CONFERENCE ON FACILITATING THE ENTRY INTO FORCE OF THE COMPREHENSIVE NUCLEAR-TEST-BAN TREATY

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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, 2005)

INTRODUCTION

1. The adoption of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) by the United Nations General Assembly on 10 September 1996 marked the successful conclusion of one of the longest negotiations in the history of arms control. The Treaty was opened for signature on 24 September 1996, when 71 States signed it. It is now approaching the status of a universal Treaty, with 175 Signatories. One hundred and twenty-two States, including 33 of the 44 States whose ratification is required for the Treaty to enter into force, have deposited their instruments of ratification with the Secretary-General of the United Nations.

2. On 19 November 1996, the Secretary-General of the United Nations, as the Depositary of the CTBT, convened a meeting of States Signatories in New York. The participating States adopted Resolution CTBT/MSS/RES/1 and the Text on the Establishment of a Preparatory Commission for the CTBTO (the "PrepCom Document") annexed to it, thereby establishing the Preparatory Commission and its Provisional Technical Secretariat (PTS) in Vienna. The PrepCom Document, which regulates the activities of the Preparatory Commission and the PTS, sets out the purpose of the Commission, namely to carry out the necessary preparations for the effective implementation of the CTBT and to prepare for the first session of the Conference of the States Parties to the Treaty. The Commission has created three subsidiary bodies: Working Group A on administrative and budgetary matters; Working Group B on verification issues; and an Advisory Group on financial, budgetary and administrative matters. Altogether 112 States are accredited to the Commission, and 108 States have designated their National Authorities or focal points.

THE TREATY

3. Under Article I of the Comprehensive Nuclear-Test-Ban Treaty:

> "1. Each State Party undertakes not to carry out any nuclear weapon test explosion or any other nuclear explosion, and to prohibit and prevent any such nuclear explosion at any place under its jurisdiction or control.

> 2. Each State Party undertakes, furthermore, to refrain from causing, encouraging, or in any way participating in the carrying out of any nuclear weapon test explosion or any other nuclear explosion."

4. Thus the CTBT prohibits all nuclear test explosions, whether for a military or any other purpose, as well as nuclear explosions for peaceful purposes. Unlike some of its predecessors, it covers all environments and does not set a threshold from which the prohibitions should apply. It is clearly stated in the preamble to the Treaty that its primary objective is "to contribute effectively to the prevention of the proliferation of nuclear weapons in all its aspects" and "to the process of nuclear disarmament".

ARTICLE XIV OF THE TREATY

5. Under Article XIV, the Treaty will not enter into force until it has been signed and ratified by the 44 States listed in Annex 2 to the Treaty. This list comprises States that formally participated in the 1996 session of the Conference on Disarmament, and that possess nuclear research and nuclear power reactors according to data compiled by the International Atomic Energy Agency. If the Treaty has not entered into force three years after the date of the anniversary of its opening for signature, a conference of those States that have already ratified it may be held to decide by consensus what measures consistent with international law may be taken to accelerate the ratification process and to facilitate the Treaty's entry into force. States Signatories will also be invited to attend the conference.

6. The first Conference on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty, convened under Article XIV of the Treaty, was held from 6 to 8 October 1999 in Vienna. A total of 92 ratifying States and States Signatories participated in the conference, which adopted a Final Declaration calling upon all States which had not done so to sign and/or ratify the Treaty (document CTBT – Art. XIV/1999/5). In the course of the follow-up to the 1999 conference and in accordance with paragraph 7(g) of its Final Declaration, Japan was selected "to promote cooperation to facilitate the early entry into force of the Treaty, through informal consultations with all interested countries".

7. A second such conference was held on 25-27 September 2001 in New York, with 109 ratifying States and States Signatories participating. A Final Declaration calling upon all States which had not done so to sign and/or ratify the Treaty (document CTBT – Art. XIV/2001/6) was adopted. In the course of the follow-up and in accordance with paragraph 12(g) of the Final Declaration, Mexico was selected "to promote cooperation to facilitate the early entry into force of the Treaty, through informal consultations with all interested countries".

8. A third conference was held on 3-5 September 2003 in Vienna, with 102 ratifying States and States Signatories participating. This conference adopted a Final Declaration calling upon all States which had not done so to sign and/or ratify the Treaty (document CTBT – Art.XIV/2003/5). The declaration includes Measures to Promote the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty. In the course of the follow-up and in accordance with paragraph 10(c) of the Final Declaration, Finland was selected "to promote cooperation, through informal consultations with all interested countries, aimed at promoting further signatures and ratifications". In addition, in accordance with paragraph 10(e) of the Final

Declaration, Ambassador Jaap Ramaker of the Netherlands was selected in the course of the follow-up as a Special Representative "to assist the coordinating State in the performance of its function in promoting the entry into force of the Treaty".

VERIFICATION REGIME

9. The CTBT provides for the establishment of a unique global verification regime that consists of an International Monitoring System (IMS), a consultation and clarification process, on-site inspections (OSIs) and confidence building measures (CBMs). Data from IMS stations are to be processed and analysed by an International Data Centre (IDC) established for this purpose.

10. The Treaty stipulates that the verification regime shall be capable of meeting the verification requirements of the Treaty at its entry into force. Hence, it is the responsibility of the Preparatory Commission and the PTS to ensure the timely build-up of the regime. The present document describes measures undertaken by the Commission and the PTS in accordance with their mandate.

INTERNATIONAL MONITORING SYSTEM

11. The IMS is to consist of a network of 321 monitoring stations and 16 radionuclide laboratories that, after entry into force of the CTBT, will produce data to detect possible nuclear explosions and provide evidence thereof to States Parties for verification of Treaty compliance. The locations of monitoring facilities, to be established or upgraded in some ninety countries around the world, are set out in Annex 1 to the Protocol to the CTBT. In order to provide global coverage, many stations are in areas that are remote and hard to reach. This poses engineering challenges unprecedented in the history of arms control. The IMS employs four verification technologies and the most modern methods available.

Monitoring Technologies

12. When a nuclear device is detonated, two basic phenomena occur – energy is released and physical products are created. The energy interacts with the environment and propagates as seismic or acoustic waves through the solid earth, ocean or atmosphere. The radioactive products are released into the surrounding medium and can leak into the atmosphere from underground or underwater.

13. The IMS uses seismic, hydroacoustic and infrasound monitoring technologies to detect the transient signals created when the energy is released. The radionuclide monitoring technology is used to collect air samples and analyse them for evidence of the physical products created and carried by the winds, including noble gases. The seismic, hydroacoustic and infrasound technologies, collectively called the waveform technologies, all utilize sensors which record signals from explosions and naturally occurring events. The waveform data provide diagnostic information to detect, locate and characterize the energy source. The radionuclide technology is based on air samplers which collect and analyse atmospheric particulate matter and noble gases.

Seismology

14. The seismological component of the monitoring system detects and locates seismic events. The seismic network will be composed of 50 primary stations, which will send their data in real time to the IDC in Vienna, and 120 auxiliary stations, which will make data available upon request from the IDC. The principal use of the seismic data in the verification system will be to locate and distinguish between an underground nuclear explosion and the numerous earthquakes that occur around the globe.

Hydroacoustics

15. Hydroacoustic monitoring detects acoustic waves produced by phenomena of natural or human origin in the oceans. The hydroacoustic network will comprise 11 stations and cover the world's oceans. Few stations are required because of the very efficient propagation of acoustic energy in the oceans. The data from the hydroacoustic stations will be used in the verification system to locate and distinguish between an underwater nuclear explosion and other phenomena, such as submarine volcanic activity and earthquakes, which also propagate acoustic energy into the oceans.

Infrasound

16. The infrasound network of 60 stations will use microbarometers (acoustic pressure sensors) to detect very low frequency sound waves in the atmosphere produced by events of natural or human origin. These stations are arrays of four to eight sensors which are located one to three kilometres apart.

17. The IDC will use infrasound data to locate and distinguish between an atmospheric nuclear explosion, natural phenomena such as meteorites entering the atmosphere, volcanic explosions and meteorological events, and phenomena of human origin, such as re-entering space debris, rocket launches and aircraft in supersonic flight.

Radionuclide

18. The radionuclide network of 80 stations will use air samplers to detect radioactive particles released from an atmospheric nuclear explosion or vented from an underground or underwater nuclear explosion. Half of these stations will have the dual capacity to detect both radioactive particles and noble gases.

19. The relative abundance of different radionuclides in air samples can be used to distinguish between materials produced by a nuclear reactor and those arising from a nuclear explosion. IMS radionuclide laboratories will analyse samples that are suspected of containing radionuclide materials that may have been produced by a nuclear explosion. The presence of specific radionuclides provides unambiguous evidence of a nuclear explosion. The presence of noble gases is particularly important in detecting releases from an underground nuclear explosion.

Establishing a Monitoring Station

Site Survey

20. The locations of the monitoring stations as specified in Annex 1 to the Protocol to the CTBT need to be verified by site surveys to ensure that they are suitable for establishing or upgrading and operating stations as part of the IMS. A site survey covers the physical and environmental characteristics of the site as well as the availability of infrastructure, such as roads and electricity, and of technical personnel.

Site Preparation

21. To prepare the site for the installation of equipment, civil work usually needs to be carried out, in accordance with the findings of the site survey. Site preparation may include the construction of shelters for instruments, the establishment of a suitable power supply, the erection of antennas or the laying of cables to communicate data from the sensors to the central site, and the installation of security fencing.

Equipment Procurement and Installation

22. The Commission has approved a set of technical specifications that monitoring stations must meet in order to be certified for inclusion in the IMS. All equipment for installing or upgrading a station is procured in accordance with the provisions of the Financial Regulations and Rules of the Commission.

23. Equipment is usually shipped directly from the manufacturer to the site for installation. It is installed by the supplier, by a knowledgeable local institution that is likely to operate the station, or by a third party contracted by the Commission. During installation, the manufacturer provides on-site training in equipment maintenance and operation to the designated station operator.

Current Status

24. The installation of the IMS is proceeding at a steady pace, with 209 (65%) of the stations essentially installed. One hundred and thirty (40%) of the stations and five (31%) of the radionuclide laboratories have been officially certified as meeting all the specifications of the Commission and have thereby been officially incorporated into the verification system. It is expected that up to 35 more stations and two more laboratories will be certified by the end of 2005, and another 70 stations are either under construction or under contract negotiation.

Post-Certification Phase

25. Once established and certified as meeting all technical requirements, most of the monitoring stations are operated by local institutions under contract with the Commission. The post-certification operation and maintenance (O&M) contract between the Commission and the station operator makes reference to the station operations manual, which will have a station-specific annex defining the standards to be met in station operation.

IMS Facility Agreements and Arrangements

26. The CTBT provides that States hosting international monitoring facilities and the PTS agree to cooperate in establishing, upgrading, financing, operating and maintaining monitoring facilities in accordance with appropriate agreements or arrangements. The Twelfth Session of the Commission (22-24 August 2000) adopted a decision calling upon States hosting international monitoring facilities which have not yet done so to negotiate and to conclude IMS facility agreements or arrangements, in accordance with their national laws and regulations, and as a matter of priority (CTBT/PC-12/1/Annex VIII). To date, 32 formal facility agreements or arrangements have been concluded in accordance with models adopted by the Commission (Table 1). Of these, 25 have entered into force and 2 are being applied provisionally. Legal arrangements in the form of facility agreements or arrangements, or interim exchanges of letters, have been concluded to regulate the Commission's activities at 326 of the 337 IMS facilities, hosted by 83 of the 89 host States.

Table 1. States with Which IMS Facility Agreements or Arrangements Have Been Concluded

Argentina	Israel[a]	Norway	Russian Federation[b]
Australia	Jordan	Oman[a]	Senegal[b]
Canada	Kazakhstan[a]	Palau	South Africa
Cook Islands	Kenya	Panama	Spain
Czech Republic	Mauritania	Paraguay[a]	Sri Lanka[a]
Finland	Mongolia	Peru	Ukraine
France	New Zealand	Philippines	United Kingdom
Guatemala	Niger	Romania	Zambia

[a] Agreement or arrangement has not yet entered into force.
[b] Agreement is being applied provisionally.

Alternative Locations, Names and Codes of IMS Facilities

27. An important question considered by the Commission and its Working Groups on an ongoing basis is that of alternative locations, names and codes of the facilities set forth in Annex 1 to the Protocol to the CTBT. Alternative locations, names and codes may be necessary, for example, where Annex 1 uses an incorrect name or code for an existing station, incorrectly locates a station or locates a station at an unrealistic site. The Tenth Session of the Commission (15-19 November 1999) decided upon the following legal procedures for introducing alternative locations, names and codes of monitoring facilities: (1) the procedure for the correction of errors before the entry into force of the CTBT in accordance with article 79, paragraph 2, of the Vienna Convention on the Law of Treaties of 1969; and (2) the procedure for introducing changes of an administrative or technical nature after entry into force in accordance with Articles IV and VII of the Treaty.

INTERNATIONAL DATA CENTRE

28. The mission of the IDC is to support the verification responsibilities of States Signatories by providing products and services necessary for effective global monitoring after entry into force of the Treaty. Prior to entry into force, its task is to establish and test

the facilities that will receive, collect, process, analyse, report on and archive the seismic, hydroacoustic, infrasound and radionuclide data from IMS stations. The build-up of the IDC is proceeding according to a seven phase Initial Plan for the Progressive Commissioning of the IDC, which was adopted at the Second Session of the Commission in May 1997 (CTBT/PC/II/1/Add.2). The development of the IDC is regularly assessed through tests that involve other parts of the PTS as well as States Signatories.

29. As of June 2005, there were 111 new or upgraded seismic, hydroacoustic and infrasound stations in IDC operations, together with a further 17 stations which have not yet been upgraded to meet IMS specifications. The number of radionuclide stations in IDC operations has doubled in the last two years to 36. Seven noble gas stations employing four somewhat different technologies have contributed to the International Noble Gas Experiment.

30. The IDC receives, processes, forwards and archives waveform data automatically on a continuous basis. Raw data are made available to States Signatories within a few minutes after an event occurs. IDC standard products, including integrated lists of all signal detections and standard event lists and bulletins, are prepared and made available to States Signatories in support of the development, testing and evaluation of IDC functionality and the development of National Data Centres (NDCs). Interactive analysis of waveform data is conducted during business hours to produce daily Reviewed Event Bulletins, which are normally made available to States Signatories for every day of the year within 10 days of data being recorded at a station for a particular event. Screening filters out those events that can be attributed to natural phenomena or to non-nuclear phenomena of human origin. Spectra from radionuclide stations are analysed and reported on. Executive summaries contain a summary of all events, results of the event screening and the operational status of the IMS.

31. A total of 703 users, nominated by 88 States Signatories, currently have access to IMS data and IDC products. A user can obtain data and products by setting up a subscription, submitting a request for data or products of special interest, accessing the IDC database directly or browsing and downloading from the IDC secure web site. Access is in most cases handled fully automatically by the IDC. During 2004, around 740 000 products or data segments were sent to users. Continuous IMS data can also be supplied to NDCs of States Signatories upon request, and 630 gigabytes of data were sent in 2004.

32. The PTS has invested in a computer infrastructure that serves the many functions of the PTS. The development, administration and operation of this infrastructure are managed by the IDC Division. The computer infrastructure hosts a range of information systems, which are custom-built for the PTS, commercially available off the shelf or open source. These information systems include administrative support systems (e.g. for the payroll, staff administration, accounting and travel management) and technical support systems (e.g. the IDC applications software, Public Key Infrastructure and station and equipment database). In addition, several web sites are deployed to support the work of the PTS (e.g. the public web site and Intranet).

33. In 2001, a mass storage system, using high density cartridges, was installed to keep all collected verification related data archived and accessible to States Signatories. With the help of the Center for Monitoring Research in Arlington, Virginia, United States of America, the PTS transferred historical waveform data to the mass storage system. The capacity of the system is currently 160 terabytes; this can be expanded to more than 240 terabytes. In

addition, all disk storage was consolidated into an 8 terabyte storage area network in 2003. Further consolidation of servers and continuous replacement of ageing hardware are under way.

34. As a result of the decision to migrate PTS information systems to an open source environment, the PTS has introduced the Linux operating system. Although some parts of the verification system software are still dependent on the Solaris operating system, efforts are being made to migrate to the largest extent feasible.

35. During the last two years, essential improvements have been carried out on methods and software for the four verification technologies. The main development in the waveform area was new software for processing infrasound data and for receiving and forwarding continuous data. Within the radionuclide area, a new system for interactive review of particulate spectra was developed that reduces the review time by more than a factor of 5. Software for analysis of noble gas data is being developed in five phases, the first two of which were completed with a contractor in 2005. Atmospheric transport analyses are now carried out with a system developed by the PTS and powerful client software has been developed for convenient post-processing directly by the NDCs.

36. In accordance with the decision of a special session of the Commission on 4 March 2005, the PTS has been exploring with national authorities and international tsunami warning organizations recognized by the United Nations Educational, Scientific and Cultural Organization (UNESCO) the potential value of IMS data and IDC products in tsunami warning efforts. To this end, data from selected IMS seismic and hydroacoustic stations are being forwarded in support of technical tests.

GLOBAL COMMUNICATIONS INFRASTRUCTURE

37. The Global Communications Infrastructure (GCI) of the PTS ensures the transport of data from IMS facilities to the IDC, and access to IMS data and IDC products by States Signatories. It collects data from the 337 IMS facilities and distributes them as well as IDC products to these States through a closed and secure worldwide satellite communications network. The GCI provides global two way data links from the IMS facilities, or NDCs, to the IDC in Vienna, and from the IDC to States Signatories. As many IMS stations are located in remote areas with harsh environments, the optimal and most reliable means of communication for data collection is by satellite links. Once it is fully operational, the GCI is expected to carry daily some 11 gigabytes of data, equivalent to over 4000 pages of information.

38. Many IMS stations and NDCs are connected by very small aperture terminal (VSAT) satellite stations on the earth to one of six geostationary satellites, depending on the geographical region. Additionally, special circuits have been installed to connect IMS stations in the polar regions. The satellites relay the data transmitted from the IMS stations and NDCs to one of six VSAT hubs. The data collected at these hubs are then transferred via a terrestrial frame relay network to the host processor at the IDC. This data-only network is closed, secure and inaccessible to any other organization.

39. The signing of the GCI contract in September 1998, for a period of 10 years and worth US$70 million, created the first global VSAT network of its kind in the world. The contract provides for turnkey services covering the design, manufacture, delivery, installation and O&M of the global network of VSAT satellite stations. After nearly seven years of the contract term, 6 VSAT hubs have been established and 196 VSAT stations installed at IMS facilities, NDCs and development sites. Currently there are 34 VSAT installations in preparation and site surveys have been completed for all of these. VSAT operating licences have been obtained for 201 sites. The PTS is working with States Signatories to obtain operating licences for a further 48 VSATs. A procurement process for the next GCI contract has been initiated.

JOINT PROGRAMMATIC ACTIVITIES

Provisional Operation and Maintenance

40. As the construction of the monitoring regime advances, the task of provisional O&M becomes ever more important. Since 2003, the PTS has been performing provisional O&M under more relaxed guidelines (in particular for data availability rates) than those expressed in the draft IMS and IDC Operational Manuals, which provide requirements for performance following entry into force of the Treaty. The Commission has approved the continuation of these relaxed guidelines until the end of 2006. Nevertheless, processes and procedures must be designed, tested and practised so that the standards prevailing after entry into force can be met.

41. Provisional operation of the monitoring system involves generation of data at the remote facility, transmission of the data to the IDC in Vienna, receipt and storage of the data, automatic and interactive processing of the data to create bulletins, and finally forwarding of data and products to States Signatories.

42. The PTS is further developing unified tools and processes to record and to track problems in the verification system and to monitor its state of health. The PTS Operations Centre provides the location for the human interface to these and other computerized tools. The Operations Centre has been functioning since April 2005, and the full system-wide integration of the tools will be completed in 2006. An incident tracking tool provides a mechanism to open an incident report on any and every data outage and to track the incident until resolution. A system for monitoring state of health provides status information on a wide variety of hardware and software items at remote facilities and in Vienna. The Operations Centre provides centralized monitoring and support functions and enables the efficient resolution of incidents, including the forwarding of information on more complex incidents to the appropriate party for resolution. The tools and processes of the Operations Centre generate O&M statistics which can be used for developing knowledge to allow the elaboration of policies to enhance performance and optimize costs.

43. Meeting the specifications and high operational availability requirements of IMS facilities poses unprecedented challenges. Many stations are located in parts of the world that are remote and difficult to reach. Increasing attention is therefore being paid to the arrangements for long term O&M of these globally dispersed facilities. There are many

activities under way to support the O&M of certified stations. Such activities are performed collaboratively by the PTS and States Signatories.

System-Wide Performance Test

44. In 2003 the Commission decided to conduct a system-wide performance test (SPT1) to measure the performance of the verification system and its component parts. It was determined that the earliest practical opportunity to begin the system-wide testing would be in mid-2004, since by that time about 40% of the stations in the IMS would be able to send data. By mid-2005 the percentage exceeded 50%, thus providing a representative sample of the IMS network.

45. The Commission therefore decided that SPT1 would be conducted in three progressive stages: a preparatory (developmental) phase of testing in May-June 2004, a performance testing phase in April-June 2005, and an evaluation and reporting phase in the second half of 2005.

46. The preparatory phase of SPT1 was completed in 2004. A total of 130 IMS stations and four certified radionuclide laboratories participated in the test. May 2004 was devoted to testing and assessing the procedures and performance metrics to be used during the 2005 performance testing phase. The PTS collected performance statistics and established a system-wide performance baseline under the current provisional mode of operation. In June 2004, procedures for the implementation of specific simulated 'failures' of selected system components were tested in order to examine the response of the overall system.

47. In April 2005, the performance testing phase of the SPT1 started, with the participation of 163 stations in all four verification technologies and five certified radionuclide laboratories. During June 2005, 21 test case scenarios were implemented on a controlled basis to analyse the response of the system. This test phase provided the framework and the data for further evaluation and assessment of the verification system, while contributing to the development of the draft IMS and IDC Operational Manuals.

48. The third phase of SPT1, scheduled for the second half of 2005, will focus on evaluation of and reporting on the performance tests. NDCs, IMS station operators and radionuclide laboratories are expected to play an active role in this phase.

49. The results and the experience gained during SPT1 will be used in technical and budgetary planning and in supporting the future development of the verification system.

ON-SITE INSPECTIONS

50. As a final verification measure, an on-site inspection (OSI) is provided for in the Treaty (Article IV.D). The OSI regime as defined by the Treaty is unique: every inspection will be a challenge inspection. Inspections are likely to consist of field activities with use of visual, seismic, geophysical and radionuclide analysis techniques. Instead of a permanent inspectorate, there would be a roster of potential inspectors nominated by States Parties. Experience gained and lessons learned in the context of other multilateral disarmament

treaties are of reference value, but the establishment of this regime will require its own method.

51. The Commission has been building up the OSI regime as part of the CTBT verification system in accordance with Treaty requirements. This requires the development of a draft OSI Operational Manual setting out the procedures for inspections, the designation of OSI equipment specifications, the acquisition of a limited amount of inspection equipment for testing and training purposes, the development of a long range training and exercise programme to prepare a cadre of potential inspectors, and the development and testing of specific OSI methodology.

52. In accordance with the objectives of the OSI strategic plan developed by the PTS, the Commission is planning to conduct a near full scale exercise. This would constitute a significant step towards achieving OSI operational readiness and effectiveness**.**

53. The development of the draft Operational Manual has taken place so far within the framework of Working Group B, the body responsible for verification issues. The first reading of the initial draft rolling text (IDRT) of the manual was completed in February 2005, producing an annotated draft rolling text (ADRT). The second phase of elaboration of the draft manual, based on the ADRT, is continuing under Working Group B, and is taking into consideration such aspects as the continued refinement of manual elements for testing in field exercises and the preparation of subsidiary documents to support the manual.

54. The initial concept of the OSI infrastructure as developed by the PTS and introduced to Working Group B includes an Operations Support Centre, a database and equipment storage facilities. The Commission has defined most OSI equipment specifications for the initial and continuation periods of inspection. A Seismic Aftershock Monitoring System (SAMS), a low resolution gamma monitoring tool and several instruments for visual observations have been procured and tested. Field demonstrations of geophysical equipment for shallow and deep investigations below the surface were conducted in 2003 and 2004, and another such field demonstration is planned for October 2005. The development of sampling and measurement equipment for the radioactive noble gases xenon and argon began in 2004. Further necessary work is planned in relation to SAMS.

55. Three inspection field experiments were successfully conducted in October 1999, September-October 2001 and September-October 2002. Lessons learned from the experiments create a basis for the development of OSI methodology and allow the testing of OSI procedures and equipment under realistic conditions, which will contribute to the elaboration of the draft Operational Manual. In this regard, the first directed exercise was conducted in 2004 to contribute to the further development of SAMS and a second such exercise took place in July 2005 to address overflight, gamma survey and environmental sampling issues.

TRAINING AND CAPACITY BUILDING ACTIVITIES

56. The PTS has developed a number of training and capacity building courses and workshops in various verification related disciplines in which trainees acquire skills to facilitate implementation of the Treaty at the national level. These training and capacity

building activities also enable trainees to contribute towards the enhancement of their country's scientific capacity.

57. By the end of June 2005, the PTS had organized 19 introductory training programmes (ITPs) on the IMS. In addition, 44 technical training programmes (TTPs) for station operators and managers on the different IMS technologies, more than 40 equipment provider and on-site training courses, and two workshops on the O&M of IMS stations had been conducted. The focus of IMS training is to train personnel involved in IMS station operation from the different geographical regions. A total of 597 trainees from 89 States Signatories have participated.

58. ITPs are designed to provide an overview of the Treaty, the operations of the PTS and the monitoring technologies. TTPs have the objective to provide station operators with in-depth operational, maintenance, troubleshooting and reporting procedures as well as hands-on training specific to each of the four monitoring technologies.

59. Training courses for NDC personnel are intended to provide information necessary for States Signatories to take greater advantage of the data, products and services available from the IDC and to provide training in the use of the software package that the IDC distributes to NDCs. The software has so far been distributed to 76 States Signatories. The training programme during the last two years has focused on regional training and joint IMS–IDC courses, when feasible. The aim of joint IMS–IDC training courses is to better coordinate PTS training programmes by illustrating the stages from monitoring to data processing and analysis.

60. Since 1997, the PTS has organized eight training courses for analysts, six training courses for NDC managers, of which two have been jointly organized by the IMS and IDC Divisions, and eleven training courses for NDC technical staff, five of which were jointly organized regional training courses by the IMS and IDC Divisions. In addition, six workshops have been held on aspects of data transmission through the GCI.

61. The PTS has conducted ten workshops to address technical matters related to the OSI regime. It has also organized nine OSI introductory training courses, in which 340 trainees from over 60 States Signatories have participated. Moreover, the PTS has held five curriculum building activities (experimental advanced courses) for the training of OSI inspectors after entry into force of the Treaty, as well as three field experiments and four tabletop exercises, to generate inputs for the draft OSI Operational Manual. The tabletop exercises, which simulate elements of an inspection, are aimed at testing procedures in the draft manual as well as developing training activities. These activities are based on a Long Range Plan developed for the training cycle of OSI inspectors after entry into force. The PTS has also carried out a number of OSI equipment testing activities.

62. In addition, a total of nine workshops on evaluation and four workshops on quality assurance issues have taken place so far.

63. The Commission also acts as an information clearing house, coordinating initiatives of the PTS and States Signatories to provide experts from developing States with training opportunities.

CONFIDENCE BUILDING MEASURES

64. As set out in Article IV.E, paragraph 68, of the CTBT, confidence building measures (CBMs) are meant to accomplish two primary objectives. The first is to "Contribute to the timely resolution of any compliance concerns arising from possible misinterpretation of verification data relating to chemical explosions". The second is of a more technical nature: "Assist in the calibration of the stations that are part of the component networks of the International Monitoring System". Part III of the Protocol to the Treaty outlines the voluntary nature of the CBM regime. The key components of this regime are data exchanges on single chemical explosions of 300 tonnes or more of TNT-equivalent blasting material. Four separate measures are envisaged: (a) individual event reporting, (b) annual event reporting, (c) site visits and (d) calibration explosions.

65. At its Ninth Session, in August 1999, the Commission adopted "Guidelines and Reporting Formats for the Implementation of Confidence-Building Measures" and agreed on the establishment of a database on chemical explosions (CTBT/PC-9/1/Annex II, Appendix IV), thereby creating the basic technical conditions for the implementation of the CBM regime after entry into force of the CTBT.

EVALUATION

66. The evaluation of the establishment and provisional operation of the CTBT verification regime is conceived by the Commission as an integral component of the regime. The PTS evaluation policy is to frame, coordinate and integrate systematic self-assessment by the various parts of the organization and to ensure continuous improvement.

67. SPT1 provided the opportunity to develop an assessment framework for the provisional operation of the verification regime focusing on the products and processes of the PTS, and to commence the development of the basic tools for systematically monitoring, recording and improving (e.g. on the basis of trend analysis) the performance of the verification system. NDC evaluation workshops represent a fundamental mechanism for obtaining feedback from States Signatories, as 'customers' of the PTS, on PTS products and services.

68. Under the Evaluation Major Programme, work is in progress to review the PTS quality management system, which covers all processes of the organization with the aim of continuously improving their effectiveness and efficiency, thus permeating the whole organization as a single integrated system. This integrated approach to all processes and their interconnections, together with a hierarchical system of metrics relating to key organizational processes, products and resources, and strategic and quality objectives, has as its aim a result based management system linking the quality of delivered products with the performance of the organization. To help achieve quality objectives and find opportunities for improvement, the PTS will progressively verify that processes are executed and products are produced and delivered in compliance with the specified levels of quality, and that controls on input, processes and products are implemented as specified.

PROVISIONAL TECHNICAL SECRETARIAT

69. The PTS opened its offices in Vienna on 17 March 1997. Mr Wolfgang Hoffmann served as the first Executive Secretary of the Preparatory Commission from 3 March 1997 until 31 July 2005. Mr Tibor Tóth was appointed by the Commission as the next Executive Secretary for a four year term beginning on 1 August 2005. As of 30 June 2005, the PTS comprised 269 staff members from 69 countries. The number of staff in the Professional category was 175. There were 45 women in Professional positions, corresponding to 25.7% of the Professional staff. The PTS is committed to a policy of equal employment opportunities. The approved Budget for the Commission for 2005 was for the first time split between US dollars and euros and amounts to $51.0 million and €42.5 million. As of 14 July 2005, 79.0% of the dollar part and 83.0% of the euro part of the 2005 assessed contributions had been received. The collection rates had reached 95.2% for 2004 and 95.3% for 2003.

70. From 1997 up to and including the financial year 2005, total budgetary resources approved for the Commission amounted to $643.3 million and €42.5 million. In US dollar equivalents, calculated using the 2004 budgetary rate of exchange of US$1:€0.93167, these amounts correspond to $689 million. Of this total, $549.1 million, or over 79.7%, has been dedicated to verification related programmes, including $239.6 million for the Capital Investment Fund (CIF) for the installation and upgrade of IMS station networks. Budgetary resources approved to date for the CIF represent about 84% of the estimated requirement for fully financing the completion of the networks. Other verification related funds are used to finance the IDC and activities in the OSI and Evaluation Major Programmes. The PTS has made constant efforts to maintain non-verification-related funds at a low level relative to total budgetary resources. In 2005, 20.1% of the budgetary resources were allocated for non-verification-related activities.

71. In its bilateral interactions to assist States in promoting the entry into force and the universality of the Treaty, the PTS has placed emphasis on the 44 States whose ratification is necessary for the Treaty to enter into force, as well as on the 89 States hosting IMS facilities. In addition, activities to enhance understanding of the Treaty have been undertaken in Africa, the Caribbean and the Pacific, where signature and ratification are lagging behind. Between the 2003 Conference on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty and 31 July 2005, the CTBT was signed by seven States (Afghanistan, the Bahamas, Eritrea, Rwanda, Saint Kitts and Nevis, the Sudan and the United Republic of Tanzania) and ratified by 18 States (Afghanistan, Bahrain, Belize, the Democratic Republic of the Congo, Djibouti, Eritrea, Honduras, Kyrgyzstan, the Libyan Arab Jamahiriya, Liechtenstein, Rwanda, Saint Kitts and Nevis, Serbia and Montenegro, Seychelles, the Sudan, Togo, Tunisia and the United Republic of Tanzania), including one of the Annex 2 States (the Democratic Republic of the Congo). In this period the Executive Secretary visited four Annex 2 States: China, the Democratic Republic of the Congo, Indonesia and Viet Nam.

72. Twelve regional international cooperation workshops have been held to date: in Baku (Azerbaijan), Beijing (China), Cairo (Egypt), Dakar (Senegal), Istanbul (Turkey), Lima (Peru), Nadi (Fiji), Nairobi (Kenya), Saint Ann (Jamaica) and, since September 2003, in Kuala Lumpur (Malaysia), Pretoria (South Africa) and Tunis (Tunisia). These workshops have stressed the importance of national implementation measures and the signature and ratification of the Treaty. Two additional workshops are planned for the second half of 2005,

one in Guatemala for States from Latin America and the Caribbean, and the other in the Republic of Korea for States from South-East Asia, the Pacific and the Far East.

73. The PTS stresses the benefits of participation in the Treaty not only from the security aspect, but also in the civil and scientific applications of the verification technologies, in accordance with Treaty provisions. In this regard, the PTS has assisted the organization of senior experts' meetings on civil and scientific applications of CTBT verification technologies, the first of which was held in London, United Kingdom, in 2002. Since the 2003 Conference on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty, two further experts' discussions have been held in Sopron, Hungary (2003), and in Berlin, Germany (2004). The PTS also aims to enhance understanding of the significance of the Treaty and the work of the Commission, with a view to increasing the participation of States in this work and to advancing the signature and ratification of the Treaty.

74. Using voluntary contribution funds provided by States Signatories in support of the Commission's international cooperation and outreach activities, the PTS has organized several information visits to its premises in Vienna for policy and decision makers, scientific experts, and diplomatic representatives of signatory and non-signatory States. It has also assisted in the organization of national seminars in a number of non-ratifying States. Such activities have been financed thus far by the Czech Republic, the Netherlands and Norway. Many other States have also provided contributions in kind to enhance States' knowledge and understanding of the work of the Commission, applications of the verification technologies and the benefits accruing from membership of the Commission. These contributions have been provided in the form of hands-on training courses for NDC managers and station operators and support for national seminars to enhance awareness of the CTBT within the relevant parts of the respective governments.

75. The Commission has established close working relations with several international organizations. The first formal relationship agreement concluded by the Commission was the Agreement to Regulate the Relationship between the Preparatory Commission and the United Nations, which entered into force on 15 June 2000. Pursuant to the agreement, the PTS and the United Nations Secretariat regularly consult on issues of joint interest and the Commission also participates in the United Nations security arrangements in the field. Since then, the Commission has concluded relationship agreements with several United Nations agencies and regional intergovernmental organizations. Cooperation with these bodies has proved useful in implementation of the Commission's programme of work. The relevant organizations (together with the year in which the agreement was concluded) are: the United Nations Development Programme (UNDP) (2000), the World Meteorological Organization (WMO) (2001), the Agency for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (OPANAL) (2002), the European Centre for Medium-Range Weather Forecasts (ECMWF) (2003) and the Association of Caribbean States (ACS) (2005). It is expected that the Commission will continue, in response to the initiatives of States, to seek appropriate cooperation with other intergovernmental organizations. Following the example of the United Nations and other international organizations, the Commission acceded to the 1986 Vienna Convention on the Law of Treaties between States and International Organizations or between International Organizations on 11 June 2002.

76. The PTS has also established a programme of legislative assistance to States on national implementation measures to be taken in accordance with Article III of the CTBT. The

objective of this programme is to provide, upon request and within the limits of available resources, legislative assistance and advice to States on implementing the Treaty at a national level.

77. The fifty-ninth session of the United Nations General Assembly included an item on its agenda entitled "Cooperation between the United Nations and the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization" (agenda item 56r). The Executive Secretary addressed the General Assembly under this agenda item in October 2004. He gave a report on the activities of the Commission and on cooperation with the United Nations and its funds, programmes and agencies, and underlined the importance of international verification regimes in light of heightened concern about the proliferation of weapons of mass destruction.

78. The PTS also encourages and participates in multilateral conferences and meetings at the global, regional and subregional levels to further support the Treaty. The Executive Secretary and the Director of the Legal and External Relations Division addressed the First Committee meetings of the fifty-eighth and fifty-ninth sessions respectively of the United Nations General Assembly. The Executive Secretary also addressed the forty-seventh and forty-eighth regular sessions of the General Conference of the International Atomic Energy Agency (IAEA). Furthermore, the PTS has made contact with the secretariats of different regional organizations such as the African Union (AU), the Association of South-East Asian Nations (ASEAN), the Organization of American States (OAS), OPANAL, the Pacific Islands Forum (PIF) and the United Nations regional disarmament centres.

79. Several multilateral bodies have undertaken initiatives at the global or regional level to back the Treaty. At the global level, a Joint Ministerial Statement in support of the CTBT was launched by a group of countries on 23 September 2004 at the United Nations Headquarters in New York and has been submitted to the Secretary-General of the United Nations to be recorded as a United Nations document. To date, ministers from 70 countries have associated themselves with the statement. Resolutions entitled "Comprehensive Nuclear-Test-Ban Treaty" were adopted at the fifty-eighth and fifty-ninth sessions of the United Nations General Assembly. Moreover, the Fourteenth Ministerial Conference of the Non-Aligned Movement in 2004 expressed, in its Final Document, its support for the CTBT.

80. At the regional level, the thirty-fourth and thirty-fifth regular sessions of the OAS General Assembly, in 2004 and 2005, approved resolutions entitled "Inter-American support for the Comprehensive Nuclear-Test-Ban Treaty" in support of the objectives of the Treaty as well as its early entry into force. Also, at the Eighteenth Regular Session of its General Conference, in 2003, OPANAL adopted a resolution entitled "Comprehensive Nuclear-Test-Ban Treaty".

81. The new corporate identity of the Commission is now well established and is being applied to different media and documents in the PTS. The newsletter *CTBTO Spectrum*, issued twice a year, is now in its third year and enjoys a large subscription among States Signatories, academia, the media, disarmament groups and organizations and the wider public. The newsletter *CTBTO News* is sent to States Signatories after every session of the Commission and the Working Groups and is presently in its 64th edition. An exhibition on CTBT verification was produced and mounted at the 2003 Conference on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty. It was also successfully

remounted for the Twenty-First Session of the Commission. The exhibition, which comprised 17 display panels as well as examples of technologies used in the IMS, the IDC, the GCI and OSIs, provided an insight into the scope and capacity of the Treaty verification system, and was supported by photographs of IMS stations around the world.

82. New information material continues to be produced in support of outreach activities. Recent examples include four posters designed for use by Permanent Missions, NDCs, IMS facilities and other institutions that support CTBT related activities, and brochures geared towards a particular geographical region; to date three such brochures have been produced. In addition, standard information material continues to be updated. The PTS receives numerous press enquiries and conducts interviews with the media, as well as giving press conferences, briefings and presentations to States Signatories, the media, academia, non-governmental organizations (NGOs) and sections of the public. Close contact is maintained with the NGO communities in Vienna, Geneva and New York to promote the Treaty and the work of the Commission. The public web site has been expanded and is regularly updated. Press releases covering various topics, including the latest Treaty signatures and ratifications as well as developments in the build-up of the verification regime, continue to be issued.

83. In the administrative area of the PTS, the present focus is on the provision of support and services to verification programmes within the framework of constant budget and staffing levels. Extensive attention has been devoted to addressing both the financial and human resources of the PTS. On the financial side, the Commission has adopted a split currency appropriation and assessment system to mitigate exchange rate losses, and, on the human resource side, PTS management has been working to address anticipated turnover of Professional staff resulting from the limitation on length of service.