Fulfilling the NPT

A Verifiable Test Ban

VERTIC Briefing Paper 00/1

Trevor Findlay & Oliver Meier

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Executive Summary

- With the adoption of the Comprehensive Nuclear Test Ban Treaty (CTBT) by the General Assembly in September 1996, a major benchmark of the 1995 Nuclear Non-Proliferation Treaty (NPT) Review Conference's Principles & Objectives was reached.
- Yet the slow pace of signatures and ratifications since 1996 has been disappointing and entry into force of the treaty remains uncertain.
- Meanwhile, implementation of the CTBT's verification system is making good progress. Three years after the Preparatory Commission (PrepCom) for the CTBT Organization began establishing the International Monitoring System (IMS), about 100 monitoring stations are reporting to the Provisional Technical Secretariat (PTS). The International Data Centre (IDC) is reportedly 50 per cent complete.
- Establishing the arrangements for conducting on-site inspections in cases of suspected violations of the treaty is currently the biggest hurdle in the PrepCom's work: the verifiability or even entry into force of the treaty may be jeopardised if current disagreements continue.
- Confidentiality provisions are also contentious. Access by scientific and humanitarian relief organisations to IDC data should be able to be managed, taking legitimate national security concerns into account.
- The 2000 NPT Review Conference should clearly identify the states responsible for the delay in entry into force of the CTBT and express support for the work of the CTBTO PrepCom and PTS.
- Signatory states and ratifiers need to maintain political, technical and financial support if the CTBT's verification system is to be ready at entry into force.

INTRODUCTION

The Comprehensive Nuclear Test Ban Treaty (CTBT) is one of the major steps towards fulfilling the Article VI commitments of the parties to the Nuclear Non-Proliferation Treaty (NPT). Even though the NPT does not mention the CTBT by name, its preamble does reiterate the goal of a ban on all nuclear tests. This was reinforced in the Principles and Objectives adopted by the 1995 NPT Review and Extension Conference, which called for 'the completion by the Conference on Disarmament of the negotiations on a universal and internationally and effectively verifiable CTBT no later than 1996.'[1]

This goal was achieved on 10 September 1996 when the UN General Assembly adopted the CTBT by a vote of 158:3. Since then, the CTBT's viability has been called into question by the slow pace of signature and ratification and its consequent failure to enter into force. One hundred and fifty-five states have signed the treaty and 56 have ratified it. Twenty-nine of the 44 states with an advanced civilian nuclear capability, whose ratification is necessary for the CTBT to enter into force, have ratified. Among them, China, Israel, Russia and the United States have still not ratified, while India, Pakistan and North Korea have not even signed. The nuclear tests conducted by India and Pakistan in May 1998 and the US Senate's vote against US ratification of the CTBT in October 1999 have been the most severe setbacks for the nuclear test ban since it was opened for signature.

While political developments around the CTBT are not encouraging, the implementation of the treaty's verification system is making good progress. On 4 April 2000, the Provisional Technical Secretariat (PTS) of the CTBTO Preparatory Commission (PrepCom), based in Vienna, which is in charge of setting up the system, celebrated its third anniversary. Of the 321 stations and 16 radionuclide laboratories which form the International Monitoring System (IMS), 88 are complete or substantially meet treaty specifications. Another 65 are currently being installed or a contract for them is under negotiation.[2] On 20 February 2000 the International Data Centre (IDC) in Vienna assumed responsibility for collecting and disseminating data from the IMS stations in operation.

Even if some tasks remain problematic, such as the development of on-site inspection arrangements, the PTS could complete its work within the next five years. This will, however, require the undiminished political, technical and financial support of all states participating in the work of the PrepCom.

Status of the 44 States Required to Ratify the CTBT Before it Enters into Force*

The ratifiers
Argentina, Australia, Austria, Bangladesh, Belgium, Brazil, Bulgaria, Canada, Chile, Finland, France, Germany, Hungary, Italy, Japan, Mexico, Netherlands, Norway, Peru, Poland, Romania, Republic of Korea, Slovakia, South Africa, Spain, Sweden, Switzerland, Turkey, United Kingdom

The signatories
Algeria, China, Colombia, Democratic Republic of Congo, Egypt, Indonesia, Iran, Israel, Russia, Ukraine, United States, Viet Nam

The non-signatories
Democratic People's Republic of Korea, India, Pakistan

*As of 16 April, 2000. Up-to-date information on signatures and ratification can be found at http://www.ctbto.org/cgi-bin/ctbto_states.cgi?Status Report

THE INTERNATIONAL MONITORING SYSTEM (IMS)

The IMS will consist of 321 monitoring stations and 16 radionuclide laboratories located in some 90 countries. Some of these already exist, while others will have to be constructed. Four types of stations are to be established-seismological, infrasound, hydroacoustic and radionuclide. One hundred stations, about one third of the total planned, are currently reporting to the IDC in Vienna.[3] In many cases, IMS stations use existing infrastructure, which are upgraded and certified for use by the IMS.

The Seismic Network

The principal and most mature verification technique for the CTBT is seismology. Fifty primary and 120 auxiliary seismic stations, distributed world-wide, will be used to detect seismic waves generated by movements of the earth's surface, including underground nuclear explosions. Primary stations will report continuously and in near real time. Many primary stations consist of up to 20 seismometers, spaced up to two kilometres apart. The network of primary stations, once fully implemented, should be able to detect underground nuclear explosions with a yield greater than one kiloton.[4] If additional information is needed to help clarify the nature of suspicious events, the CTBTO can use data from auxiliary stations. The seismic network will be able to determine the location of an event within an area of a few hundred to a few thousand square kilometres. The seismic network is likely to receive the largest capital investment of the four monitoring technologies over the next few years. Fourteen primary and 29 auxiliary seismic stations already meet PTS specifications. Fifteen more primary and three more auxiliary stations are presently being installed.[5]

Hydroacoustic Network

Eleven underwater hydroacoustic stations are being established to detect explosions under water or in the atmosphere at low altitude. Six will use hydrophones, which have three microphones at each end of 100-kilometre fibre-optic cables, located mostly in the oceans of the Southern hemisphere. Five so-called T-phase stations are based on islands in oceans in the Northern hemisphere and will be used to detect seismic signals created when hydroacoustic waves hit land. Hydroacoustic stations are more expensive, but more sensitive than seismic stations. The hydroacoustic network is expected to be able to detect underwater explosions below one kiloton. In broad ocean areas, the location of such an explosion can be determined within an area of less than 1,000 square kilometres. Four hydroacoustic stations are currently being installed.

Infrasound Stations

Sixty land-based infrasound stations will use sonar to detect atmospheric tests. Although at present infrasound is the least developed of all IMS technologies, the broader frequency ranges now available make it potentially very sensitive. A single station will usually consist of three or four microbarographs spaced about one kilometre apart to increase sensitivity and help determine the location of an event. Infrasound stations should be able to detect a one kiloton nuclear explosion within several thousand kilometres. The coverage of the network will be global and the network by itself will be able to determine the location of a nuclear explosion within approximately 1,000 to 10,000 square kilometres, depending on regional and weather conditions.

Three infrasound stations are complete; 13 more are being installed. The few stations operating have already demonstrated the capabilities of this technology: a Canadian infrasound station detected a space shuttle launch in Florida, some 2,500 kilometres away, while an infrasound station in Germany has detected the sound waves from the sonic boom of the Concorde aircraft over the Atlantic.[6]

Radionuclide Stations

Eighty radionuclide stations will measure radioactive particles in the atmosphere from atmospheric nuclear tests or underground tests which vent. Forty of these will also be capable of detecting relevant noble gases, such as argon-37, xenon-133 and krypton-85. Sixteen radionuclide laboratories will analyse filters from the stations, plus samples taken by inspectors. While the radionuclide network will be able to detect atmospheric nuclear explosions with a yield of less than one kiloton, its capability to detect underground nuclear explosions will largely depend on the degree of venting of nuclear particles. The network's ability to pinpoint the location of an event is relatively uncertain and will depend largely on the ability to model weather conditions before an event was detected. The main task of the network is not the detection and location of small nuclear explosions but helping distinguish between nuclear and non-nuclear events detected by other verification technologies.

Four radionuclide stations have been completed, while 15 are being installed. Certification will depend largely on the stations' capability for high sensitivity gamma spectroscopy. Radionuclide stations will have the capability to analyse samples and report the findings to the IDC. In case of suspicious findings, the samples will be taken to one of the 16 certified laboratories for detailed analysis.

The International Data Centre

Integrating data on a large scale from many different sources poses a completely new monitoring and verification challenge, but is likely to result in great synergies.[7] Thus, while seismic and acoustic detection technologies under specific circumstances might not

[1] The 1995 Principles and Objectives for Nuclear Non-Proliferation and Disarmament can be found at http://www.un.org/Depts/dda/WMD/1995dec2.htm.

[2] 'Working Group B Holds Eleventh Session,' *CTBT News*, no. 22, Provisional Technical Secretariat, Preparatory Commission of the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), Vienna, March 2000, p. 1.

[3] An overview over the planned scope of the IMS is given at http://www.ctbto.org/ctbto/verif.shtml.

[4] Provided they are not 'decoupled' by detonating them in existing underground cavities.

[5] Preparatory Commission of the Comprehensive Nuclear-Test-Ban Treaty Organization, Provisional Technical Secretariat, '1997-2000 Achievements', Presentation at seminar on 'CTBT Three Years On-Significance, Achievements, the Way Forward', Vienna, 4 April 2000.

[6] See Peter D. Marshall, 'Achievements of the CTBT, efficacy and benefits of the Treaty regime,' Presentation at seminar on 'CTBT Three Years On-Significance, Achievements, the Way Forward', Vienna, 4 April 2000.

[7] A good summary of synergies between the different IMS components is given in Larry S. Walker, 'A Systems Perspective of Comprehensive Test Ban Treaty Monitoring and Verification', *Sandia Report*, Sandia National Laboratories, Albuquerque, NM, Nov. 1996, SAND96-2740/UC-700.

provide enough conclusive data to reveal whether a large conventional explosion or small nuclear test has taken place, radionuclide stations might help clarify the nature of the event by detecting radioactive particles.

The IDC, which is being progressively commissioned, will receive and process data from all the IMS monitoring facilities. The network will use very small aperture terminals (VSATs) to ensure the swift and secure transport of up to 11.4 gigabytes of data between facilities, the IDC and states parties. By March 2000, VSATs had been installed at 25 IMS stations, National Data Centres and developmental sites. Thirty-seven more VSATs are being installed in the near future.

Three 'hubs', which receive data collected by different IMS stations in a specific region and send it to the IDC, are complete and now transmitting data from Germany (European hub), Italy (Atlantic and Indian Ocean hubs) and California (Pacific Ocean hub).

Data from seismic and acoustic stations will be collected in near real time and the information made available within a few hours to states parties. The IDC officially took responsibility from the provisional IDC in Arlington, Virginia, for collection and dissemination of data on 20 February 2000.

The PTS maintains that the IDC is 50 per cent complete, with about a hundred IMS stations reporting to Vienna and more stations expected on-line soon. During the first trial stage, 20 of these IMS stations are continuously transmitting data to the IDC.[8]

Data processing will be largely automated. After some delay, the second of four software releases for data analysis was installed at the IDC in late 1999. Radionuclide reports will be available with a delay of several days because samples have to be collected and analysed. New technologies currently being developed may automatise even this procedure.

The extent to which the IDC will make judgements about events detected remains unclear. Yet states without significant national technical and analytical means will naturally look to the IDC for more precise information once initial suspicions are aroused. It will be primarily the responsibility of states parties, in the forum of the future CTBTO's Executive Council, to decide whether an event is suspicious enough to warrant an on-site inspection.

ISSUES TO BE RESOLVED

Specifying Confidentiality Rules

Before the IDC starts to distribute data and products to member states on a large scale–including daily 'Fused Event Bulletins', *ad hoc* event bulletins and analyses of data–the precise handling of the 'confidentiality' provisions of the treaty will have to be decided. This has remained a controversial issue in the PrepCom. The treaty itself provides only that it is the duty of the Technical Secretariat to 'make available all data, both raw and processed, and any reporting products, to all States Parties' (Article IV paragraph 14.e). But it is unclear whether this excludes the possibility of making information available to others.

Scientific and humanitarian relief organisations are especially interested in receiving data from IMS stations. Data from the seismic network can provide early warning of earthquakes but is also of interest to seismologists to improve their ability to predict earthquakes and other natural phenomena. Hydroacoustic stations could give early warning of tsunamis, while infrasound stations could warn of volcanic eruptions.

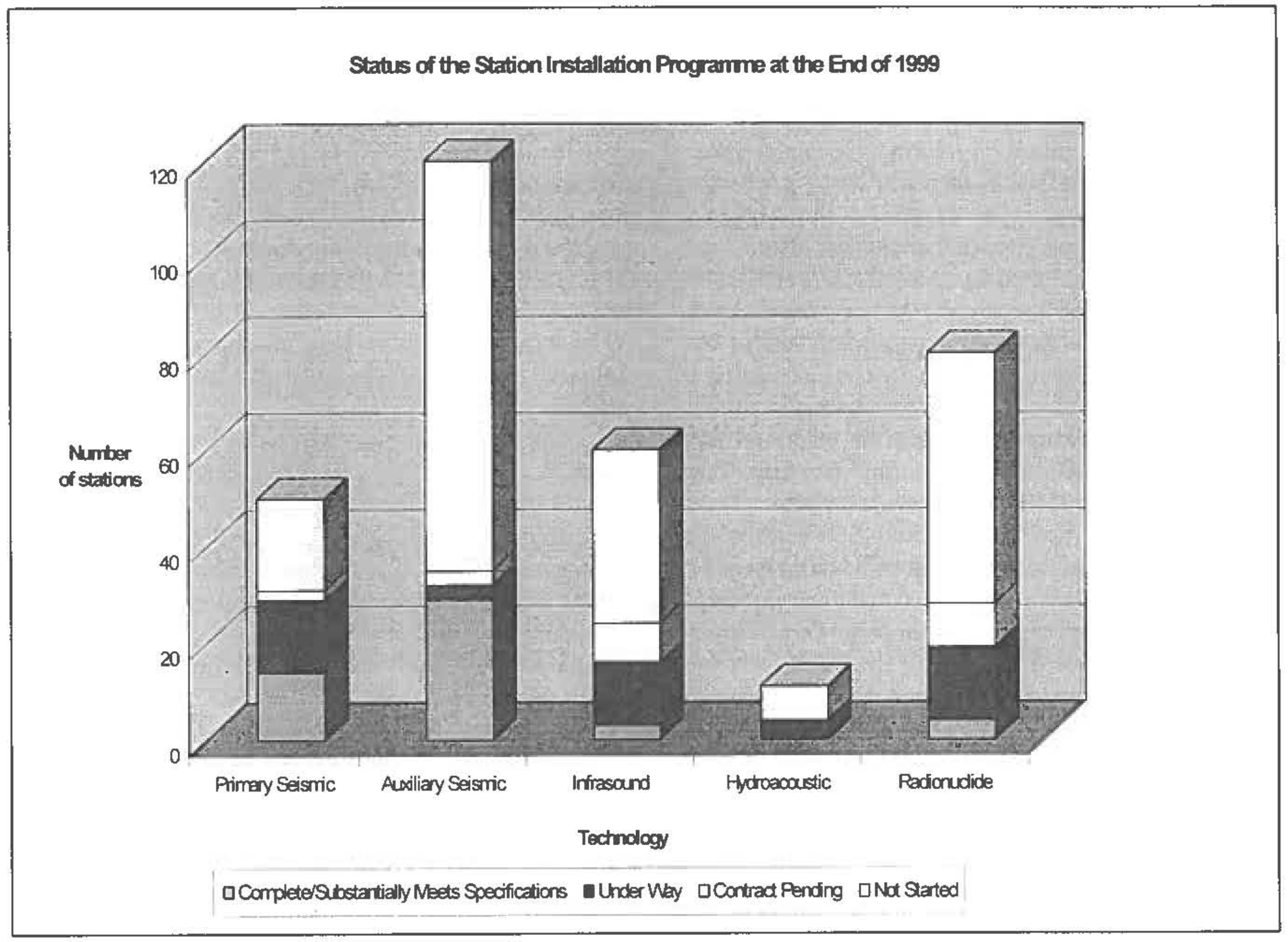
China and other states have taken a conservative position, arguing that access should be restricted to national governments. Some Western states and others are in favour of a more open policy, arguing that IMS data hardly has national security relevance. It will in any case be difficult to prevent 'leakage' of this data, since data centres in all CTBT member states will have direct access to it. In order to evaluate confidentiality rules, the PTS is planning a phased release of certain types of data to specific non-state recipients. Thus, humanitarian organisations could receive IMS data for disaster relief operations very quickly, while others would have only delayed access.

Developing an On-Site Inspections Manual

In parallel to setting up the IMS, the PrepCom is also laying the groundwork for on-site inspections (OSIs). OSIs may be mandated by the Executive Council of the CTBTO to clarify suspicious events detected by the IMS. The CTBTO will not have a standing OSI inspectorate, but will draw from a pool of trained inspectors nominated by member states. This pool needs to be geographically representative and large enough to supply a team of up to 40 inspectors within six days. Inspectors will require a diverse range of skills and the ability to work in harsh climates or terrain. By November 1999 one hundred and two participants had successfully concluded three introductory courses conducted by the PTS.

OSI teams will be permitted to spend up to 130 days on an inspected state's territory and will therefore require significant in-country support. Substantial

[8] 'CTBTO Preparatory Commission Three Years Old', Press Release, Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization, Provisional Technical Secretariat, Vienna, 17 March 2000.



amounts of portable equipment will also be needed, including geophysical and radionuclide equipment, drilling equipment, communications equipment and the means to conduct overflights.

The development of an Operations Manual for on-site inspections is proving one of the most difficult areas of the PrepCom's work, largely because too many fundamental issues were left unresolved by the treaty negotiators. While OSI provisions received insufficient attention during the early days when establishing the IMS was the first priority, in November 1999 the PrepCom took steps to speed up the development of OSI procedures. The budget for developing an OSI capacity was doubled and a group of Friends of the OSI Programme Coordinator was established, open to participation by all signatories, to draft an initial rolling text for an OSI manual.

This process faces several difficulties. First, there is no agreed understanding about the scope and the purpose of the manual. Israel, which is wary of intrusive OSIs for reasons unrelated to the CTBT, favours a minutely detailed manual which explains the purpose, methodology and parameters of the activities to be undertaken by inspectors. Others prefer a manual that outlines general responsibilities of the inspectors but leaves room for flexibility and, more importantly, is within the spirit of the treaty's OSI provisions. Any attempt to re-negotiate the CTBT through the backdoor of negotiations on the OSI provisions is a cause for concern.

Second, the development of the manual has until very recently depended on national contributions, since the PTS was not allowed to propose language for the manual. Fortunately, this is changing.

Third, the current drafting method, in which national contributions are simply compiled into a rolling text that now amounts to 1,000 pages, is too slow and ineffective. The small group of interested states involved has met once and is expected to meet just three more times this year.

Finally, there is a danger of linkage between completion of the OSI manual and entry into force of the CTBT. At least one state whose ratification is required for entry into force has argued that it cannot ratify the treaty as long as the OSI arrangements have not been agreed. It would be deplorable if disagreement over the least important element of the CTBT's verification system for day-to-day monitoring of compliance should delay entry into force.

STATUS OF IMPLEMENTATION

Completion of station establishment

After a slow start, the setting up of the required IMS stations is progressing steadily. In the early days of the PTS, many legal and bureaucratic hurdles had to be overcome before construction and/or certification of a station could begin. The PTS first had to establish the legal procedures for setting up stations and establish links with National Authorities and scientific co-operating partners in IMS participating countries.

The setting up of stations continues to be hampered by the slow process of signatures and ratifications. Another impediment is the complex certification process. In order to certify a station, the PTS has to be assured that technical specifications are substantially met and data from the stations can be authenticated. Finally, a proper link to the global communications infrastructure (GCI) has to be established. Setting up a new IMS station–from the planning stage to certification–takes at least two years.

Calibration of IMS stations has also been slow. Three conventional explosions have taken place to calibrate IMS stations, two in Kazakhstan and one in the Red Sea conducted by Israel. The test in Kazakhstan, in October 1999, was also used for an on-site inspection exercise by the PTS.

Legal frameworks

Certification of stations must be covered by an agreed legal framework, 'facility agreements or arrangements', between the PrepCom and host states. These must be approved by the PrepCom if they differ substantially from the model agreement provided by the Secretariat. The Executive Secretary of the PTS has urged those governments that have not yet negotiated facility agreements to do so.[9] So far, nine have been concluded, with Argentina, Australia, Canada, Jordan, Kenya, New Zealand, South Africa, Ukraine and the United Kingdom.

Meanwhile, some legal problems have been alleviated by temporary exchanges of letters that allow work to proceed. Two hundred and sixty-one IMS facilities in 59 countries were covered by some kind of legal arrangement by the end of February 2000.[10] In most cases the PTS has been able to establish whether station co-ordinates contained in Annex 2 to the Protocol to the CTBT are suitable. Site surveys for 196 IMS stations are complete.[11]

For about 30 stations, and one radionuclide laboratory, new sites had to be found when site surveys revealed that the co-ordinates given in Annex 2 were unsuitable. The reasons included excessive background noise or because the locations were at sea.[12] Infrasound station 59 on Hawaii had to be relocated because of potential volcanic activity and because it was within a state prison.

Costs

The 2000 PrepCom budget is $US 79.9 million, compared with $US 74.7 million in 1999 and $US 58.4 million in 1998. The collection rate for assessed contributions to the budget was approximately 95 per cent for the 1999 budget. This is a good record compared with most international organisations, but needs to be maintained.

The PTS' five-year plan envisages rising budgets over the next years, mainly because the costs of operating and maintaining stations, as well as for staff, will increase as the IMS nears completion. Annual operating and maintenance costs for the system once completed are estimated to be around $US 85 million. Setting up additional IMS stations will require additional funds.

While the PTS has generally accepted responsibility for the costs of operating and maintaining primary IMS stations after certification, a question remains as to whether the PTS will completely or partially pay the operating costs for auxiliary seismic stations after their certification. These stations are 'dual use' and mostly serve scientific purposes. They need to be certified by PTS, but will only report to the IDC on request (for example to clarify a suspicious event).

Some auxiliary stations are also nominated to back up primary stations in case they cannot report. If entry into force is substantially delayed, states might even decide to turn off stations already reporting to the IDC to save costs. At least one state has already threatened to do so. One way to resolve this question would be for the PTS to provide financial assistance to states having trouble funding their auxiliary stations.

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[9] CTBTO PrepCom document CTBT/PC-9/1/Annex III, 2 Sept. 1999, p. 8.

[10] Preparatory Commission of the Comprehensive Nuclear-Test-Ban Treaty Organization, Provisional Technical Secretariat, '1997-2000 Achievements,' Presentation at seminar on 'CTBT Three Years On–Significance, Achievements, the Way Forward', Vienna, 4 April 2000, p. 5.

[11] CTBTO PrepCom document CTBT/PTS/INF.233/Corr. 1, 8 Feb. 2000.

[12] CTBTO PrepCom document CTBT/PC-10/1/Annex II, 24 Nov. 1999.

The PTS 2000 Budget

($US 79.9 million)

- $US 40.2 million for establishing or upgrading IMS stations
- $US 12.6 million for the IDC
- $US 7.3 million for establishing the global communications infrastructure
- $US 2.8 million towards developing an on-site inspection capacity
- $US 13 million on administration.

Source: CTBTO PrepCom document CTBT/PC-10/1/Annex V '2000 Programme and Budget', Tenth Session, Vienna, 15-19 Nov. 1999.

Cost estimates for non-seismic stations made during negotiations on the CTBT have been consistently too low because expenditures for installation, especially in remote locations, were not taken into account and because little experience with novel monitoring technologies existed.

The 2001 budget projection calls for a moderate increase to $US 94.9 million. Some states, however, have already stated that they would not be in a position to accept the estimates for 2001.[13] Yet a static or shrinking PTS budget is hard to reconcile with the investment required to have the verification system fully functioning by entry into force.

THE ROAD AHEAD

According to Article IV of the CTBT, the IMS must be able to meet verification requirements at entry into force, six months after all the 44 states required to ratify the treaty have done so. From a legal perspective this requires that all three operational manuals–for the IMS, the IDC and OSIs–are ready for adoption by the first conference of states parties. Practically, it means that the verification is workable and has global coverage.

The PTS is now planning on the basis that the IMS will need to be completed by 2005. However, contingency plans exist should entry into force be achieved earlier. The CTBTO is evolving quickly into a fully-fledged international organisation. The PTS as of 17 March 2000 employed 221 staff from 67 signatory states–more than two-thirds of its eventual size. Even though the PrepCom's two Working Groups (on financial issues and verification respectively) and the PrepCom itself still define the parameters of PTS work, the Secretariat is gradually becoming more independent. Since October 1999, when the Article XIV Special Conference took place in Vienna and the US Senate refused to agree to ratification of the CTBT, some progress on entry into force has been made. One additional state (Zimbabwe) has signed and five (Bangladesh, Chile, Lithuania, Macedonia and Turkey) have ratified. China and Russia have both submitted the CTBT to their parliaments for ratification.[14]

In the US, the Clinton administration has appointed retired Army General, John Shalikashvili, to lead a high-level task force 'to reach out to members of the Senate and to construct a path that will bridge any differences and ultimately obtain Senate advice and consent to the Treaty'.[15] While the US government has made clear it will not seek ratification of the CTBT this year, it is trying to lay the groundwork for ratification in the early stages of the next administration.[16]

Another good opportunity to promote further ratifications of the CTBT will be the PrepCom's second Regional Workshop, to be held in Beijing, China from 6 to 9 June 2000, on Technical Cooperation/Ratification. A third workshop is planned for Latin America in Lima, Peru in late November 2000.

Finally, signatories have to decide whether to hold another Article XIV Special Conference on facilitating entry into force. Since the Article XIV Special Conference in October 1999, Japan has consulted widely with states signatories and ratifiers. Although the Japanese have concluded so far that a majority under the present circumstances do not think it necessary to have another Special Conference this northern autumn,[17] this might change after the NPT Review Conference.

It is important that even if an Article XIV Conference cannot be convened this year or early next year, pressure on the 'hold-out' states, both non-signatories and non-ratifiers, is maintained.

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[13] CTBTO PrepCom document CTBT/PC-10/1 'Report of the Tenth Session of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization', 24 Nov. 1999, p. 3.

[14] For a summary of the CTBT's verification system in October 1999 see Trevor Findlay and Oliver Meier, 'Not Quite Ready and Waiting: The CTBT Verification System', *VERTIC Briefing Paper 99/3*, Sept. 1999.

[15] Secretary of State Madeleine K. Albright, Statement on the Comprehensive Test Ban Treaty, Davos, Switzerland, 28 Jan. 2000.

[16] See Statement of General Shalikashvili at the 2000 Carnegie International Non-Proliferation Conference at http://www.ceip.org/programs/npp/shalikashvili2000.htm.

[17] Statement of Ambassador Nobuyasu Abe of Japan at seminar on 'CTBT Three Years On–Significance, Achievements, the Way Forward', Vienna, 4 April 2000.

RECOMMENDATIONS

The NPT Review Conference should:

- name those responsible for, and express regret at, the delay in entry into force of the CTBT
- express profound regret at the damage done by the Indian and Pakistani nuclear tests to the norm against nuclear testing
- call on those states that have not done so to sign and ratify the CTBT at the earliest possible date
- express support for the CTBTO PrepCom and PTS for their continuing work in establishing the CTBT verification system.

States which have signed and ratified the CTBT should maintain their political, technical and financial support for the CTBT verification system. This involves at least the following:

- a greater willingness to fund the establishment of the verification system at the higher levels envisaged prior to entry into force
- ensuring faster progress is made in determining the on-site inspection arrangements
- ensuring that the need for confidentiality is balanced with the transparency and confidence-building benefits from a wide distribution of IMS data and analyses.

Trevor Findlay is Executive Director of VERTIC. Oliver Meier is VERTIC's Arms Control and Disarmament Researcher.

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Fulfilling the NPT

Strengthened Nuclear Safeguards

by
Oliver Meier

April 2000

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Baird House
15/17 St. Cross Street
London EC1N 8UW
United Kingdom

Tel: +44 (0)20 7440 6960
Fax: +44 (0)20 7242 3266
Email: info@vertic.org
Web: www.vertic.org

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