of other treaties. Proposals have recently been made to extend this mechanism to the BW Convention or to the inhumane Conventional Weapon Convention.[122] Other proposals have suggested using aircraft or satellites. However, the cost and the lack of an immediate requirement precludes any immediate serious follow-up for the latter two. Indeed, the success of the development of such non-treaty-specific, multi-purpose techniques or procedures remains dependent on a real need, a real requirement. To some extent the Security Council Special Commission could also be considered in this capacity. Why not invest the Security Council with responsibilities for last-resort on-site challenge inspections? From a legal point of view nothing prohibits such utilization of the Security Council. Politically, however, such a policeman function would rapidly become untolerable to many. The composition of the Security Council, with its five permanent members, is already subject of heated discussions. Moreover, it would run counter to the principle that "all States have equal rights to participate in the process of international verification of agreements to which they are parties" and the principle that "verification of compliance with the obligations imposed by an arms limitation and disarmament agreement is an activity conducted by the parties to an arms limitation and disarmament agreement or by an organization at the request and with the explicit consent of the parties, and is an expression of the sovereign right of States to enter into such agreements."[123] Involvement of the Council would thus seem warranted only on an *ad hoc* basis.

Specialized Agencies

International Atomic Energy Agency (IAEA)

The Agency was highly commended at the last NPT Review Conference, which took place in Geneva in August and September 1990 and the safeguards procedure was strongly endorsed. A number of important nuclear-exporting States pledged to apply in the future full-scope IAEA safeguards on exports to all non-NPT member States. Certain proposals made at the Review Conference and of interest to Agency activities called for the randomization of routine inspections and for making the results of safeguards activities (*i.e.* inspections) more transparent. More far-reaching, however,

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[122] See the proposals of the Federation of American Scientist and of Peru at the BW Review Conference. Proposals to extend the mechanism to the inhumane Conventional Weapon Convention have been made by the Soviet Union. See also the UN Study, A/45/372, para 271.

[123] See priniciple 10 and 13 as elaborated by the UN Disarmament Commission in 1988, (A/S-15/3, para 60).

was the proposal that called for the IAEA not to hesitate to resort to "special inspections" in case of questions on compliance. It was also suggested that the Agency prepare a study on the possible scope, application and procedures of such inspections. If carried out, such special inspections would better integrate the safeguards into the verification procedure, in that they would be aimed at searching out clandestine activities, and would thus be more directly related to the non-proliferation commitment.[124] However, such special inspections are not to be confused with challenge inspections since, they are not based on the principle of "*anytime, anywhere*". Requests may be made to inspect undeclared facilities, but a State could legally - if not politically - refuse access.

The idea that IAEA inspections should not be limited to nuclear material but should also apply to nuclear installations also derives from the desire to give the Agency a more prominent role in the field of the verification of the non-proliferation commitments. However, as was already pointed out in connection with the UN Special Commission, without any indigenous information capability, the Agency will remain dependent on information transmitted to it by its members. Only a few countries are able to provide it with the information necessary. As in the case of the UN, innovative mechanisms have to be found to share the evaluation and judgement of this data.

It was also recognized that the Agency would need sufficient political, technical and financial support. Indeed, with its safeguards activities increasing, particularly if - as proposed at the last NPT Review Conferences safeguards are to be extended to all civil nuclear facilities in the nuclear weapon sates, or if it is to engage in special inspections, more funds would seem necessary.[125] If the Agency is to be a viable institution it will need to continuously update its techniques, including in the field of safeguards. Technical organizations have a tendency towards atrophy and self-centeredness. The Arms Control Agency of the Western European Union is a case in point. Atrophy occurred not only because it had less meat to chew on, so to speak, but also because no renewal of its methods or objectives took place. It might be argued that the fact that the IAEA has a broader mandate that extends beyond mere verification or safeguards guards it against such tendencies.

Regional Organizations

Ample references have already made to proposals concerning the different Western European organizations, particularly the WEU. Mention should perhaps be made of the involvement of NATO in the verification of the CFE/CSCE agreements. Within the

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[124] See the report of Main Committee II, NPT/CONF.IV/MC.II/1, 10 September 1990.

[125] From 1980 to 1989 the number of inspections doubled from 1100 to 2200. The number of inspectors increased from 116 to 211, States with safeguards agreements in force increased from 86 to 101 and the number of safeguarded installations went from 774 to 992. Safeguards expenditures however, have remained well behind. The budget went from 32,340,000 US $ in 1980 to 48,830,000 US $ in 1989. See Summary of briefing by the Deputy Director General (Safeguards) of the IAEA, during the 4th Review Conference of the NPT, August-September 1990. In addition to the 210 inspectors the Safeguards division employs approx. 100 technical officers and 200 clerical and secretarial staff.

alliance a special Verification Co-ordinating Committee (VCC) has been set up to act as a clearing house for data exchanges and for co-ordinating verification positions.

Different proposals related to the denuclearization of Africa provide for a role of the Organization of African Unity, and under an Indonesian proposal on a nuclear weapon-free zone in South-East Asia, the Association of South-East Asian Nations would be implicated. Canada has recently proposed that the OAS Secretary-General receive statements of Member States' "national policies, laws and administrative procedures governing the transfer and procurement of conventional arms" and that he disseminate this information annually to all Member States. It also proposed that the Secretary-General seek the views of Member States on the establishment of a consultative mechanism for situations where excessive conventional arms build-ups appear to be developing.[126] However, none of these proposals is under active negotiation and all have a very perfunctory character.

Analysis of the involvement of the regional non-verification-dedicated organizations in the verification of arms control agreements, as a separate and generic category of study, appears of little interest. Indeed, regions and organizations are too disparate to enable any kind of generalisation. Europe, with its mosaic of organizations epitomizes this condition, but Latin America and the OAS are equally illustrative.

Concluding Remarks

The above review of existing and proposed verification-dedicated organizations clearly illustrates the idea of treaty-specificity. Only a treaty warrants the establishment of an organization. Moreover, not one of the existing organizations is identical to the next, and even the Consultative Commission-type organizations are characterized by great differences.

The above review also points to the low level of institutionalization of the organizations. Indeed, ACA and to a greater extent OPANAL and the future CW organization appear to be real exceptions. Furthermore, even if highly institutionalized, their functions and the methods at their disposal remain limited to fact-finding. On-site challenge inspections remain the panacea of State parties both in the CWC framework as in the CFE context. The legal/ political qualification of facts, let alone responses, has as yet not really found its way onto the negotiating tables despite the increasing recognition of its importance. Nonetheless, States are increasingly recognizing the importance of international consultation on compliance and feel the need to institutionalize this process.

Institutionalization is an essentially political process. Frequently the question, and degree of involvement, of an international organization will be posed in terms of *giving*

[126] See Canadian Draft Resolution to the OAS General Assembly, June 1991 and OAS Resolution "Cooperacion para la seguridad en el hemisferio. Limitacion de la proliferacion de los instrumentos de guerra y armas de destruccion masiva" (Curbing the proliferation of instruments of war and weapons of mass destrucion) OEA/Ser.P, AG/doc/2780/91, 7 June 1991.

up some sovereignty. In this respect, it may be recalled that the concept of treaty-specificity was developed to counter the centralized, integrated and egalitarian organizational designs which emerged in the wake of the Special Sessions of the United Nations devoted to disarmament.

The above review clearly shows not only increased calls for, but also increased tendencies towards, co-operative efforts, towards the institutionalization of the verification process.

Basically wo different visions exist with respect to international organizations in the field of verification. The organization is either to provide technical services and assistance, or it is to be a political mechanism for consultation. The former necessitates far greater investments and warrants a more integrated type of organization than does the latter. However, if the latter is really to be involved in the qualification of data in compliance issues, it will sooner or later also require an independent information and data-assessment capability.

Current developments in the international political environment tend to favour unilateral disarmament, confidence-building and transparency measures. These trends therefore privilege the political-consultation type of organization and defuse the problem of data assessment and treaty-specificity.

The development of the role of the United Nations in the field of confidence-building and transparency measures is of primary importance. It would seem that the United Nations greatly under-utilizes its potential in this area. The principle of treaty-specificity does not preclude a more general non-treaty-specific role for the world organization.

Annexes

Table 1: Organizations Involved in the Verification of the Multilateral Disarmament and Arms Limitation Agreements

Name of the Agreement	*Verification-Dedicated Organization*	*Non-Verification-Dedicated Organizations*							
		UN Security Council	UNGA	UN Secretary General	International Court of Justice	IAEA	Other UN specialized organizations	Regional (and other) international organizations	Appropriate international procedures
Geneva Protocol (1925)				[a]					
Brussels Treaty (WEU) (1948/1954)	Arms Control Agency (ACA)								
Antarctic Treaty (1959)	Meeting of Contracting Parties								
PTBT (1963)									
Outer Space Treaty (1967)									
Treaty of Tlatelolco (1967)	OPANAL							- OAS - IAEC*	
NPT (1968)									
Seabed Treaty (1971)									
BWC (1972)	Consultative meeting								
ENMOD (1977)									
Moon Treaty (1979)									
Conventional Weapon Convention (1981)									
Treaty of Rarotonga (1985)								South Pacific Forum	
Stockholm Document on CSBM's (1986)									
CFE Treaty (1990)	Joint Consultative Group (JCG)								
CSCE Paris Charter (1990)[b]	Conflict Prevention Center (CPC)								

[a] *Cf.* A/Res/37/98 D (1982) and A/Res/42/37 C (1987); [b] Has superceded the Stockholm Document on CSBM's (1986)
* Inter American Energy Commission

Table 2: Organizations Involved in the Verification of the Bilateral Disarmament and Arms Limitation Agreements

Name of the Agreement	*Verification-Dedicated Organization*	*Non-Verification-Dedicated Organizations*							
		UN Security Council	UNGA	UN Secretary General	International Court of Justice	IAEA	Other UN specialized organizations	Regional (and other) international organizations	Appropriate international procedures
ABM Treaty (1972)	Standing Consultative Commission (SCC)								
SALT I (1972)	Standing Consultative Commission (SCC)								
TTBT (1974)	Bilateral Consultative Commission (BCC)								
PNET (1976)	Joint Consultative Commission (JCC)								
SALT II (1979)[a]	Standing Consultative Commission (SCC)								
INF Treaty (1987)	Special Verification Commission (SVC)							Risk Reduction Center	
US-USSR CW Agreement (1990)*									
START Treaty (1991)	Joint Compliance and Inspection Commission (JCIC)							Risk Reduction Center	
Brazilian-Argentine Guadalajara Agreement (1991)[b]*	Brazilian-Argentina Agency for Accounting and Control of Nuclear Materials (ABACC)								

[a] The Treaty never entered into force; [b] Agreement between the Argentine Republic and the Federative Republic of Brazil for the exclusively peaceful use of nuclear energy.

* Not yet entered into force

Chapter 9
United Nations Special Commission on Iraq Pursuant to SCR 687 (1991): Verification of Future Compliance

Frank R. Cleminson

Introduction

On April 3, 1991, the United Nations Security Council adopted Resolution 687 (1991) which outlined the terms of a cease-fire for the Persian Gulf War. It imposed stringent restrictions upon Iraq, specifically in terms of its future ability to acquire weapons of mass destruction and their associated delivery systems. The Resolution also outlined, in general language, the verification measures which the UN would be entitled to employ to ensure Iraqi compliance, particularly relating to the short term disarmament requirement specified in the Resolution. *Inter alia* Iraq is required to "unconditionally accept the destruction, removal, or rendering harmless, under international supervision, of ..." all its chemical and biological weapons and/or stocks of precursor agents. In addition, Iraq must dispose of "all ballistic missiles with a range greater than 150 kilometres and related major parts, and repair and production facilities ...". Similar measures have been applied to Iraq's activities in the nuclear area. In terms of future activities, Iraq is compelled to renounce forever the acquisition of nuclear weapons, and is required to submit to stringent inspections.

Under UNSCR 687(1991), the Security Council mandated the establishment of a United Nations Special Commission (UNSCOM) with the objective of verifying compliance by Iraq with the resolution's provisions. UNSCOM has been authorized not only to verify the required Iraqi weapons declarations by visiting any sites within Iraq which it needs to inspect, but also to organize "the destruction, removal, or rendering harmless ..." of the proscribed material. For the overall verification task, UNSCOM is authorized to seek expert assistance from such agencies as the World Health Organization (WHO) and the International Atomic Energy Agency (IAEA) as required. In the nuclear area, the IAEA has prime responsibility for verification of compliance with the assistance and cooperation of UNSCOM. In the other proscribed weapons areas, there is much less multilateral experience or organizational capability and UNSCOM has been forced to essentially develop many of its own procedures on an ad hoc basis.

The United Nations Secretariat has been deeply involved in this verification process, particularly in the area of administrative support. Individual member states have also played a vital role in UNSCOM activities through the provision of expert personnel and materiel support. Without this support, the success that UNSCOM has achieved to date in monitoring Iraqi compliance, would have been significantly more difficult if not impossible to achieve.

Purpose

This paper undertakes an initial review of the experience of UNSCOM to date with the objective of aiding in the assessment of the potential application of various monitoring methods to the verification of Iraq's future compliance under the terms of United Nations Security Council Resolution 687 and, in the longer term, to the verification of multilateral arms control agreements which are under negotiation.

UNSCOM Organization

The organizational structure and consequently the operating procedures developed by the United Nations Special Commission have been innovative and are potentially precedent setting. At its initial plenary meeting in May 1991, with a mandate based solely on a single Security Council resolution, the Special Commission moved to initiate inspections in four areas identified in the resolution: nuclear, chemical and biological weapons and ballistic missiles. Within eight days of this first meeting, UNSCOM personnel were participating in an on-site inspection (OSI) lead by the IAEA at the Tuwaitha Atomic Research Facility near Baghdad. Since then, the Special Commission has initiated or participated in a series of difficult and technically complex OSI relating to all four weapons categories. While the nuclear related inspections continue to be conducted by teams organized and led by the IAEA with the support and cooperation of UNSCOM, inspections in the other weapons areas have been organized and led by UNSCOM, drawing upon expertise from member nations of the United Nations, from specialized UN agencies and from the UN Secretariat. Because of stringent time lines, UNSCOM was forced to focus initially on the hands-on aspects of field operations rather than the more bureaucratic aspect of Headquarters organization. A notional chart, included as Table 1, attempts to capture the organizational structure which has evolved on a pragmatic basis to successfully support UNSCOM/IAEA field operations.

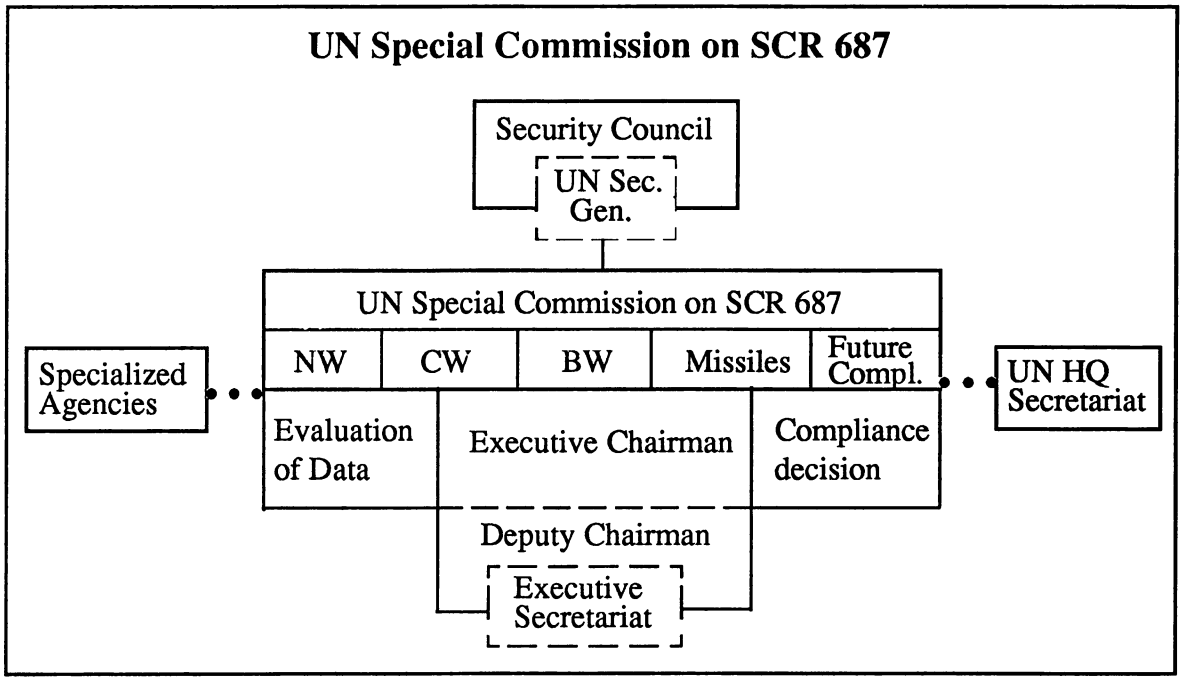
Verifying Iraqi Compliance

Security Council Resolution 687 (1991) is unprecedented in terms of the obligations it imposes on Iraq and the consequent monitoring requirements assumed by the UN. While the immediate focus of activities is understandably directed towards the disposal of Iraq's existing stocks of weapons proscribed by the Resolution, the long-term future compliance of Iraq with the terms of the Resolution is a matter of considerable concern as well. The task of verifying Iraqi compliance logically falls into three stages:

1. First stage (Inspection) now on-going, is to authenticate Iraqi declarations of proscribed equipment and materiel through a series of intensive inspections. UNSCOM is also mandated to carry out inspections designed to ensure that proscribed material is not held at undeclared sites;

2. Second stage (Destruction) which can be implemented concurrently with the first, is meant to ensure destruction of the banned materiel or to render such materiel harmless; and
3. Third stage (Future Compliance) is to monitor and verify future compliance of Iraq in accordance with pertinent United Nations resolutions.

Table 1



Clearly, there is no distinct dividing line between these three stages. Third stage verification (future compliance) will evolve from and merge with the baseline verification and destruction processes. It should benefit from experience gained to date as the first stage inspection program reaches completion. Future compliance will require an innovative approach designed to routinize procedures. It will have to address aspects of the interface between commercial and military use and the implications associated with potential dual-usage.

Results from the UNSCOM verification process could provide useful lessons in terms of ongoing multilateral arms control negotiations involving more than just the region. This includes the CFE Treaty, whose verification provisions will be implemented upon treaty ratification; probably mid-1992. These lessons learned could also have a beneficial effect on the ongoing negotiations in Geneva respecting a comprehensive Chemical Weapons Convention (CWC) as well as continuing efforts to enhance the Biological and Toxin Weapons Convention (BTWC) authorized as a result of the recently concluded Third BTWC Review Conference. Finally, as a result of the revelations about Iraqi non-compliance, it is likely that the IAEA itself will

review and improve its safeguards inspection procedures established under the Non-Proliferation Treaty of 1972.

Experience Gained to Date

Up to October 31, 1991, twenty inspection missions have been undertaken under the mandate of UNSCR 687(1991). Thirteen of these missions have been initiated by the Special Commission in the fields of chemical and biological weapons and ballistic missiles. The remainder of the missions have been associated with the nuclear research program of Iraq and have been lead by the IAEA with the assistance and co-operation of UNSCOM. Such assistance and cooperation included the provision of specialists in the nuclear weapons and nuclear energy related technologies as well as special materials expertise. In addition, the Special Commission has provided broad logistical and organizational support relating to transportation, explosive ordonnance disposal, medical assistance and financing. The Commission also has the responsibility, in the absence of declarations by Iraq, for designating locations for nuclear inspections as well as for all other inspections.

Under the mandate of UNSCR 687(1991), inspection teams have been organized from personnel made available by Governments, members of the Commission, the United Nations Secretariat and, in the nuclear field, by inspectors and staff of the IAEA. Selection of team members has been based principally upon the technical qualifications and expertise of the inspectors with due regard to drawing the members of inspection teams from as many Member States as possible within the range of available capabilities and experience. Nationals of 34 countries have so far served on inspection teams.

UNSCOM Verification Operations

In accomplishing its mandate, UNSCOM has undertaken the largest multilateral verification operation in history. In the initial stages, with little other experience to call upon, UNSCOM and the IAEA focused almost exclusively on the use of OSI techniques drawing heavily upon IAEA experience related to NPT Safeguards inspections modified to the more intrusive requirements of UNSCR 687 (1991). Experience gained was quickly used to modify methodologies to meet particular requirements in the field of chemical, biological and ballistic missile inspections. Member nations reinforced UNSCOM's initial operations by the provision of specialist staff on request and by direct expert support from national capitals. Initial field operations suggested that OSI, while effective in providing accurate and immediate data for a specific place and time, would need to be supported by other methods. OSI has proven to be an expensive and person-intensive operation. Early in June, defector reports proved useful in identifying suspect activities in Northern Iraq. By August, UNSCOM announced that it had requested the use of high altitude aerial inspections to supplement other resources. In September, UNSCOM had integrated the use of its own helicopters in support of a longer-range verification program. Table 2 illustrates a variety of interrelated methods of verification which, combined in a greater or lesser

manner could form a verification package capable of meeting the longer term compliance requirements under SCR 687 (1991).

Table 2

UNSCOM VERIFICATION PACKAGE

- **Space Imagery**
  - NTM
  - Commercial
- **Aerial Imagery**
  - High Altitude
  - Medium/Low Altitude
- **OSI**
  - Declared
  - Undeclared
- **Ground Imagery**
  - Helicopter
  - Inspector
- **Other**
  - Defector
  - Collateral

IAEA Verification Operations

While UNSCOM has initiated inspections in the chemical, biological and ballistic missile areas with considerable success, it is the area of nuclear inspections in which Iraq authorities have displayed the greatest sensitivity and have resorted to physical obstruction and intimidation. In April 1991, the IAEA appointed an action team of three senior officials to oversee its inspection operations in Iraq. Each of the seven nuclear inspections, have been led by one of the action team members. These IAEA-lead inspections have disclosed three clandestine uranium enrichment programs or activities.

On the second and sixth of these nuclear inspections, physical obstruction tactics were used by the Iraqi authorities in an attempt to thwart the inspectors. These tactics suggest that although no definitive "smoking gun" regarding a nuclear weapons production program has been uncovered, as yet, there appear to be sufficient "powder burns" to cause very serious concerns. Iraq had the capacity to produce enriched uranium. The extent, cost and secrecy associated with the program were more than required for a strictly civilian program. Dr. Hans Blix, Secretary General of the IAEA, has declared that, at the very least, Iraq was in violation of the NPT. For the first time in its history, the IAEA Board of Governors on 8 July 1991 passed a resolution condemning Iraq's non-compliance with NPT, calling on its Government to remedy the situation immediately and deciding to report the matter to all members of the IAEA,

to the Security Council and to the General Assembly. On several occasions, the Security Council, deeply concerned, has issued strong warnings to Iraq to cease obstructionist activities and to comply with its resolutions.

Interface With Wider Confidence-Building and Verification Regimes

While the obligations imposed on Iraq are stringent, operative paragraph 14 of Resolution 687 gives an important context to these obligations. It states that ".. the actions to be taken by Iraq ... (pursuant to its disposal of the banned weapons) ... represent steps towards the goal of establishing in the Middle-East a zone free from weapons of mass destruction and all missiles for their delivery and objective of a global ban on chemical weapons." It is the clear intention of the Security Council that, in the longer term, Iraq not remain permanently "singularized" as the only state in the region prohibited to acquire weapons of mass destruction or subject to intrusive verification. In this context, the Special Commission is likely to view its efforts in part as laying the foundation for future confidence-building and verification efforts in the region.

Of particular note in this context is that the verification activities of the Special Commission should reflect, to the degree possible, the procedures likely to come into force with the future comprehensive Chemical Weapons Convention (CWC). Thus, it is possible, in a strictly conceptual manner, to envisage the Iraqi case as being a useful exercise in the development of verification procedures worked out for the CWC, which will be extended to other countries when that convention comes into force.

A similar view can be taken with respect to the use of aerial overflights. It is conceivable that such flights of Iraq could form the basis for a broader, Open Skies type regime that would be extended to other countries of the region. To date, Open Skies has been conceptualized in the context of North America, Europe from the Atlantic to the Urals (ATTU) and Soviet Siberia.

In a related way, Special Commission/IAEA inspections of undeclared nuclear sites in Iraq could provide valuable experience and perhaps suggest ways in which IAEA Safeguards could be strengthened. However, care will need to be taken to ensure that this does not compromise the existing Safeguards regime, which is founded on a cooperative relationship between the IAEA and inspected states.

There are similarities between the structure and methods of verification to be applied by UNSCOM with those in other multilateral areas and Table 3 identifies similarities between UNSCOM and CFE verification.

Lessons Learned From On-going Experience for Future Compliance

A review of material already provided to the Special Commission, and an initial assessment of the results of the above inspections undertaken pursuant the mandate of UNSCR 687(1991), lead to the following conclusions:

Table 3

UNSCOM/CFE VERIFICATION SIMILARITIES
• Baseline Inspection • Reduction/Destruction • Second Base Line Inspection • Residual/Future Compliance • Declared/Undeclared Sites • Routine/Challenge/No Notification Inspection • Concentration on OSI

1. The Special Commission, the IAEA and the UN Secretariat have done an outstanding job in pulling together, on short notice, an initial on-site inspection capability which is representative, comprehensive and effective, recognizing the serious constraints which exist.

2. There continues to be serious concern over Iraq's willingness to comply fully with all UNSCR resolutions. Iraq's initial response to the requirements of UNSCR 687 has been less than complete; the current level of cooperation has resulted from international pressure on Iraq.

3. Meeting the mandate requirements of UNSCR 687(1991), particularly in terms of verification of future compliance, will be a complex, costly and lengthy process.

4. OSI is effective at best when verifying data at a single location and within a specific timeframe. Broader verification of compliance would be difficult to achieve using a single method.

5. Without some directing or triggering mechanism, OSI is not adequate to verify compliance in a non-cooperative environment.

6. Particularly in terms of future compliance, there must be additional verification methods applied to provide the United Nations with an indigenous capability such that its verification process is not dependent upon Iraqi cooperative for effectiveness.

7. While verification of future compliance will be dependent upon many sources of information, it should be seen as having an indisputable UN identify.

8. The development of a verification package of mutually supporting methods of verification is a significant step forward in the field of multilateral verification. Recognition of full capabilities of each method is essential to provide an effective and cost-effective method of verifying Iraq's future compliance with UNSCR 687(1991).

Concluding Observations

UNSCOM/IAEA verification operations to date have been generally successful. It can be said with some confidence that through rigorous and intensive inspections by the Special Commission, in the chemical, biological and ballistic missile fields and by the IAEA and Special Commission in the nuclear field, it has been possible to gain a general picture of Iraq's capacities and facilities in all of the areas concerned. While

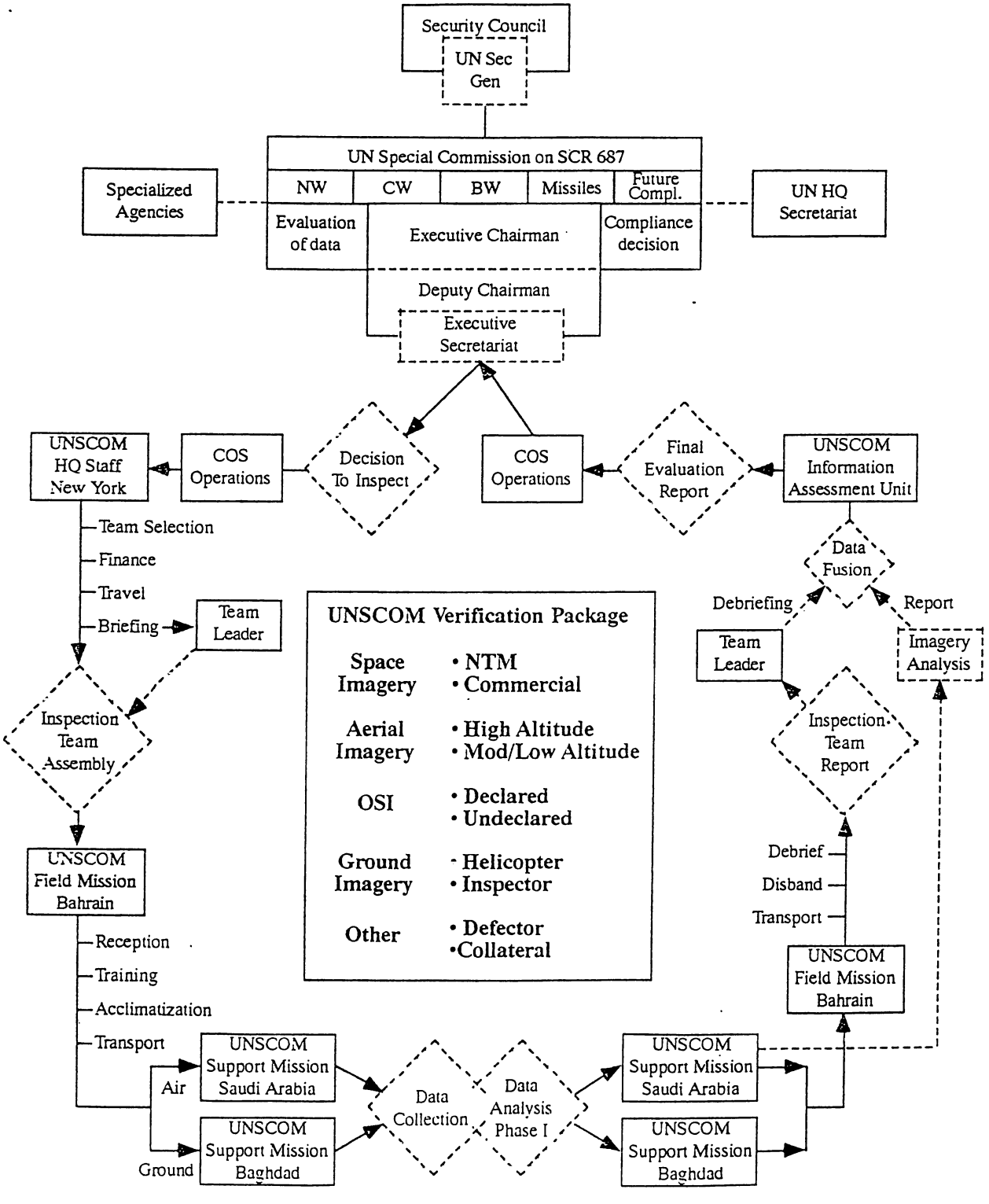
significant lacunae remain to be resolved as the long term compliance phase is approached, appropriate monitoring plans, submitted to the Security Council by UNSCOM[1] and IAEA[2], have been harmonized and approved by the Council in its resolution UNSCR 715(1991).

The success of the Special Commission in carrying out its mandate has depended upon three critical factors: (a) the full political support of the Security Council, (b) the political and technical support of Member States, and (c) the ability of agencies and organizations within United Nations system through the Security Council to improvise and provide support for this unique (and in some ways precedent setting) operation. Continued support in all three areas will be necessary to ensure the successful conclusion of this United Nations action under the mandate of UNSCR 617(1991).

[1] Security Council Document S22871 1 August 1991.
[2] Security Council Document S22872 1 August 1991.

Annex

Notional UNSCOM Verification Process Flow Chart



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