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Test ban verification: technical progress confronts political uncertainty

Trevor Findlay and Oliver Meier

Over the past year political progress towards entry into force of the Comprehensive Nuclear Test Ban Treaty (CTBT) has slowed, even as the establishment of the treaty's verification system progresses.[1] Since 1997, when the Provisional Technical Secretariat (PTS) for the future Comprehensive Test Ban Treaty Organisation (CTBTO) commenced its work in Vienna, Austria, major technical milestones in implementing the system have been reached. The groundwork for the International Monitoring System (IMS) has been laid and the system in increasingly being put in place. The nascent Organisation is evolving rapidly into an effective and efficient international verification body.

But the CTBTO Preparatory Commission (PrepCom), which oversees the work, still has to overcome several political, financial and technical hurdles before its mission is accomplished. Some of these are simply a result of the novelty of the undertaking that the PrepCom is engaged in—the establishment of a global, multilateral treaty monitoring regime that will be on round-the-clock lookout for the tell-tale signs of a clandestine nuclear test. There are, however, now more ominous signs that uncertainty about entry into force is beginning to affect the PrepCom's work. Not only are there several states that are essential to entry into force which have not yet even signed the treaty—namely India, North Korea and Pakistan—but the US, under President George W. Bush's administration, has declared that it will not ratify the treaty in the near future. Moreover, the US has announced that it will no longer participate in non-IMS activity, most significantly the crucial preparations for on-site inspection, and will reduce its funding of the PrepCom commensurately. These set bad precedents for a preparatory process that has hitherto enjoyed uniquely strong political, financial and technical support from participating states.

Ultimately, effective verification of the CTBT will depend on the interplay between the official verification system, the additional scientific resources available to the international community that are able to provide data relevant to monitoring the test ban, and national technical means operated by states parties, including their own seismic and other remote monitoring systems as well as satellite imagery and intelligence gathering. This chapter focuses on progress being made in respect of the official, treaty-based verification system, although the other elements that will contribute to verifiability will be mentioned where relevant to the official system.[2]

Progress in establishing the CTBT's verification regime

The three components of the CTBT's verification regime are the IMS, the International Data Centre (IDC) and the on-site inspection (OSI) arrangements.

The International Monitoring System

The IMS will consist of 321 monitoring stations and 16 radionuclide laboratories located in some 90 countries. Four types of station are to be established—seismological, infrasound, hydroacoustic and radionuclide.

The seismic network will form the core of the system. Seismic waves generated by earthquakes, explosions or other phenomena will be detected using 50 primary and 120 auxiliary seismic stations distributed worldwide. Sixty land-based infrasound stations will use sonar to detect atmospheric tests. In addition, 11 underwater hydroacoustic stations are being set up while 80 radionuclide stations will measure radioactive particles in the atmosphere from atmospheric nuclear tests or underground tests that vent. Sixteen radionuclide laboratories will analyse filters from the stations, as well as samples taken by inspectors.

After a slow start during the early years, when the legal and political foundations for the new system were being established, the completion of the IMS is now making good progress. The PTS was able to achieve most of its targets for 2000. By August 2001, 291 IMS facilities in 70 countries were covered by some kind of legal arrangement.[3]

As of mid-2001, 258 site surveys for IMS stations had been completed. Construction was under way or a contract under negotiation for 113 stations. Forty-one stations belonging to the primary network and 62 auxiliary stations had been

Status of IMS station installation programme

Station type	Certified[1]	Complete[2]	Underway	Pending[3]	Not started
Primary seismic	5	20	9	0	21[4]
Auxiliary seismic	0	60	8	5	47[5]
Infrasound	1	7	16	6	31
Hydroacoustic	0	2	3	0	6
Radionuclide	5	9	15	18	38

NOTES 1 Meets PTS technical requirements; 2 Substantially meets specifications; 3 Contract pending; 4 Thirteen of these stations are operational but require upgrades. The remaining eight do not yet exist; 5 Twenty-five of these stations exist but require a major upgrade. The remaining 22 do not yet exist. Information correct as at 31 December 2000.

SOURCE CTBT/PC-14/1/Annex III, 24–26 April 2001, pp. 2–4.

completed or substantially completed. In some cases, the surveying of station sites and the resulting correction of locational co-ordinates was taking longer than expected. By August 2001 the PrepCom had still not reached agreement on changing the co-ordinates for eight stations.[4] Slow progress in station certification is a continuing problem. By July 2001 only 12 stations had been certified as eligible to become part of the IMS.[5] Because of practical difficulties in bringing stations up to the standard required for certification, the PTS had to adjust its projections: in mid-2000 it had projected that around 80 stations would be certified by the end of 2001, but a year later this had fallen to just 32.[6]

The International Data Centre

All information from IMS stations is transmitted to the IDC via the Global Communications Infrastructure (GCI). The IDC receives the data, processes it and distributes it to the national authorities that member states are required to establish. All CTBT states parties are entitled to receive raw data and/or filtered information as they wish.

Waveform data from the seismic, infrasound and hydroacoustic stations is processed automatically. It is the IDC's responsibility to screen out events which are clearly of natural origin. A large percentage of earthquakes, for instance, occur at depths at which it is impossible to conduct clandestine nuclear tests. By applying

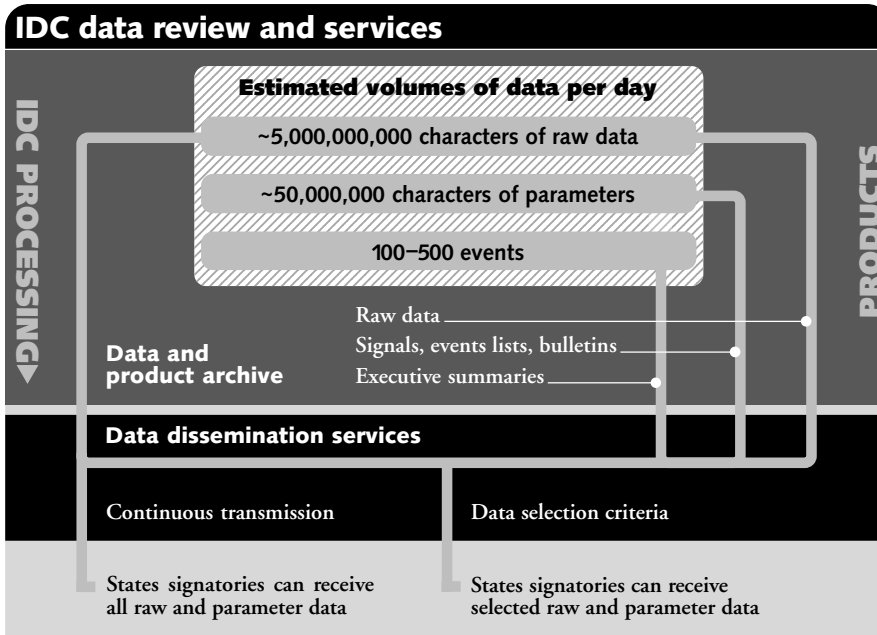
screening criteria to the vast amount of data received, the number of potentially suspicious events can be reduced. The product—so-called Standard Event Lists—are reviewed by human analysts, who produce Reviewed Event Bulletins (REBs). Because radionuclides take much longer to be collected and analysed, this takes place on a different timescale.

The IDC will issue Standard Event Bulletins which will indicate the degree to which each detected event meets specific screening criteria.[7] States without significant national technical and analytical means will naturally look to the IDC for more precise information if suspicions are aroused concerning a particular event. The IDC is expected to assist any state party in the technical analysis of IMS data as well as of data provided by other states parties.[8]

Since 21 February 2000, when the IDC took over from the provisional IDC (PIDC) in Arlington, US, its products have been produced regularly, although only on the basis of data from a few stations and with delays and gaps in reporting. As of August 2001 the centre was receiving about five gigabytes of data per day from IMS stations. Member states received, on average, 21,000 segmented data and product deliveries per month from the IDC.[9] The REB reported, on average, 52 events a day.[10] Over the course of 2000, 74 IMS stations were sending data to the IDC, but only 16 were transmitting data over the GCI. Data availability for all stations at the end of the year reached an average of 80 percent, but was higher (about 91 percent) for stations transmitting via the GCI.[11]

As more stations deliver data to the IDC on a near real-time basis, the centre will distribute data and products to member states on a larger scale. This has raised the question of whether the IDC, prior to entry into force of the treaty, should be expected to provide services to member states on a 24-hour, seven-days a week basis, thereby fulfilling the requirements for a fully operational IDC.

Three releases of IDC applications software, which filters and screens IDC data, have been successfully installed and tested at the IDC, the last one after some delay in June 2000.[12] One setback for the IDC is that, in line with the US decision in August 2001 to cut back its involvement in the non-IMS parts of the PTS' work (see below for details), the PIDC will no longer provide the software that it has been developing for the IDC, beginning with the so-called fourth release. However, the PTS has begun to set up a Software Integration Unit and budgeted US$1.8 million



SOURCE Preparatory Commission for the CTBTO, *Annual Report 2000*

in 2001 for external contracts for the development, maintenance and documentation of IDC software.[13]

In August 2000 the PrepCom took the unprecedented step of commissioning an external expert evaluation of the IDC's work to date. Led by Ian Kenyon, former Executive Secretary of the Preparatory Commission for the Organisation for the Prohibition of Chemical Weapons (OPCW), six international experts spent two weeks in Vienna examining the Centre's operations. Aspects considered by the evaluation team included the implementation of PrepCom guidelines; the overall state of the IDC and the GCI; the interaction between the IDC and other parts of the PTS, states signatories and the broader scientific community; and possible improvements in the scientific methods and software used by the IDC.

The report commended the IDC for the quality of its staff and its work, but identified some areas of concern. Specifically, the experts recommended that:

- the IDC reform its policy and planning procedures in order to plan its work better;
- the IDC (and the PTS as a whole) institute procedures to better assess the skills and performance of its staff (such as self-assessment exercises);

- the PTS create the position of 'verification czar' responsible for the operational management, integration and strategic planning of the verification function as a whole;[14] and
- the CTBTO strive to be an open organisation, co-operating with other national and international organisations to the make the most effective use of its resources, both to verify compliance with the treaty and for the common good.[15]

The review team's recommendations continue to be discussed in the PrepCom's Working Group B. A similar external review of the IMS by six outside experts is planned for late 2001.

On-site inspections

OSIs may be mandated by the Executive Council of the CTBTO to clarify suspicious events detected by the IMS or on the basis of information from national technical means (NTM) submitted by states parties.[16] The CTBTO will not have a standing OSI inspectorate but will draw on 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.

OSI teams will be permitted to spend up to 130 days in an inspected state's territory and will therefore require significant in-country support. Substantial amounts of portable equipment will also be needed, including geophysical, radionuclide, drilling and communications equipment.

In November 1999, realising that development of this component of the verification system was lagging behind, the PrepCom took steps to speed up the development of OSI procedures. Consequently, the budget for developing an OSI capacity was doubled. However, the process remains problematic. Preparing for on-site inspections has several, interrelated aspects:

- the development of an Operational Manual (OpsMan);
- the selection and training of future inspectors; and
- the procurement of equipment.

The Operational Manual

The OpsMan is to be a guide for on-site inspectors, detailing the rights and obligations of both the team and the inspected party. To draft a text for the manual, a

group of Friends of the OSI Programme Co-ordinator was established in November 1999, open to participation by all treaty signatories. This process did help identify contentious issues, but was unable to deliver a usable manual. An Initial Draft Rolling Text of more than 1,000 pages was compiled from all of the proposals received. By the end of 2000 it covered about 75 percent of the elements that need to be covered, but some crucial ones were still missing. For other issues, competing language was included. Delegations began discussing this text in June 2001 but were unable to reach compromises on key areas of dispute.

The drafting process faces several fundamental difficulties. First, there is no agreed understanding of the scope and purpose of the manual. Israel, which is wary of intrusive OSIs because they might reveal details of its particularly opaque nuclear weapons programme, favours a minutely detailed manual that explains the purpose, methodology and parameters of the activities to be undertaken by inspectors. Others, including the US, prefer a manual that outlines the general responsibilities of the inspectors but leaves room for flexibility and is within the spirit of the treaty's OSI provisions.[17] A second difficulty is the dependence of the drafting process on papers provided by national delegations rather than impartial technical contributions, including from the PTS.

To speed up the process, discussions on the OpsMan were brought into the PrepCom's Working Group B. In addition, in late 2000 the new position of Task Leader for the OSI Operational Manual was created. Since February 2001, Dutch Ambassador Arnd Meerburg has occupied the position. Moving the OpsMan discussions to Working Group B did not speed them up, however; on the contrary, by increasing the political salience of the negotiations it led to their becoming further politicised. The new Task Leader, moreover, was not able to convince delegations to move beyond line-by-line negotiations. Even though it would make it harder for some of the smaller delegations in Vienna to participate, some form of work on the OpsMan between sessions of the PrepCom is likely to be required.

The greatest threat to the development of a balanced, technically sophisticated and effective OSI regime came, however, in August 2001, when the US, in addition to announcing that it would no longer fund non-IMS activities, served notice that it would withdraw from the OpsMan deliberations. The comparatively large US delegation had contributed many crucial elements to the existing draft. Without

the US, the influence of those states that want to limit the freedom of inspectors to actively investigate suspicious events will grow. The US withdrawal is counter-productive even from the perspective of the treaty's opponents in Washington, since it delays the development of a mechanism that could produce the 'smoking gun' needed to prove that an illicit nuclear test has been conducted. Unless pro-verification states fill the gap left by the US, the result could be a regime that is less able to clarify suspected violations of the test ban.

Exercises and training

Meanwhile, the PTS is continuing to conduct exercises and mock OSIs to help develop the OSI regime. Two tabletop exercises have been conducted to test procedures for fielding an inspection team. The second of these, held from 29 November to 1 December 2000, also involved the OSI Operations Support Centre, based at the PTS.[18] Slovakia will host an experimental mock OSI in October/November 2001.[19] Another trial, the timing and location of which remain confidential, will take place at a later stage.[20] Such trials have been successfully used in the development of the OSI arrangements for other regimes and have helped dispel exaggerated fears of the loss of confidential information.[21]

Training courses have also been conducted, including an OSI Experimental Advanced Course in Snezhinsk, Russia, which was used to further develop the training programme. By the end of August 2001, 170 experts had participated in introductory training courses, some of whom will be trained in advanced courses and participate in OSI exercises.[22]

Procurement of equipment

The slow progress of discussions on the OpsMan is hindering the procurement of OSI equipment. As long as the procedures for OSIs are unclear, the PTS can only procure certain types of equipment, including for passive seismic measurements, still and video photography, visual observation and position-finding, and low-resolution gamma search. But the procurement of other instruments, such as that for high-resolution gamma spectrometry and xenon detection, has been delayed because of disagreements about requirements.[23] For example, some states insist that certain equipment be 'blinded' so that it will only reveal data indicative of a nuclear explosion. Further, they insist that these limitations be incorporated

into the equipment's hardware (rather than simply encoded in the software). Such specifications are expensive and will unnecessarily prolong the procurement process.

The PTS has also started looking at the logistical requirements for future OSIs, for example, the facilities and arrangements at Vienna International Airport, for ensuring the rapid dispatch of on-site inspectors and equipment.

Challenges faced by the Preparatory Commission

The PrepCom for the CTBTO, which consists of representatives of states which have signed or ratified the CTBT, oversees the work of the Provisional Technical Secretariat. The Commission and its two working groups (Working Group A on finances and Working Group B on verification) each meet three times a year. It faces numerous challenges in fulfilling its mandate.

Entry into force

Five years after the CTBT was opened for signature, the completion of the verification system is overshadowed by the uncertain prospects of entry into force. This political uncertainty means that the PrepCom and the PTS are working against a shifting deadline, further complicating their already difficult task. At the same time it will become increasingly difficult to maintain political support for full establishment of the verification system if entry into force of the CTBT does not appear imminent.

As of 27 September 2001 an impressive roster of 161 states had signed and 81 had ratified the CTBT. However, 13 of the states listed in Annex 2 of the treaty as being required to ratify it before it can enter into force have still to do so. Three of the listed states, India, North Korea and Pakistan, have not even signed the treaty.

The key to entry into force is the US. Despite the longstanding involvement of the US in the negotiation of the CTBT, President George W. Bush, after a policy review, announced in February 2001 that his administration would not ratify the treaty in the near future. The administration has also taken several other steps to distance the US from the test ban, including:

- seeking legal advice on a possible withdrawal of the US signature: the State Department's advice was that the CTBT remains before the Senate despite the failed ratification vote on 13 October 1999.[24] Yet parts of the Republican leadership in Congress and in the administration still want to renounce US signature;[25]

Status of the 44 Annex 2 states

The ratifiers

Argentina, Australia, Austria, Bangladesh, Belgium, Brazil, Bulgaria, Canada, Chile, Finland, France, Germany, Hungary, Italy, Japan, Mexico, Netherlands, Norway, Peru, Poland, Romania, Russia, Slovakia, South Africa, South Korea, Spain, Sweden, Switzerland, Turkey, Ukraine, UK

The signatories

Algeria, China, Colombia, Democratic Republic of the Congo, Egypt, Indonesia, Iran, Israel, US, Vietnam

The non-signatories

India, North Korea, Pakistan

NOTES **As of 12 September 2001. Up-to-date information on signatures and ratification can be found at pws.ctbto.org.**

- sounding out US allies on their reaction to a US withdrawal: fortunately the reaction was apparently uniformly negative; and
- taking steps to shorten the lead time necessary for a resumption of nuclear testing at the Nevada Test Site.[26]

The US position has taken the pressure off other countries which are reluctant to sign or ratify. This is most obvious in the case of India and Pakistan, which have both stated that they will not stand in the way of entry into force but have taken no measures themselves to become state parties. A second conference of states signatories and ratifiers designed to encourage movement towards entry into force is to be held in November 2001 but is unlikely to have much practical effect.

All of this increases the uncertainty about the timing of entry into force and complicates the Prepcom's planning and work. The PTS has developed a Programme Option Memorandum for 2002–06 which describes several timelines for completion of the verification system. It has made 2005 the target date for completion of at least the IMS, even though this is not necessarily a realistic date for entry into force to be achieved.

Several states, including China and some Latin American countries, have begun to make a connection between the completion of the IMS and entry into force, especially with regard to costs. As stations are increasingly incorporated into the IMS, the PTS must absorb their operational and maintenance costs. Some delegations have therefore floated the idea of 'mothballing' part of the system until entry into

force. From a verification point of view, such proposals are short-sighted. Monitoring stations need to be maintained and operated continuously if they are to be ready for entry into force. In most cases a halt to the operation of stations would necessitate re-certification and only add to the costs of setting up the IMS.

Behind these questions looms the larger issue of what exactly will be required for the verification regime 'to be capable of meeting the verification requirements' of the CTBT at entry into force.[27] The bottom line among delegations seems to be that the completion of the three operational manuals—for the IMS, the IDC and OSIS—is necessary. But how much of the IMS itself needs to be operational is unclear. Although it is unlikely that all 321 stations will be ready in the near future, this should not prevent entry into force and will not be necessary to verify the CTBT with sufficient confidence. While this is not yet an urgent issue, developing realistic expectations of the system will make it easier to tailor the work of the PrepCom to the eventual political requirements.

Funding

The 2000 PrepCom budget was US$79.9m, compared with US$74.7m in 1999 and US$58.4m in 1998. The collection rate for assessed contributions to the budget was approximately 97 percent for the 2000 budget and more than 84 percent for the 2001 budget.[28] This is a good record compared with most international organisations and indicates a high level of continued international political support for the CTBT.

This hitherto impressive record is, however, threatened by the US announcement on 21 August 2001 that it 'will continue to participate in and fund only those

PrepCom 2001 budget [US$83.5m]

- US$43m for establishing or upgrading IMS stations
- US$12.9m for the IDC
- US$10m for establishing the global communications infrastructure
- US$2.3m towards developing an on-site inspection capacity
- US$15.2m on administration

SOURCE CTBT/PC-13/1/Annex V, 20–21 November 2000, p. 8

PrepCom activities directed to establishing and supporting the International Monitoring System including, to the extent required for IMS support, the International Data Centre and Global Communications Infrastructure'.[29] This new policy will apparently result in a 4.5 percent reduction in the US contribution, or US$900,000 annually, starting in 2002.[30]

The US move sets a worrying precedent for arms control and disarmament verification regimes generally because states normally do not attempt to dictate how their individual assessed contributions are spent. There is, moreover, traditionally an unstated understanding among signatories to any treaty which mandates the establishment of a new organisation prior to entry into force that in spite of the apparent tenuousness of their legal obligations they will work co-operatively on their joint endeavour. This includes providing the necessary financial support. The new US attitude disturbs this understanding. Failure to pay its assessed contributions in full and on time puts the US in technical non-compliance with its political, if not legal, commitments as a treaty signatory. Should the US allow its underpayments to accumulate, it runs the risk of losing its vote in the PrepCom.[31]

Other developments on the financial front are also of concern, including the questioning by some developing countries of the assumptions previously made about the funding levels required prior to entry into force. Debate appeared to be triggered by the agreement reached among UN member states in January 2001 on a new scale of assessment for financial contributions to the UN and its associated agencies from 2002. The new scale pegs the US contribution at 22 percent and redistributes the reduction among other countries.[32] Some states have argued that the PrepCom should continue to use the old scale of assessment or apply the scale of assessment for UN peacekeeping operations, which sets the US contribution of 25 percent.

Meanwhile, despite the questions raised by some states, the PTS continues to project the need for substantial budget increases over the next few years to fund both the operation of existing certified stations and the installation of new ones. These discussions are taking place while the PTS tries to establish the legal and financial rules for the operation and maintenance of IMS stations already certified. Like so many PrepCom issues, this is uncharted territory. No international organisation has ever operated such an elaborate network of monitoring stations. Working

Group B has, however, made some initial recommendations for the provisional operation and maintenance of IMS facilities.[33]

One controversial issue is whether the PTS should shoulder the operating and maintenance costs of the 120 auxiliary seismic stations envisaged. These stations will normally be used for non-IMS purposes but will transmit data to the IDC when there is a need to clarify a suspicious event. Some developing countries want the PTS to pay for the operation of these stations in the same way that it pays for the primary stations.[34] Papua New Guinea is the first state to have made a specific request in this regard. The emerging approach to this problem within the PrepCom is to deal with such requests on a case-by-case basis.

Growth and continuity

The PTS has grown consistently over the years and, as of June 2001, employed 254 staff from 68 countries, including 156 professionals. While the eventual size of the Organisation is not yet clear, by mid-2001 the PrepCom had approved the filling of 280 posts.[35]

The CTBTO was intended to be a non-career organisation and contracts were supposed to be limited to seven years. In 2004 the first contracts will expire and the PTS could lose key staff who in its infancy. If the PrepCom wants to avoid the loss of institutional memory and experience, it will soon have to initiate discussions about adjusting its tenure policy. In addition, the PTS is having problems in achieving gender balance. As of August 2001, 27 percent of all staff employed were women, but this percentage was much lower at senior levels.

Creating a transparent organisation

For a number of years the use of IMS data for purposes other than test ban monitoring has been a contentious issue in the PrepCom. IMS data could be used for a variety of other purposes, including scientific and humanitarian. Data from the seismic network are of interest to seismologists in improving their ability to predict earthquakes and other natural phenomena.[36] Hydroacoustic stations could give early warning of tsunamis, while infrasound stations could warn of volcanic eruptions.

Some states, including China, argue that the confidentiality provisions of the treaty imply that the distribution of IMS data should be restricted to states parties.

Some Western states and others favour a more open policy, arguing that IMS data have little relevance to national security. Indeed, unlike other verification regimes, IMS data are not confidential information provided by governments but scientific data collected and analysed by the international organisation itself. The US urges the immediate and complete release of all IMS data.[37] While the treaty itself obliges the Technical Secretariat to 'make available all data, both raw and processed, and any reporting products, to all States Parties', it also states that 'the provisions of this Treaty shall not be interpreted as restricting the international exchange of data for scientific purposes'.[38]

In order to test the confidentiality rules, the PTS has been planning a phased release of certain types of data to a limited number of non-state recipients. Thus, humanitarian organisations could receive IMS data promptly for disaster relief operations, while others would only have delayed access. The proposed test of a delayed release of certain types of IMS data beyond states parties' national data centres has not begun because of the continued resistance of more than one state party.

The evolution of the CTBTO as an open organisation is supported by the external review team that evaluated the IDC.[39] Such a development would not only enable the CTBTO to exchange information freely with the scientific and non-governmental community, but might also provide another political *raison d'être* for the IMS in addition to monitoring for nuclear explosions. It will in any case be difficult to prevent leakage of IMS data, since the data centres of all CTBT parties will have direct access to it.[40]

Conclusion

The PTS and the IDC have already demonstrated that, in principle, they will be able to fulfil their assigned role in verifying compliance with the CTBT. Completing the IMS and designing procedures for OSIS should not be technically difficult, given the necessary political, financial and technical support from states signatories and parties.

The fate of the CTBT's verification system is, however, ultimately dependent on the decisions of states that have not yet signed and ratified the treaty, since it cannot be truly operational until the treaty enters into force. Paradoxically, continu-

ing progress in completing the system may hasten entry into force by demonstrating its increasingly powerful capabilities, even when partially complete, thereby challenging the considerable scepticism that exists in some quarters, especially in the US. Demonstrable progress in establishing the system will also symbolise the political importance that the overwhelming majority of states attach to the CTBT. What is needed at this critical juncture, then is for such states to demonstrate their continuing commitment by increasing their political, financial and practical support for the earliest implementation of the treaty's unparalleled verification system.

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Endnotes

[1] For background on the evolution of the Treaty's verification system, see Oliver Meier, 'Nuclear Test Ban Verification: Work in Progress', in Trevor Findlay (ed.), *Verification Yearbook 2000,* Verification Research, Training and Information Centre (VERTIC), London, December 2000, pp. 25–41; and Oliver Meier, 'The CTBT Verification System: Entering Rough Waters?', *Briefing Paper 01/04*, Verification Research, Training and Information Centre, London, September 2001.

[2] For an argument in favour of exploiting the synergies between these different verification resources, see 'Report of the Independent Commission on the Verifiability of the CTBT', London, October 2000, www.ctbtcommission.org; and 'Findings and Recommendations Concerning the Comprehensive Nuclear Test Ban Treaty', Report by General John Shalikashvili (US, Ret.), Special Advisor to the President and Secretary of State, submitted 5 January 2001, Washington, DC, www.state.gov.

[3] Private communication.

[4] CTBT/PC-15/1/Annex II, 21–23 August 2001, pp. 27–28.

[5] See 'Background Document by the Provisional Technical Secretariat of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization prepared for the Conference on Facilitating the Entry into Force of the CTBT (New York, 2001)', CTBT-Art.XIV/2001/3, 5 July 2001, pws.ctbto.org.

[6] Peter Basham, 'The Current Status of the CTBTO International Monitoring System', background paper for the Independent Commission on the Verifiability of the CTBT, www.ctbtcommission.org.

[7] Protocol to the CTBT, Part I, Section F, para. 18.

[8] Protocol to the CTBT, Part I, Section F, para. 20.

[9] See pws.ctbto.org.

[10] CTBT/PC-14/1/Annex III, 5–16 February, 2001, p. 7.

[11] Preparatory Commission for the CTBTO, Provisional Technical Secretariat, *Annual Report 2000*, Vienna, April 2001, pp. 11–12.

[12] One positive effect of this development is that IDC staff now have the opportunity to alter and modify software according to their needs (private communication).

[13] Private communication.

[14] This recommendation, not universally endorsed by the PTS, was triggered by the apparent lack of communication between the staff operating the IMS and the IDC. The IMS and IDC directorates are now meeting monthly to improve co-ordination. See CTBT/PC-15/1/Annex III, 21–23 August 2001, p. 4.

[15] 'Report of the External Evaluation Team (Peer Review) on the International Data Centre', 2000, p. 3.

[16] Such data must be obtained, according to the Treaty, 'in a manner consistent with international law', implying that information obtained by espionage would be unacceptable.

[17] See Mordechai Melamud, 'Background Paper on On-Site Inspections (OSI) Main Elements and Expectations', submitted to the Independent Commission on Verifiability of the CTBT, www.ctbtcommission.org.

[18] CTBT/PC-14/1/Annex III, 5–16 February 2001, p. 15.

[19] This exercise will involve the testing of some equipment, such as the Seismic Aftershock Monitoring System (SAMS) seismometers as well as some of the procedures for dispatching an inspection team. See 'Government of Slovakia hosts On-Site Inspection Field Experiment and Equipment Testing Exercise', pws.ctbto.org.

[20] CTBT/PC-15/1/Annex III, 21–23 August 2001, p. 8.

[21] See John Hart, 'On-Site Inspections Across Arms Control and Disarmament Regimes', *Verification Matters,* no. 3, VERTIC, London, 2001, forthcoming.

[22] 'Background Document by the Provisional Technical Secretariat' for the Conference on Facilitating the Entry into Force of the CTBT, pws.ctbto.org, op. cit.

[23] CTBT/PC-14/1/Annex I, 24–26 April 2001, p. 14.

[24] Tom Shanker and David E. Sanger, 'Bush to Drop Nuclear Pact', *International Herald Tribune,* 9 July 2001, p. 3.

[25] In a letter dated 12 March 2001, the then Chairman of the Senate Committee on Foreign Relations, Jesse Helms, told Secretary of State Colin Powell that it 'is time for the Executive Branch to articulate a new policy on nuclear testing, to withdraw the US signature from the CTBT, and to terminate funding to CTBT organizations' (Jonathan S. Landay, 'Jesse Helms Pushes for U.S. Pullout of Nuclear Test Ban Treaty', *Knight Ridder Newspapers,* 29 March 2001, www.krwashington.com). On 4 April 2001, 10 Republican Senators publicly called on Secretary of Defense Donald Rumsfeld to end Defense Department efforts to implement the CTBT (see Letter from Senator Jon Kyl and nine other Senators to Secretary Rumsfeld against CTBTO, 4 April 2001).

[26] C. Bruce Tarter, the director of the Lawrence Livermore National Laboratory in California, said in an interview that US nuclear weapons scientists are looking at 'what it would take to do various kinds of tests on various time scales'. See Jonathan S. Landay, 'Bush Asks Scientists for Input on Resumption of Nuclear Tests', *Knight Ridder/Tribune News Service,* 28 June 2001.

[27] CTBT, Article IV.1.c.

[28] CTBT/PC-15/1/Annex IV, 21–23 August 2001, p. 4.

[29] Statement of the US representative, delivered at the 15th session of the Preparatory Commission for the CTBTO, Vienna, 21 August 2001.

[30] Phillip C. Bleek, 'White House to Seek Partial CTBTO Funding; Plans to Drop Support for On-Site Inspection', *Arms Control Today,* 31 August 2001, www.armscontrol.org.

[31] Paragraph 5 of the Resolution Establishing the Preparatory Commission (CTBT/MSS/Res/1), Annex, adopted on 19 November 1996 obliges all signatory states to annually meet their share, based on the UN scale of assessment, of the PrepCom. The resolution states that a 'State Signatory which has not discharged in full its financial obligation to the Commission within 365 days of receipt of the request for payment shall have no vote in the Commission, until such payment is received'.

[32] General Assembly Resolution A/RES/55/B-F, 22 January 2001.

[33] CTBT/PC-14/1/Annex II/Appendix V, 24–26 April 2001, p. 32.

[34] The Treaty states that the Technical Secretariat shall agree and co-operate to establish, operate, upgrade, finance and maintain monitoring facilities and radionuclide laboratories. Protocol to the CTBT, Part I, para. 4.

[35] CTBT/PC-15/1/Annex III, 21–23 August 2001, p. 3; private communication.

[36] The American Geophysical Union (AGU) and the Seismological Society of America (SSA) in September 1999 adopted a joint statement that called for all IMS data to be available without any restriction or delay. The International Union of Geodesy and Geophysics (IUGG) and one of its member associations, the International Association of Seismology and Physics of the Earth's Interior (IASPEI), passed resolutions in July 1999 requesting that 'open, free, and undelayed access be guaranteed' to all waveform data from the IMS. The expectation of free access to IMS data stems partly from the scientific community's involvement in the design and development of the IMS, which has been provided 'with the clear expectation that the data will be available not only for treaty monitoring, but also for scientific research and hazards mitigation'. See Letter of Gregory van der Vink (Director of Planning, IRIS Consortium), Terry Wallace (Professor, University of Arizona), Ann Meltzer (Professor, Lehigh University) and John Orcutt (Director, IGPP, Scripps Institution of Oceanography) to Dr. Vigdor L. Teplitz, National Security and International Affairs Division, Office of Science and Technology Policy, Executive Office of the President, 14 September 2001.

[37] US policy, adopted under the Clinton Administration, is to distribute IMS data without restriction. The US seeks the agreement of other signatories to make their data freely available to the public. See Gregory van der Vink and Terry Wallace, 'Open Data, International Law, and the Nuclear Test Ban Treaty,' *Seismological Research Letters,* vol. 70, no. 6, November/December 1999, pp. 663–665.

[38] CTBT, Article IV paras 14.e and 10.

[39] 'Report of the External Evaluation Team (Peer Review) on the International Data Centre', p. 3.

[40] In mid-2001, 340 users in 48 signatory states had access to IMS data. 'Background Document by the Provisional Technical Secretariat of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization prepared for the Conference on Facilitating the Entry into Force of the CTBT (New York, 2001)', CTBT-Art.XIV/2001/3, 5 July 2001, pws.ctbto.org.