

CTBTO Spectrum

CTBTO NEWSLETTER ISSUE 1 | DECEMBER 2002

Who we are

The Comprehensive Nuclear-Test-Ban Treaty bans all nuclear weapon test explosions. The Treaty is a cornerstone of the international nuclear non-proliferation regime. It opened for signature in New York on 24 September 1996, and today has achieved strong worldwide support.

The CTBTO Preparatory Commission is an international organization consisting of a plenary body composed of all States Signatories and the Provisional Technical Secretariat. It carries out the necessary preparations for the effective implementation of the Treaty, and prepares for the first session of the Conference of the States Parties to the Treaty after its entry into force.

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Introduction



It is my pleasure to introduce the first issue of *CTBTO Spectrum*, a new, biannual, public newsletter designed to inform the Preparatory Commission's specialized audiences and the wider public about the Comprehensive Nuclear-Test-Ban Treaty (CTBT) and the objectives and activities of the CTBTO Preparatory Commission. The newsletter's name reflects the wide range of themes with which the Commission deals, spanning topics from technical and scientific verification issues to international cooperation and the enhancement of global peace and security.

CTBTO Spectrum gives an additional dimension to the public face of the Provisional Technical Secretariat (PTS). It provides more in-depth information on the organization's activities and focuses on new developments in the build-up of the verification regime.

This first issue gives an overview of the status of the verification regime build-up and, as an overarching theme, it highlights the significant role of the Treaty in nuclear non-proliferation and disarmament. An interview with Sergei A. Ordzhonikidze, Secretary-General of the Conference on Disarmament, and a special feature article by Peter Marshall, an expert on seismology, focus on this theme. This issue also provides an update on the latest session of the Preparatory Commission, in addition to regular columns on verification science, the potential civil and scientific applications of the CTBT verification technologies and a column on the PTS staff, which introduces the PTS mission statement.

I believe that *CTBTO Spectrum* will advance understanding of the Treaty and provide new insights in the political, diplomatic and scientific context within which the Secretariat's work takes place.

Wolfgang Hoffmann
Executive Secretary
Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization

Notes & quotes

United Nations Study on Disarmament and Non-Proliferation Education

The United Nations Study on Disarmament and Non-Proliferation Education was the subject of a roundtable discussion attended by educators, students, non-governmental organizations, representatives of the United Nations (UN) system and government officials on 9 October 2002 at United Nations Headquarters. The UN Under-Secretary General for Disarmament Affairs, Jayantha Dhanapala, gave the opening address at the public launch of the study

According to the Group of Experts, the overall purpose of disarmament and non-proliferation education and training is “to impart knowledge and skills to empower individuals to make their contribution, as national and world citizens, to the achievement of general and complete disarmament under effective international control.” The study assessed the existing experience in the field, examined new aspects of the multilateral disarmament debate, questions of non-proliferation as applied to weapons of mass destruction and small arms, and worked out a series of practical recommendations for the promotion of disarmament and non-proliferation education and training.

Effective and successful disarmament education requires an active partnership between governments, international organizations and civil society, as the UN Secretary-General noted in his preface to the study: “Disarmament education seeks to inform and empower citizens to work with their Governments for positive change. I hope that Governments, the United Nations family, other international organizations, disarmament-related organizations, non-governmental organizations and others in a position to contribute will do their part to sustain the process of consultation and cooperation started by the Group of Experts, so that disarmament and non-proliferation education becomes an integral – and natural – part of the education of the next generation.” ■

“Effective and successful disarmament education requires an active partnership between governments, international organizations and civil society.”

which was later on submitted to the First Committee of the 57th General Assembly by the Deputy Minister of Foreign Affairs of Mexico, Miguel Marin Bosch. The study was prepared over the past two years by a Group of Experts, including ten governmental experts representing diverse geographical regions of the world, under the chair of Miguel Marin Bosch. The process of producing the study brought together for the first time representatives of international organizations such as UNESCO, OPCW, CTBTO, University for Peace, UNIDIR, non-governmental organizations and educational institutions.

Ministerial statement

A joint statement by the Foreign Ministers of 18 countries, including Russia, France and the United Kingdom, was issued on 14 September 2002 following a meeting on the margins of the United Nations General Assembly. The statement urges States that have not signed or ratified the Comprehensive Nuclear-Test-Ban Treaty (CTBT) to do so as soon as possible.

The Ministers said at the press briefing during which the statement was issued that the early entry into force of the Treaty was central to nuclear disarmament and non-proliferation objectives. “The prevention of the proliferation of materials, technologies and knowledge which can be used for weapons of mass destruction is one of the most important challenges the world is facing today. Additional international tensions have developed since the CTBT was negotiated, which make entry into force of the Treaty...even more urgent today. We affirm that the CTBT has an essential role to play in strengthening global peace and security”.

The Ministers called on all States to continue the moratorium on nuclear weapon test explosions and stressed the importance of maintaining momentum in building the verification regime. They stated that they will do all they can to make the Treaty a focus of attention at the highest political levels. ■

“The prevention of the proliferation of materials, technologies and knowledge which can be used for weapons of mass destruction is one of the most important challenges the world is facing today.”

United Nations General Assembly First Committee report

The First Committee of the 57th United Nations General Assembly, which covers disarmament and international security issues, has approved a resolution on the CTBT tabled by Australia, Mexico, New Zealand and 52 other countries, by a recorded vote of 125 in favour to one against (United States). Four states abstained (Colombia, India, Mauritius, and Syria). The resolution stresses that a universal and effectively verifiable Comprehensive Nuclear-Test-Ban Treaty is a fundamental instrument in the field of disarmament and nuclear non-proliferation. It urges all States to remain seized of the matter at the “highest political level” and to sign and ratify the Treaty without delay or conditions.



THE UNITED NATIONS GENERAL ASSEMBLY IN NEW YORK

An omnibus resolution by the New Agenda Coalition (Brazil, Egypt, Ireland, Mexico, New Zealand, South Africa and Sweden), entitled ‘Towards a nuclear-weapon-free world: the need for a new agenda’, contains a paragraph

concerning the CTBT which “underlines the urgency of the entry into force of the CTBT in the context of the progress in implementing the international system to monitor nuclear weapon tests under the Treaty.” The resolution was passed by 118 votes in favour.

“This Treaty is a crucial element in the non-proliferation regime. The longer we delay its entry into force, the greater the risk that nuclear testing will resume – and that in turn would make non-proliferation much harder to sustain.”

*United Nations Secretary-General Kofi Annan,
Conference on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty, New York, 11 November 2001*

During the General Debate, the importance of the conferences to facilitate the entry into force of the Treaty (Vienna 1999, New York 2001) was underlined and concerned States were called upon to sign and ratify as soon as possible. Several States emphasized the importance of maintaining a moratorium on nuclear testing. Some States also noted that “such a moratorium cannot replace the legally binding commitment represented by signing and ratification of the Treaty.” A number of States noted that in respect to the development of the CTBT verification regime encouraging progress has been achieved. Ninety-seven States are on board and an impressive international system has been established to deter and detect explosive nuclear tests. ■



Commission update

Report on the November 2002 session

The Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) held its Nineteenth Session on 11–15 November 2002 in Vienna under the chairmanship of Ambassador Liviu Aurelian Bota of Romania. Seventy-five Member States and one observer attended the session.

The report of the Executive Secretary

Mr. Wolfgang Hoffmann, Executive Secretary of the CTBTO Preparatory Commission, reported in detail on the progress achieved in the implementation of all Major Programmes of the Preparatory Commission. He pointed out that as of 8 November 2002, 63 States Signatories had paid their assessed contributions in full and 18 States Signatories had made partial payments, which resulted in a collection rate of 88,7% of the 2002 assessment of US\$ 83 091 100.

In international cooperation, Mr. Hoffmann mentioned *inter alia* the voluntary contribution by the Netherlands for the year 2003 and the holding of a training course by Japan in cooperation with the Provisional Technical Secretariat. These voluntary contributions by Member States are welcomed as positive signals for the continuing support of Provisional Technical Secretariat programmes and activities. ■

The plenary debate

The main focus of the plenary debate was on budgetary issues. Member States congratulated Niger and Botswana on their ratification of the Comprehensive Nuclear-Test-Ban Treaty. Several Member States expressed their appreciation for the signing of the relationship agreement between the Commission and the Agency for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (OPANAL). Further negotiations on possible cooperation agreements with other Nuclear Weapon Free Zone organizations were encouraged.

Conclusions

The Commission approved the budget for 2003 amounting to US\$ 88 581 700. As an indication of the maturity of the organization, the Member States decided, on a trial basis, to reduce the annual number of Commission sessions to two in 2003. Ambassador Javier Paulinich of Peru was elected as the next chairman of the Commission for the first half of 2003. Support was expressed for the convening of another Conference on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty in 2003 and for the continuing build-up of the global verification system. ■

Profile of the Chairperson of the Preparatory Commission



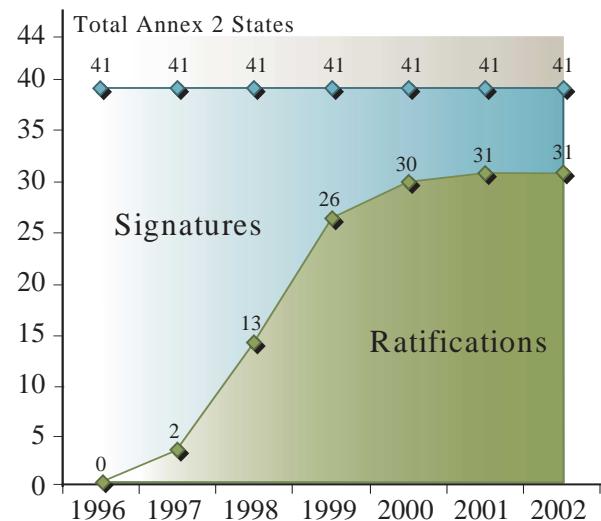
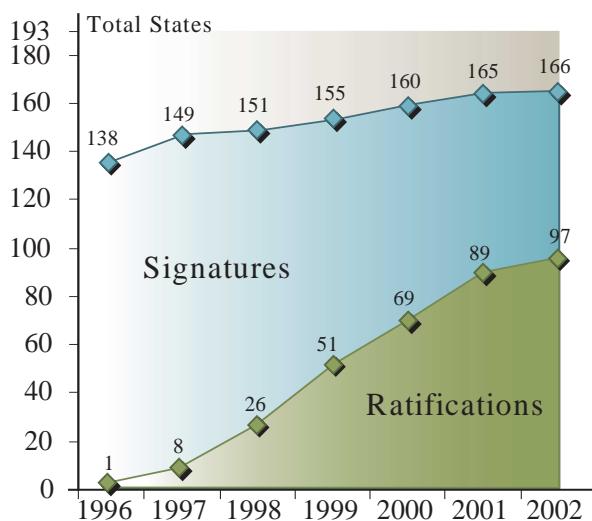
Ambassador Liviu Aurelian Bota, Permanent Representative of Romania to the International Organizations in Vienna, has served as Chairman of the Preparatory Commission for the second half of 2002.

Mr. Bota joined the diplomatic service in 1961 and spent several years as a member of the Permanent Mission of Romania to the United Nations in New York.

He also held several high-ranking positions in the United Nations system, including Director of the United Nations Institute for Disarmament Research (UNIDIR) in Geneva, Senior Advisor to the Undersecretary-General for Human Rights in Geneva and Head of the United Nations Mission of Observers to Tajikistan (UNMOT) and Georgia (UNOMIG).

In 2001 he served as Chairman of the Permanent Council of the Organization for Security and Cooperation in Europe. ■

Treaty signatures and ratifications



STATUS AS OF 28 OCTOBER 2002

TOTAL STATES 193

SIGNATORY STATES

RATIFYING STATES

NON-SIGNATORY STATES

■ 44 STATES LISTED IN ANNEX 2 TO THE TREATY

166	97	27
41	31	3

Secretariat snapshots

Mission Statement

The mission of the Provisional Technical Secretariat (PTS) is to support the efforts of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization – an independent, international, intergovernmental organization – in carrying out the necessary preparations for the effective implementation of the Comprehensive Nuclear-Test-Ban Treaty and in preparing for the first Conference of States Parties to the Treaty. The Treaty bans the carrying out of any nuclear weapon test explosion or any other nuclear explosion.

The PTS works to establish a global verification regime to monitor compliance with the Comprehensive Nuclear-Test-Ban Treaty. It builds, tests, and provisionally operates the International Monitoring System, the International Data Centre and the related global communications infrastructure, and prepares for on-site inspections. It provides timely data, assessments and other products and services to Signatory States of the Treaty. The PTS also conducts training programmes and undertakes other outreach work in support of the Treaty.

The international, multicultural staff of the PTS demonstrate the highest standards of professional expertise, efficiency and integrity. ■



AS OF 4 OCTOBER 2002, 268 STAFF MEMBER FROM 67 COUNTRIES STRIVE TO FULFIL THE PTS MISSION.
THIS MULTINATIONAL STAFF COMPOSITION REFLECTS THE GLOBAL CHARACTER OF THE ORGANIZATION.



THE DIRECTORS OF THE FIVE PTS DIVISIONS HAVE EITHER DIPLOMATIC OR SCIENTIFIC BACKGROUNDS.
TOP ROW, LEFT TO RIGHT: PIERCE S. CORDEN (United States), Director, Division of Administration;
ZIPING GU (China), Director, Legal and External Relations Division
BOTTOM ROW, LEFT TO RIGHT: GERARDO SUAREZ REYNOSO (Mexico), Director, International Monitoring System;
RASHAD KEBASY (Egypt), Director, International Data Centre;
VLADIMIR KRIOUTCHENKOV (Russian Federation), Director, On-Site Inspection Division

Outreach activities

The PTS conducts a variety of activities focusing on enhancing the Treaty understanding of decision-makers and the general public, generating political support, encouraging international cooperation and building national technical capacities through training.

External relations

External relations outreach aims to ensure the entry into force of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) through signature and ratification by all Annex 2 States and to establish the global verification regime in cooperation with International Monitoring System (IMS) host States. It also works to encourage universal adherence to the Treaty and to enhance participation in the Commission's work.



PRELIMINARY SITE SURVEY OF A RADIONUCLIDE STATION IN EDEA (CAMEROON), AUGUST 2002.

The PTS furthers Treaty support through bilateral and multilateral initiatives. It organizes missions in order to stress the political and security value of the Treaty and to provide information on technical implementation aspects. Joint missions between the Legal and External Relations Division and the

International Monitoring System Division have proven an efficient tool to achieve these goals, as they combine technical and political aspects of the activities of the Commission. So far joint missions have taken place to Cameroon (August 2002) and Libya (October 2002).

International cooperation

International cooperation workshops and training programmes also play an important outreach role. Over 350 participants from more than 130 States have so far taken part in international cooperation workshops in venues around the globe. The most recent one, in Kenya in June 2002, brought together 20 States from East and Southern Africa. 25 Caribbean States are expected to participate in an international cooperation workshop that will take place in Jamaica in December 2002.

The Commission also organizes experts discussions, information visits for senior officials from developing States, equipment donation to assist in the establishment of National Data Centres (NDCs) and special training programmes for experts from developing States.



INTERNATIONAL COOPERATION WORKSHOP FOR STATES FROM EAST AND SOUTHERN AFRICA, NAIROBI (KENYA), 18–20 JUNE 2002.

Training

In order to build and operate the verification system efficiently, training is essential. All three verification Divisions offer training courses and programmes. The IMS arranges technical training programmes for IMS station operators and staff from NDCs. In November 2002, a two-week training course has taken place for technical staff of NDCs from 12 Member States on the use of software packages to utilize International Data Centre data and products. The On-Site Inspection Division holds training courses for potential inspectors and workshops to address technical matters related to on-site inspections.



NATIONAL DATA CENTRE TRAINING COURSE FOR TECHNICAL STAFF, VIENNA (AUSTRIA), 18–29 NOVEMBER 2002

The PTS is currently consulting with Member States on ways to enhance its training programmes. At the same time, it is taking steps to establish a centralized registry of training information.

IMS facility agreements and arrangements

In view of the numerous international agreements it concludes, the Preparatory Commission recently acceded to the 1986 Vienna Convention on the Law of Treaties between States and International

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In the spotlight

Sergei A. Ordzhonikidze

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Organizations or between International Organizations. The Commission has a large number of bilateral agreements and arrangements with States hosting international monitoring facilities for the CTBT.

International Monitoring System (IMS) facility agreements and arrangements are foreseen in the Treaty and are based on models adopted by the Commission to regulate the establishment and provisional operation and maintenance of the facilities. To date, the Executive Secretary has signed 22 such agreements and arrangements on behalf of the organization, of which 15 have entered into effect and two are applied provisionally.

Negotiating IMS facility agreements can take time. Early on it was realized that the Commission's programme of work could not wait for them to be finalized. The practice thus evolved for host States to authorize the necessary work by means of interim exchanges of letters, pending conclusion of the formal facility agreement. This has been a successful approach and legal arrangements in the form of IMS facility agreements, or exchanges of letters, now govern the Commission's activities at 309 of the 337 monitoring facilities in 76 of the 90 host States. ■



Mr. Ordzhonikidze, a Russian national and career diplomat, was appointed Director-General of the United Nations Office at Geneva in March 2002. He also serves as the Secretary-General of the Conference on Disarmament.

Mr. Ordzhonikidze joined the Soviet diplomatic service in 1969 and has held several positions at the Permanent Mission of his country to the United Nations in New York, including Deputy Permanent Representative. In Moscow he served as Deputy Chief of the International Legal Department of the Foreign Ministry and Director of International Organizations of the Foreign Ministry. In 1999, Mr. Ordzhonikidze was appointed Deputy Minister of Foreign Affairs.

Q: *The Comprehensive Nuclear Test-Ban-Treaty (CTBT) was negotiated at the Conference on Disarmament in Geneva between 1993 and 1996.*

Where do you as the Secretary-General of this Conference place the CTBT in the overall historic context of the Conference on Disarmament?

A: In the nuclear context, I place the CTBT in the logical, and I hope historical, chain that leads from uncontrolled nuclear proliferation to multilaterally agreed and verified elimination of all nuclear weapons. The conclusion of the CTBT in the Conference on Disarmament marked the completion of an important step in this process that essentially started with the negotiation of the Nuclear Non-Proliferation Treaty (NPT) in one of the Conference on Disarmament's predecessor bodies.

More broadly, I see the CTBT, together with the Biological Weapons Convention and the Chemical Weapons Convention, as a link in the fence that will ultimately keep out all weapons of mass destruction. The job of the Conference on Disarmament is to continue building this fence.

Q: *In the Final Declaration of the Conference on Facilitating the Entry into Force of the CTBT adopted in New York on 13 November 2001, 109 ratifying and signatory States affirmed "...that the conduct of nuclear-weapon test explosions or any other nuclear explosion constitutes a serious threat to global efforts towards nuclear disarmament and non-proliferation."*

In your view, what effect will the entry into force of the CTBT have on global non-proliferation efforts and the disarmament process?

“The entry into force of the CTBT would provide an immediate boost to both non-proliferation efforts and the whole disarmament process.”



A: The entry into force of the CTBT would provide an immediate boost to both non-proliferation efforts and the whole disarmament process. Most immediately, there would be a solid guarantee against the resumption of testing, backed up by confidence that any illegal testing would be detected. This would deliver many governments the assurance they need that the NPT regime is protected, and that their decision not to pursue nuclear weapons is justified.

of the Treaty can be detected in a timely and effective manner.

What political significance does the verification regime have in constraining the proliferation of nuclear weapons?

A: The verification regime is the teeth of the Treaty, and the political significance is that the teeth are sharp and strong enough to bite anyone who conducts a nuclear test explosion. For countries which do not have nuclear

What could be done in your opinion to further signature and ratification of the Treaty, in particular of these 13 outstanding Annex 2 States whose signature is still needed for the CTBT to enter into force?

A: To be frank, I think the main obstacle to entry into force of the CTBT is the lack so far of political commitment to the concept of the nuclear-test-ban by one of the nuclear weapon States. Without leadership from all five of the permanent members of the Security Council, we are unlikely to see the 13 outstanding Annex 2 States join anytime soon. So it is essentially a question of building political support for the test ban within the nuclear weapon States. I think it is important that other, smaller countries, who rely for their security on the guarantees contained in the NPT, make it clear how important it is to them – in pure national security terms – that the CTBT enters into force. This message needs to be delivered through all available channels: bilateral, regional and multilateral.

"The verification regime is the teeth of the Treaty, and the political significance is that the teeth are sharp and strong enough to bite anyone who conducts a nuclear test explosion."

Secondly, entry into force would restore confidence in multilateral security arrangements in general, and would boost efforts to negotiate further instruments for nuclear disarmament, such as a treaty banning fissile material production. I think there would also be very positive effects in other areas, such as biological weapons, where general scepticism and lack of political interest is detracting from the development of potentially important multilateral barriers to proliferation.

Q: The world witnessed over 2000 nuclear test explosions before the CTBT opened for signature on 24 September 1996. CTBT's global verification regime is the result of many years of negotiations led by an international Group of Scientific Experts at the Conference on Disarmament to ensure that non-compliance with the provisions

weapons, there is a strong disincentive to developing them – essentially, there is no chance that tested and reliable weapons could be developed undetected. For the countries which do have nuclear weapons, there are serious constraints to developing and expanding their arsenals. This in turn both reduces the pressure on them to keep up with their nuclear rivals, and represents an effective tool to prevent any non-nuclear State from developing a nuclear capability.

Q: 44 States listed in its Annex 2 must ratify the CTBT before it can enter into force. These 44 States formally participated in the work of the 1996 Conference on Disarmament and possessed nuclear reactors at that time. So far 31 Annex 2 States have ratified the Treaty.

In the meantime, it is vital that those countries which have ratified this international legal instrument, work energetically with the Comprehensive Nuclear-Test-Ban Treaty Organization to ensure that when the Treaty does enter into force, everything will be ready and will operate effectively. It will be all the more difficult to get the necessary political support where it counts, if interest and support is dissipating elsewhere. ■

Perspectives

CTBT – The Arms Control Holy Grail

by Peter D. Marshall, O.B.E.



With the signing of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) on 24 September 1996 the most significant step towards nuclear non-proliferation since the signing of the Nuclear Non-Proliferation Treaty was taken. The CTBTO Preparatory Commission which, together with its Provisional Technical Secretariat (PTS), is to establish all the facilities specified in the Treaty to enable States Signatories to verify compliance with the provisions of the Treaty, started work shortly afterwards. The CTBT contained an unprecedented technical verification package, including the establishment of a total of 321 seismological, hydroacoustic, infrasound and radionuclide monitoring stations in 90 countries – the International Monitoring System (IMS). In addition to the establishment of the IMS, the Preparatory Commission had to create an International

Data Centre (IDC) and to define the process required to conduct an on-site inspection (OSI).

The status of the IMS network

At the present time only part of the IMS is operational. The speed at which stations are installed is determined by a number of factors, including budgetary constraints and the availability of specialised equipment. What is

“The IMS is to earth scientists what the Hubble telescope is to astronomers or the latest atom-smasher to nuclear scientists.”

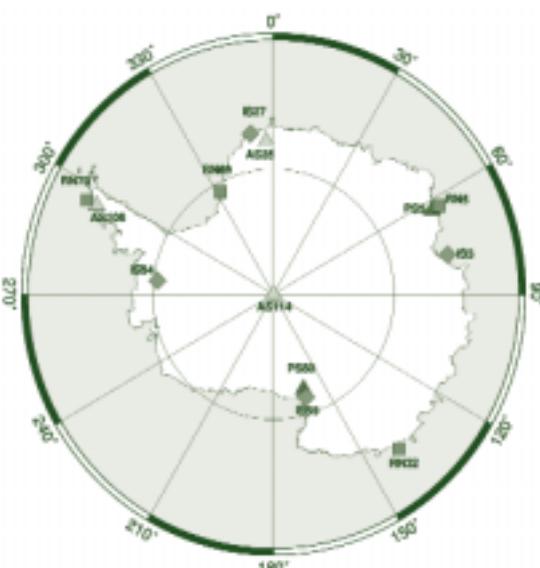
The build-up of the verification regime

The task of establishing the IMS and IDC systems, as well as the OSI procedures, is a major engineering and logistical challenge. Where no stations currently exist, a specific procedure, which can be very time consuming, must be followed. Agreements have to be negotiated with host States to allow PTS staff to enter that State's territory to carry out work. Once this has been done, site surveys are conducted to ensure that the proposed location is adequate for the purpose of Treaty monitoring. The next stage is to acquire the equipment – which for each of the technologies is of the highest specification – and arrange for its installation. A satellite communication link, part of the Global Communication Infrastructure (GCI), is set up to get the data to the IDC in Vienna. The IDC uses this data to prepare a bulletin of events detected and located for distribution within two days to all States who wish to receive it. These bulletins can be tailor-made to a State Signatory's individual monitoring requirements.

already clear is that the performance of the final IMS network for Treaty monitoring will significantly exceed the necessarily conservative estimates of the experts in Geneva who established the original specifications.

Other potential uses of the CTBT verification technologies

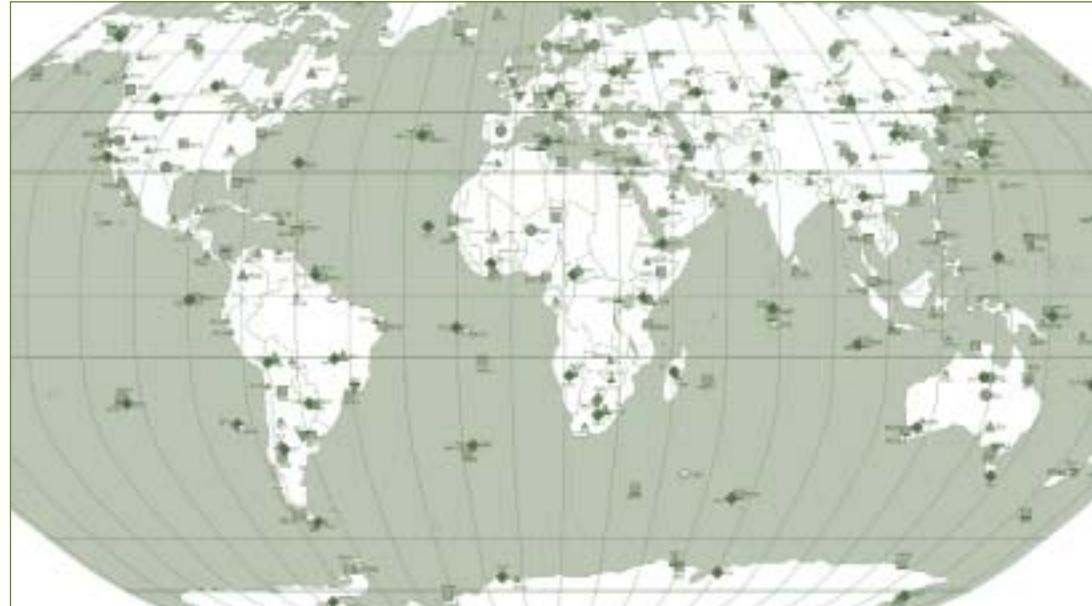
Once the IMS and the IDC are complete, the State Signatories will have access to a unique database. Much of this data could be of very significant value for a variety of scientific studies which would benefit mankind as well as provide assurance that the provisions of the CTBT are being adhered to. Earthquake hazard and risk assessment, monitoring of global warming, atmospheric and meteorological studies, early warning of the potential dangers of volcanic eruption and studies of pollutant and biological species are just a few of the studies which would benefit from timely access to the IMS data. The IMS is to earth scientists what the Hubble telescope is to astronomers or the latest atom-smasher to nuclear scientists.



OVERVIEW OF THIRTEEN IMS STATIONS LOCATED IN ANTARCTICA

The CTBT, arms control and nuclear non-proliferation

The CTBT can make a number of significant contributions to arms control but perhaps the most important is the establishment, upon entry into force, of a verifiable regime in which nuclear explosion tests are prohibited, thus arresting the development of new nuclear weapons. Growing international concern about the threats posed by the proliferation of weapons of mass destruction recognizes the CTBT as a major step forward in reducing such threats.



GLOBAL OVERVIEW OF THE 337 IMS MONITORING FACILITIES LOCATED IN 90 COUNTRIES

“With a verifiable CTBT in force the nuclear non-proliferation objectives of much of the international community will be significantly strengthened. All States Parties are provided with a reduced threat to their national security thus making the world a safer place for humankind.”

When the CTBT, often described as the Holy Grail of arms control, was signed, President Clinton described the event as “the longest-sought, hardest-fought prize in arms control.” Given that the first attempt to impose restraints on nuclear testing and thus control nuclear weapon development were made over 50

years ago, this is perhaps a very reasonable statement. With a verifiable CTBT in force the nuclear non-proliferation objectives of much of the international community will be significantly strengthened. All States Parties are provided with a reduced threat to their national security thus making the world a safer place for humankind.

The excellent work of the Preparatory Commission and its PTS will, with the entry into force of the Treaty, put an unprecedented brake on horizontal and vertical nuclear proliferation. However, there is still much work, both technical and diplomatic, to be done before the search for the arms control Holy Grail is over. ■

Biographical note

After several years working on ground shock from underground explosions, Peter Marshall became a founder member of the United Kingdom Forensic Seismology Research Group at AWE Blacknest and conducted research on the technical problems of test-ban monitoring. During more than 40 years of research up to his retirement in June 2002, he published over 100 scientific papers related to test-ban seismology. Peter Marshall acted as technical adviser to successive UK Delegations on test-ban treaty issues since 1975 and served as Chairman of the Expert Group during the 1994-1996 CTBT negotiations in Geneva. He is now enjoying a busy retirement.

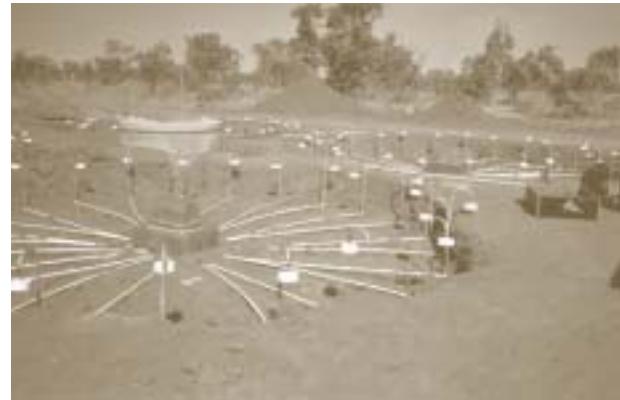
Verification highlights

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) includes a definition of a global verification regime to monitor compliance with the Treaty.

Establishing this regime, which must be capable of detecting nuclear explosions underground, in water and in the atmosphere, is the main activity of the Preparatory Commission for the CTBTO. The verification regime must be operational at the Treaty's entry into force. The regime consists of an International Monitoring System (IMS) supported by an International Data Centre (IDC), consultation and clarification, on-site inspections (OSI) and confidence-building measures.

monitoring stations in 90 countries that make up the "listening posts" of the IMS (see Figure 1).

Located in some cases in the most remote areas of the world, the stations use seismic, hydroacoustic, infrasound and radionuclide monitoring technologies.



CONSTRUCTION OF WIND-NOISE-REDUCING PIPE ARRAYS AT INFRASOUND STATION IS07 WARRAMUNGA (AUSTRALIA)

To date, site surveys for stations have been completed at 87 % of the sites. 137 stations (43%) are installed and substantially meet the Commission's specifications. PTS staff and numerous contractors around the world have worked in difficult environments to prepare the sites, construct the necessary infrastructure, purchase the equipment and install and test it.

Thirty-four IMS stations have so far undergone the formal process of certification. A certified station meets all the requirements necessary to become a recognized part of the IMS. This includes

meeting all of the technical specifications established by the Commission, ensuring that data are tamper-proof and authenticated, and that data are sent in an uninterrupted stream to the International Data Centre in Vienna over an official Global Communications Infrastructure (GCI) link.

Following certification, the PTS begins to pay the station operation and maintenance costs, usually through a contract with the local technical institution that has assisted with the establishment of the station. ■

IMS station status

The global network of stations which constitutes the International Monitoring System is unprecedented in the history of engineering. Stretching from the Arctic to Antarctica and from the Atlantic to the Pacific Ocean, it covers the entire earth. In 1997 work began on the 321

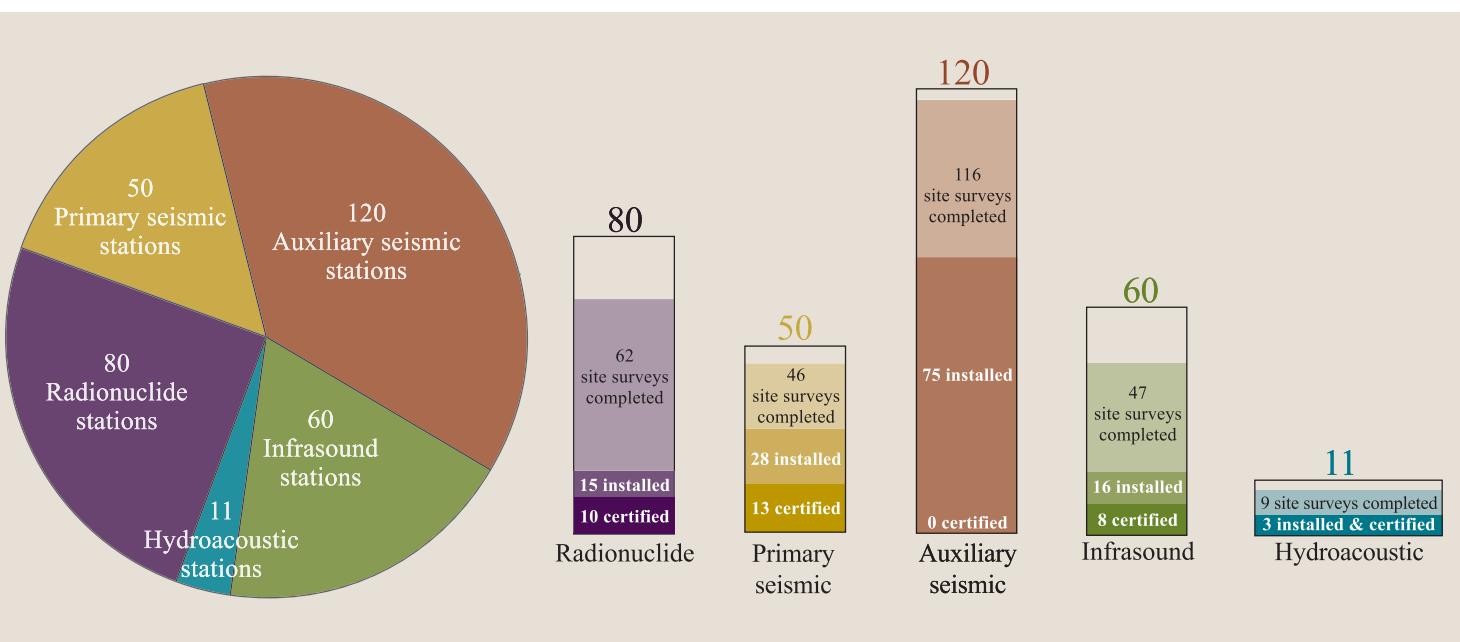


FIGURE 1. OVERVIEW OF IMS STATION STATUS AS OF 4 OCTOBER 2002

IDC and GCI activities

Data collected by the International Monitoring System is transmitted in near-real time via the satellite-based Global Communications Infrastructure to the International Data Centre in Vienna for processing and analysis.



ANALYST AT THE INTERNATIONAL DATA CENTRE IN VIENNA

The GCI is the first global satellite communications network based on Very Small Aperture Terminal (VSAT) technology. IMS facilities and Member States in all but near-polar areas of the world can exchange data via their local VSAT earth stations through one of the five geosynchronous satellites. The satellites route the transmissions to VSAT hub stations on the ground, and the data is then sent to the IDC by terrestrial communications links. As of October 2002, the GCI installation programme had completed 125 VSAT installations out of the planned total of 234.

Between February 2000, when Member States approved the experimental distribution of data and products, until October 2002, over one million such items have been distributed to over 400 authorized

users from 57 different Member States. Around 60,000 events such as earthquakes, mining blasts or volcanic eruptions, etc. worldwide have been detected and reported with minimal delay to Member States in the form of Reviewed Event Bulletins, the primary products derived from IMS data. By reviewing processed IMS radionuclide data, the IDC has detected and reported on nearly 200 CTBT-relevant radionuclides, or airborne radioactive particles. IMS data and IDC products continue to be successfully distributed to an ever increasing list of Member States. ■

On-Site Inspection activities and field experiments

On-site inspections are the final verification measure that can only be carried out once the Treaty has entered into force. An OSI clarifies whether a nuclear explosion has taken place in violation of the Treaty and gathers any facts which might assist in identifying any possible violator.



VISUAL OBSERVATIONS DURING THE ON-SITE INSPECTION FIELD EXPERIMENT IN KAZAKHSTAN,
17 SEPTEMBER–15 OCTOBER 2002

The major components of an OSI are an agreed Operational Manual, well-trained inspectors and approved equipment. On the request of any Member State and after approval by the Executive Council, an on-site inspection team of a maximum of 40 people must be on the territory of the Inspected State Party within six days and at the inspection site 36 hours thereafter. An on-site inspection may last up to 130 days and cover an inspection area of up to 1000 km².

The Preparatory Commission has given high priority to the elaboration of the draft OSI Operational Manual. An initial draft rolling text of the Manual was completed in 2001 and the production of the draft Manual, which must be approved by the Conference of the States Parties at its initial session, is currently a major task of the Commission. Various training activities, workshops, equipment testing, tabletop and field experiments have taken place. To further elucidate the inspection procedures and technical and logistical aspects of an OSI, field experiments were held in Kazakhstan (1999) and in Slovakia (2001).

Between 17 September and 15 October 2002, an extensive field experiment took place in Kazakhstan to test the initial phase of an OSI. Twenty-seven surrogate inspectors with OSI equipment were flown into the country in order to find 'evidence' of a hypothetical nuclear event in an area covering 400 km². The experiment will provide valuable data and insights for future OSIs. ■

Verification science

The network of the International Monitoring System (IMS) with its associated communications infrastructure and the International Data Centre (IDC) was designed by a Group of Scientific Experts at the Conference on Disarmament in Geneva to be fully capable of monitoring compliance with the Treaty. New research and improved communications technology continuously strengthens and refines the detection capabilities of the IMS. This column introduces some of the latest developments in the field of verification science.



The noble gas experiment – phase III

The IMS is currently carrying out the final stage of a three-phase experiment to test noble gas equipment. The experiment aims to develop appropriate instrumentation for deployment at radionuclide stations to measure radioactive xenon content in the atmosphere. To meet the IMS requirements for xenon measurements, existing

measurement devices need to be adapted and completely new technologies developed.

In phase I, xenon measurement systems were developed by four institutions located in France, Russia, Sweden and the USA that cooperate with

the Provisional Technical Secretariat for this purpose. During phase II of the experiment all four noble gas systems were located at a single laboratory to test their performance synchronously and to examine the correlation of the results. In the current phase III of the experiment, noble gas systems are being delivered to selected sites in four different global regions – Brazil (Rio de Janeiro), Norway (Spitsbergen), French Polynesia (Tahiti), and Southern China (Guangzhou). Phase III aims to assess how the systems operate under various climatic conditions. The systems must demonstrate their capability to operate automatically and reliably in the field. In addition, the achievement of secure and accurate data transmission from the noble gas systems to the IDC in Vienna is of particular importance for phase III. ■



NOBLE GAS SYSTEM DEPLOYED AT RADIONUCLIDE STATIONS RN27 IN PAPEETE (TAHITI)

Potential civil and scientific applications

The International Monitoring System uses seismic, hydroacoustic, infrasound and radionuclide monitoring technologies capable of detecting evidence of nuclear explosions in underground, in water and in the atmosphere in order to monitor compliance with the Comprehensive Nuclear-Test-Ban. These verification technologies, together with the data, technologies and products of the International Data Centre, have potential civil and scientific applications which can provide significant benefits to States and the international scientific community.

How IMS seismic data can support earthquake research

Access to IMS seismic data is one of the principal civil benefits available to Member States. The data, from a globally distributed network of modern seismic stations, could be used to improve the accuracy and timeliness of reports on potentially damaging seismic events, especially in countries lacking a national seismic network.



EARTHQUAKE AFTERSHOCK MONITORING MAP, IZMIT (TURKEY), AUGUST 1999

IDC bulletins can provide reports of the location and magnitude of large earthquakes rapidly and could also be used to support emergency response and relief efforts. IDC products can also be used to compute statistics on the

aftershocks following large earthquakes, and to provide estimates of the size and frequency of further aftershocks.

For example, the IDC has estimated the locations and magnitudes of several aftershocks that followed the main shock of the very destructive earthquake that took place near Izmit, Turkey, in August 1999. More recently, the IDC prepared special event analyses for 19 earthquakes that occurred over a six day period in January 2002 around Goma in the Democratic Republic of the Congo. These earthquakes were probably related to the volcanic activity observed during the same time period.



EARTHQUAKE AFTERSHOCK MONITORING MAP, GOMA (DEMOCRATIC REPUBLIC OF THE CONGO), JANUARY 2002

Studies of the earthquake process and studies of the structure and properties of the interior of the earth are the two principal fields of seismological research, and IMS seismic data may also contribute significantly to this field. High quality seismic data is required to study the distribution of stresses active at the earthquake source and the geometry and orientation of the causal fault. In addition, much of what is known about the structure and properties of the interior of the earth has come from studies of seismic waves passing through the earth. The IMS seismic stations provide thousands of seismic waves signals per day that have traversed all parts of the solid earth. This vast source of data can be used by scientists to improve our understanding of the earth's interior. ■

Vienna seminar

A seminar on the potential civil and scientific applications of the four IMS verification technologies, sponsored by the Permanent Missions of Australia, Japan, the Netherlands and the United Kingdom, took place at the Vienna International Centre on 15 October 2002. The seminar focused on the technologies' potential to assist national authorities and researchers in diverse scientific and civil fields, and was a follow-up to the senior experts' discussion on civil and scientific applications of the CTBT verification technologies held in London, 9-10 May 2002. Fifteen senior experts and scientists from thirteen States representing all six geographical regions of the Treaty had participated in the London discussion.



PRESENTATION BY PETER MARSHALL AT THE VIENNA SEMINAR, VIENNA INTERNATIONAL CENTRE, 15 OCTOBER 2002

Peter Marshall, a United Kingdom seismology expert and chairman of the London seminar, presented an overview of potential IMS technology applications in the fields of earthquake monitoring, tsunami prediction, monitoring of underwater volcanoes and ocean processes, and meteorology relevant to

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climate change and nuclear accidents, as well as the potential use of findings deriving from geological mapping conducted during an on-site inspection.

Mr. Marshall stressed the fact that all potential civil and scientific applications of International Monitoring System technologies depend on data availability. The International Data Centre processes IMS raw data and makes it available to States in the form of Event Bulletins. It is up to the States to make the data available for civil and scientific applications. Mr. Marshall underlined also the importance of

synergies with other technologies in the discussed fields, which have not yet been exploited.

Ambassador Liviu Aurelian Bota of Romania, Chairman of the Preparatory Commission, presented the concluding remarks. He encouraged further expert discussions, increased exchange of information and technical knowledge between States Signatories and increased State participation to upgrade national technological capacities. ■

Calendar of Meetings 2003

Preparatory Commission:

20th Session 24 – 27 June 2003
21st Session 10 – 14 November 2003

Working Group A:

23rd Session 10 – 13 June 2003
24th Session 29 September – 3 Oct. 2003

Working Group B:

20th Session 17 Feb. – 7 March 2003
21st Session 26 May – 6 June 2003
22nd Session 1 – 12 September 2003

Advisory Group:

20th Session 22 – 25 April 2003
21st Session 27 – 30 May 2003
22nd Session 22 – 26 September 2003

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Publications of the Provisional Technical Secretariat

The following publications are currently available in hard copy or can be downloaded electronically from our web site at www.ctbto.org:



2001 ANNUAL REPORT
of the Preparatory Commission for the
Comprehensive Nuclear-Test-Ban Treaty Organization

AVAILABLE IN ARABIC, CHINESE, ENGLISH, FRENCH, RUSSIAN AND SPANISH.



BASIC FACTS: SIX BOOKLET SERIES

Booklet 1: The Comprehensive Nuclear-Test-Ban Treaty (CTBT) at a Glance

Booklet 2: The Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization

Booklet 3: The Global Verification Regime and the International Monitoring System

Booklet 4: The Global Communications Infrastructure and the International Data Centre

Booklet 5: On-Site Inspections

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