CTBTO
PREPARATORY COMMISSION

preparatory commission for the comprehensive nuclear-test-ban treaty organization

Annual Report 2010

www.ctbto.org

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comprehensive nuclear-test-ban
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The map on the back cover shows the approximate locations of International Monitoring System facilities based on information in Annex 1 to the Protocol to the Treaty adjusted, as appropriate, in accordance with proposed alternative locations that have been approved by the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization for reporting to the initial session of the Conference of the States Parties following entry into force of the Treaty.

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Message
from the Executive Secretary

Two thousand and ten symbolizes an end to a decade of unrelenting progress towards universalization of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) and operational readiness of its verification system. Equally, it heralds the beginning of a demanding future for the Treaty. This Annual Report, while offering an account of the activities and achievements of the CTBTO Preparatory Commission in 2010, attempts to briefly capture the salient features of our collective achievements since 2000.

During this period, the Commission experienced many challenges. Most notable among these challenges were to strengthen the international norm against nuclear testing, to build, operate and sustain an unprecedented worldwide international monitoring system, to constantly provide the States Signatories with a wide range of data and data products, and to respond to the declared nuclear tests by the Democratic People's Republic of Korea in 2006 and 2009, while working with a zero real growth budget and a fixed ceiling on its human resources.

However, I am pleased to note that, with a strong sense of purpose and determination, the Commission succeeded in turning these challenges into opportunities to emerge as a more robust organization.

As I am reporting to you, the Treaty has secured 153 ratifications, signifying a threefold increase since 2000, and 182 signatures. Equally, the political drive for entry into force of the Treaty, as an essential component of the nuclear disarmament and non-proliferation regime, has gained a powerful momentum.

There has been a rapid growth in the installation and certification of International Monitoring System (IMS) facilities. In this regard, the numbers are very revealing. At the beginning of 2000, there existed no certified facility. By the end of December 2010, the number of certified seismic, infrasound, hydroacoustic and radionuclide (both particulate and noble gas) stations and radionuclide laboratories stood at 267. This figure clearly implies extensive progress in network coverage and resilience as well as data availability. Station design, especially in the infrasound technology, has also evolved, resulting in a higher detection capability.

In the meantime, the activities and services of the International Data Centre have surged significantly. The increased volume of data and data products is indicative of this surge. The average daily number of events contained in the Reviewed Event Bulletin grew from 50 in 2000 to more than 100 in 2010. With further expansion of the IMS seismic network and reduction of the global detection threshold, this figure will

continue to rise further. To cope with this major growth in its activities and services, the Commission has embarked on developing training procedures and conducting regular courses for its analysts, station operators and staff of National Data Centres. Moreover, new analyst tools have been applied to enhance the quality and comprehensiveness of the final bulletins.

Relying on the incremental development of the IMS network and its solid operational experience, the Commission is now offering a reliable continuous, real time flow of data and data products to the States Signatories.

The Commission has also advanced its on-site inspection (OSI) operational readiness. The OSI methodology and necessary policies have been developed and directed exercises have been held to review the OSI inspection procedures and equipment. In September 2008, a large and complex Integrated Field Exercise was carried out for one month in Kazakhstan. It involved over two hundred participants and more than fifty tonnes of equipment. The exercise contributed greatly to the further development of the OSI regime by serving as a basis for the preparation of an OSI action plan as well as for further refinement of OSI policies, procedures, and methodology and equipment specifications. The Commission has also focused on the training of surrogate inspectors.

To keep pace with the dynamic advances in the CTBT verification related technologies and to further explore the potential civil and scientific applications of the verification system, international scientific conferences were held. This initiative has also helped the Commission garner the support of the scientific community for the objectives of the Treaty.

For many years, despite a substantial increase in its workload, the Commission has had to function with a zero real growth budget and a constant level of staff. This situation obviously caused considerable financial and human resource constraints for the Commission. Still, by employing various management initiatives, it was able to achieve a high level of synergy and efficiency. The Commission has also succeeded in registering a high standard in transparency, accountability and oversight.

I believe these achievements pave the way for accelerated progress in fulfilling the mandate of the Commission and realizing the objectives of the Treaty.

The photograph of the staff of the Provisional Technical Secretariat and the Chairpersons of the Commission and its subsidiary bodies is placed above this message in tribute to our collective accomplishments in the past 10 years.

Tibor Tóth
Executive Secretary
CTBTO Preparatory Commission
Vienna, February 2011

Treaty

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) is an international treaty outlawing nuclear explosions in all environments. In providing for a total ban on nuclear testing, the Treaty seeks to constrain the development and qualitative improvement of nuclear weapons and end the development of new types of nuclear weapon. In doing so, it constitutes an effective measure of nuclear disarmament and non-proliferation in all its aspects.

The Treaty was adopted by the United Nations General Assembly and opened for signature in New York on 24 September 1996. On that day, 71 States signed the Treaty. The first State to ratify the Treaty was Fiji on 10 October 1996.

Under the terms and provisions of the Treaty, the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) is to be established in Vienna, Austria. The mandate of this international organization is to achieve the object and purpose of the Treaty, to ensure the implementation of its provisions, including those for international verification of compliance with it, and to provide a forum for cooperation and consultation among States Parties.

Preparatory Commission

In advance of the entry into force of the Treaty and the establishment of the CTBTO proper, a Preparatory Commission for the organization was established by the States Signatories on 19 November 1996. The Commission was given the mandate of preparing for entry into force and is located at the Vienna International Centre.

The Commission has two main activities. The first consists of undertaking all necessary preparations to ensure the operationalization of the CTBT verification regime at entry into force. The second is the promotion of Treaty signature and ratification to achieve entry into force. The Treaty will enter into force 180 days after it has been ratified by all 44 States listed in its Annex 2.

The Preparatory Commission is made up of a plenary body responsible for directing policy and comprising all States Signatories, and a Provisional Technical Secretariat (PTS) to assist the Commission in its duties, both technically and substantively, and carry out such functions as the Commission determines. The PTS started work in Vienna on 17 March 1997 and is multinational in composition, with staff recruited from States Signatories on as wide a geographical basis as possible.

Putting an End to
Nuclear Test Explosions

Summary

The Preparatory Commission in 2010 succeeded in taking further significant steps in fulfilment of its mandate and promotion of the Treaty and the build-up of the verification system.

As the international support for the entry into force of the Treaty grew larger, Trinidad and Tobago and the Central African Republic ratified the Treaty, bringing the number of ratifications to 153. Among the States that have ratified are 35 of the 44 States listed in Annex 2 to the Treaty, whose ratification is required for it to enter into force. Also, Indonesia, Iraq, Guatemala, Papua New Guinea and Thailand expressed their commitment to ratify the Treaty. As of 31 December 2010, the CTBT had been signed by 182 States.

While maintenance support and technical assistance continued to be provided at International Monitoring System (IMS) facilities around the globe, the momentum to complete the IMS network was maintained in 2010. Progress towards the completion of the IMS was made in all four technologies (seismic, hydroacoustic, infrasound and radionuclide). Four new stations were installed. Thus by the end of 2010, 272 IMS facilities were installed, representing 85% of the entire network.

With 10 stations certified in 2010, the total number of certified IMS stations and laboratories, which was zero in early 2000, reached 264 at the end of the year. In addition, the first three noble gas systems were certified in 2010. This increase in the number of certified facilities has been a source of improvement for coverage and network resilience.

The Provisional Technical Secretariat (PTS) of the Commission started the largest IMS station repair/reconstruction so far in terms of financial investment at the joint site of hydroacoustic station HA3 and infrasound station IS14 in the Juan Fernández Islands (Chile), which were partly destroyed by a tsunami in 2010. This multimillion dollar project, which entails substantial technical challenges, is planned to be completed in 2013.

Infrasound monitoring, which is an important verification technology for detecting and locating an atmospheric nuclear explosion, was introduced into operations at the International Data Centre (IDC) in February 2010.

During 2010, additional noble gas systems were transferred into IDC operations. At the end of the year, a total of 27 noble gas systems were in provisional operation at IMS radionuclide stations. Efforts were also made to further enhance the capabilities to perform atmospheric transport modelling and to deliver high quality products to States Signatories. Now, atmospheric backtracking calculations are performed daily for each of the IMS radionuclide stations with near real time meteorological data obtained from the European Centre for Medium-Range Weather Forecasts.

The state of health system was deployed in the IDC Operations Centre. The system software facilitates

the tasks of monitoring and detecting incidents and problems in the IMS network (stations, links in the Global Communications Infrastructure, servers, databases, hardware, software, etc.). Also, IDC application software was converted and updated to run on open source systems.

In 2009, an on-site inspection (OSI) action plan, resulting from the review and follow-up of the lessons learned from the 2008 Integrated Field Exercise (IFE), was prepared. This was further developed to provide a framework for furthering the OSI regime in a project oriented manner.

The action plan outlines various projects in five main areas of development, namely policy planning and operations, operations support and logistics, techniques and equipment, training, and procedures and documentation. The projects are intended to steer the build-up of OSI operational capability and assist in the preparation and conduct of the next IFE.

OSI policies and operational procedures were developed further and advances were made in, inter alia, the implementation of an Integrated Inspection Support System. Training focused on the preparations for the second training cycle for surrogate inspectors, based on thorough analysis of training needs after the 2008 IFE. In this context, a series of training planning meetings were held which brought together the various stakeholders in OSI training.

A major event in 2010 related to OSI methodology development was directed exercise DE10, which was devoted to ground based visual observation and OSI communication and conducted in the area of the Dead Sea in Jordan.

The Commission also launched a new capacity development initiative that aims to build the necessary capacity in States Signatories to effectively meet political, legal, technical and scientific challenges that face the Treaty and its verification regime. As part of this initiative, it has started to develop a series of introductory as well as enhanced courses dealing with various aspects of the Treaty and the verification regime.

The Commission continued to streamline its activities and to promote synergies and efficiencies. It also fostered results based management, accountability and oversight.

To finance the reconstruction of IMS stations HA3 and IS14 and the implementation of an Enterprise Resource Planning system which is compliant with International Public Sector Accounting Standards, the Commission appropriated US$23.9 million. It also approved the creation of 10 additional new posts at the PTS in order to enhance the capacity of the PTS to fulfil its growing responsibilities.

These achievements certainly promise stronger support for the work of the Commission in 2011.

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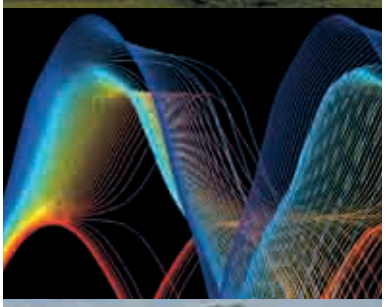
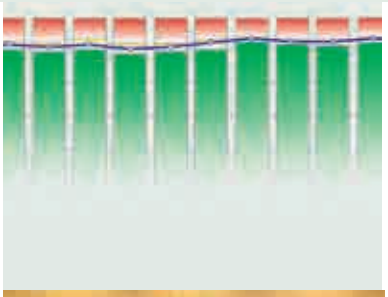
Comprehensive Nuclear-Test-Ban Treaty (CTBT)

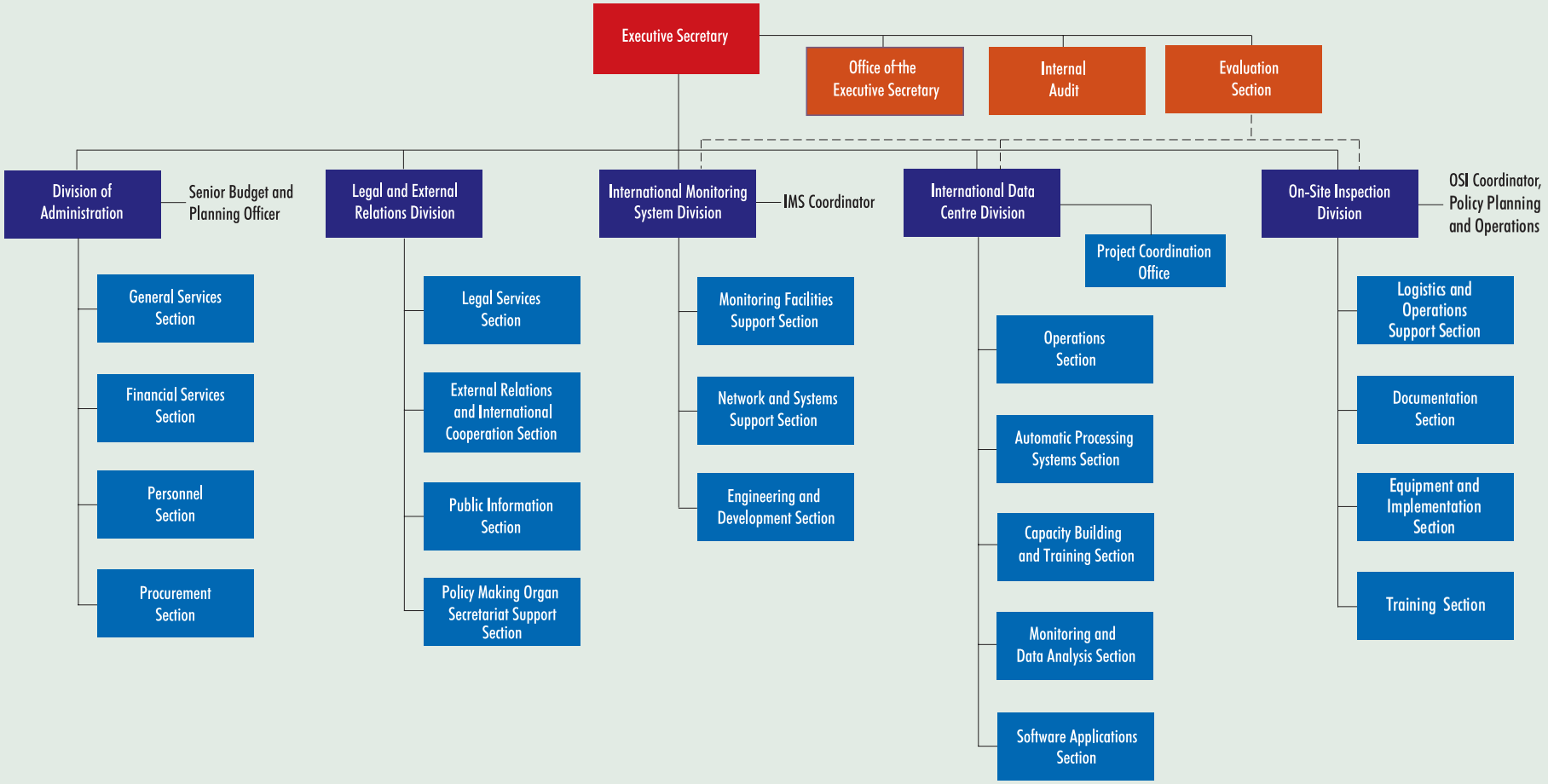




ABBREVIATIONS

CIF	Capital Investment Fund
DE	directed exercise
GCI	Global Communications Infrastructure
IAEA	International Atomic Energy Agency
IDC	International Data Centre
IFE	Integrated Field Exercise
IMS	International Monitoring System
INGE	International Noble Gas Experiment
ISS	International Scientific Studies
KPI	key performance indicator
MPLS	multiprotocol label switching
NDC	National Data Centre
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
OSI	on-site inspection
PCA	post-certification activity
PTS	Provisional Technical Secretariat
REB	Reviewed Event Bulletin
SAMS	Seismic Aftershock Monitoring System
SEL	Standard Event List
SOH	state of health
VPN	virtual private network
VSAT	very small aperture terminal
WMO	World Meteorological Organization

Organizational Structure of the Provisional Technical Secretariat
(31 December 2010)



A Period of Continuous Progress

INTRODUCTION

Since 2000, the Preparatory Commission has registered remarkable achievements in fulfilling its mandate and advancing the Treaty and its verification system.

In 2000, the Treaty had been ratified by only 51 States. Today the number has tripled and the Treaty enjoys 153 ratifications and 182 signatures.

The political support for the Treaty and the work of the Commission has reached an unprecedented level. There is an almost universal recognition that the Treaty is an effective instrument of collective security and an important pillar of the nuclear non-proliferation and disarmament regime. A growing number of States, politicians and representatives of civil society are spearheading the campaign for ratification of the Treaty by those States which have yet to do so, including those of Annex 2.

Though the Treaty is yet to enter into force, its ratification and signature by a large community of States have already established an unwavering international norm against nuclear explosions.

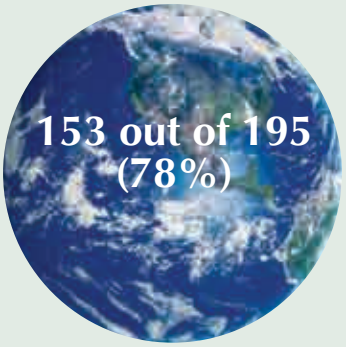
In 2000, the Treaty had been ratified by only 51 States. Today, the number has tripled and the Treaty enjoys 153 ratifications and 182 signatures, establishing an unwavering international norm against nuclear explosions.

ADVANCING THE VERIFICATION SYSTEM

Progress in the development of the system for verification of compliance with the Treaty is impressive.

The total number of certified stations and laboratories in the International Monitoring System (IMS) rose from zero in early 2000 to 264 at the end of December 2010. Such a rapid increase in the number of facilities installed and certified has been a source of major improvement for coverage and network resilience.

The October 2006 announced nuclear test by the Democratic People's Republic of Korea showed the importance of noble gas monitoring for the verification system. Since then, greater emphasis has been placed on this technology. The number of noble gas systems that were installed at the end of 2010 at IMS radionuclide stations stands at 27. In 2010, the first three noble gas systems (out of 40 foreseen by the Treaty) were certified. This is a major milestone and demonstrates the maturing of noble gas systems as a result of the International Noble Gas Experiment.



Treaty Ratifications by the End of 2010

Station Certifications by the End of 2010

Establishing the Treaty's monitoring system, consisting of 337 facilities and 40 noble gas systems, is not just about building stations. It is about taking a holistic approach to establishing and sustaining an intricate 'system of systems' that requires considerable testing, evaluation, maintenance and improvement. Since 2000, the Commission has sharpened its focus on engineering and development activities to increase the detection capability of the system and ensure robust performance of its monitoring

The total number of certified stations and laboratories in the International Monitoring System rose from zero in early 2000 to 264 at the end of December 2010.

technologies. Furthermore, attempts have been made to achieve higher levels of data availability.

As the IMS installation and certification phase approaches completion, it is also becoming all the more important to review and improve the operation and support of the facilities. Life cycle sustainment is essential to preserve the investment in the system. Operational experience with the system has increased over time. This has helped in developing an IMS sustainment structure for more effective preventive and corrective maintenance, for the recapitalization of IMS facility components and for logistical strategies. Over the years, the Commission has undertaken to develop station specific documentation, as well as capacity building activities and training programmes to enhance the capabilities of the station operator as the entity closest to the facility. As a result, there has been a continuous improvement in data availability, which reached 85% in 2010.

Over the last few years, the Commission has been developing and implementing a Quality Management System, encompassing a quality policy and manual as well as a quality assurance/quality control programme for the IMS network. This programme aims at verifying that stations conform to their certified operational tolerances, prescribing preventive action to avoid non-conformance and initiating corrective action when non-conformance is discovered. Currently, procedures for station and network calibration and data quality monitoring and assessment are being tested, as well as processes and tools to monitor and continually improve the performance of the network. Monitoring software includes state of health tools to provide precise troubleshooting.

Along with the continuous expansion of the IMS network, the activities and services of the International Data Centre (IDC) have significantly multiplied. The volume of data and data products has shown momentous growth. The average daily number of events contained in the Reviewed Event Bulletin grew from 50 in 2000 to more than 100 in 2010. With further expansion of the IMS seismic network and reduction of the global detection threshold, this figure will continue to rise further.

The incremental development of the verification system and solid operational experience provide reliable continuous, near real time and real time flow of data and data products to the States Signatories.

The time lines for the production of the automatically generated bulletins on waveform data have been decreased to those that are envisaged at the time of entry into force of the Treaty. This obviously requires skilled analysts and high quality automatic processing. To have a sufficient pool of analysts, the Provisional Technical Secretariat (PTS) has invested in developing training procedures and conducting regular courses. Besides, new analyst tools have been applied to enhance the quality and comprehensiveness of the final bulletins.

The automatic and interactive processing of infrasound data, after attaining the desired level of capability and maturity, is now being reintroduced into routine operations at the IDC. The hydroacoustic network is also surpassing its anticipated performance, as shown by its ability to locate occasional in-water explosive events down to tens of kilograms of TNT.

There has been considerable progress in the overall quality of radionuclide particulate analysis. Noble gas data have also been integrated into the IDC processing, leading to a key achievement with the first certification of an IMS noble gas system on 19 August 2010. The addition of such systems will strengthen the capacity of the IMS and continues the cutting-edge approach to the creation of the verification system.

The Commission has made good headway in atmospheric transport modelling. This is being applied to backtrack dispersed radioactive material, and the most recent advances in the domain of atmospheric transport as well as the most comprehensive meteorological data sources are integrated into IDC operations.

The computer infrastructure of the Commission has been completely

overhauled in recent years. This has facilitated the migration of all verification related applications to an open source environment. In order to accommodate the growing amount of verification data, a new mass storage system and multi-tiered storage area network have been commissioned. Satellite capacity was also expanded to cover increased demand for IMS data and IDC products.

In short, the incremental development of the verification system and solid operational experience provide reliable continuous, near real time and real time flow of data and data products to the States Signatories. The performance of the verification system during the two announced nuclear tests by the Democratic People's Republic of Korea in 2006 and 2009 is a clear example of such reliability. The timely, integrated and coherent performance of the system provided a high level of assurance about its capabilities.

The progress in the on-site inspection (OSI) regime has been steady. The strategic goal of the Commission has been to achieve OSI readiness at entry into force of the Treaty. To that end, the OSI methodology and necessary policies have been developed. In 2002, a field experiment was held in Kazakhstan to test OSI procedures and inspection dynamics. Directed exercises have also been held to test procedures and equipment for radionuclide monitoring, environmental sampling and operations. They have also helped the work on recording of seismic aftershocks, deployment of noble gas equipment and use of equipment employed during the continuation period of an inspection.

These activities culminated in the large and complex Integrated Field Exercise (IFE) in Kazakhstan in September 2008. It involved over two hundred participants, operating for one month in an extremely remote area, and over fifty tonnes of equipment. The exercise contributed greatly to the further development of the OSI regime by serving as a basis for the preparation of the action plan as well as further refinement of OSI policies, procedures, and specifications for methodology and equipment.

The steady progress in the on-site inspection regime led to the conduct of the first ever complex Integrated Field Exercise in 2008.

Workshops have provided an invaluable input towards the build-up of the OSI regime. They have, moreover, addressed essential topics, including the development of OSI techniques and equipment, their specific applications, the debriefing after the IFE and the draft OSI Operational Manual.

The training concept for OSI inspectors has been developed, contributing to a training cycle for OSI surrogate inspectors. This includes a curriculum of courses, identification of training venues and e-learning modules for remote training to facilitate efficient training activities. The first group of experts participated in an abridged training cycle in preparation for a roster of future OSI surrogate inspectors. The second training cycle is ongoing. In parallel, outreach training has been extended to States Signatories in the form of regional OSI introductory courses for experts from States Signatories and OSI introductory courses for members of Permanent Missions in Vienna. So far, more than six hundred participants have attended these courses.

Using a system engineering approach, the PTS has initiated the development of a highly adaptable and extendable OSI support solution that is capable of integrating existing systems while allowing adaptations to be made with minimal impact on critical operations in the future. The proposed solution is to design an Integrated Inspection Support System (IISS) that will be capable of providing the OSI verification regime with the right personnel, equipment and supplies at the right time, in the right place and in the right quantities. The expected outcome will combine the efficiencies and benefits of a flexible and mobile system with precise delivery of support to the point needed. The IISS is designed to be a fusion of information, logistics and operation support technologies to provide rapid response and to deliver tailored packages and sustainment directly at the required level.

ADVANCING WITH SCIENCE AND TECHNOLOGY

The advanced verification system demands close linkage with science and technology. The ability of the system to detect, locate and identify any nuclear test relies on keeping pace with advances in science and technology. That is why the Commission, since its inception, has always strived to intensify interaction and forge an effective strategic partnership with the scientific community.

The first significant initiative in building such a close cooperation was launched in 2006, when a scientific symposium entitled "CTBT: Synergies with Science, 1996–2006 and Beyond" was organized. The symposium was held on the tenth anniversary of the Treaty. It brought together more than three hundred participants, including key figures in the field of nuclear non-proliferation and disarmament and scientists from internationally prominent universities and institutions, as well as representatives of States Signatories.

With a view to furthering the synergies with the scientific community and promoting cooperation, the Commission embarked on another initiative in June 2009. The International Scientific Studies Conference was an important milestone in efforts to engage the global scientific community in support of CTBT verification objectives. It succeeded in drawing many more participants. Around six hundred people from almost one hundred countries, including nearly five hundred scientists, attended the conference and contributed to its work.

MANAGEMENT AND OVERSIGHT

Since 2002, the Commission has been working with a zero real growth budget and its level of staff has also remained the same since 2003. Managing the onerous increase in the workload with a constant level of resources has been a serious challenge. In addition, a policy on the limitation of tenure was implemented, leading to a full rotation by the end of 2009 of the Professional staff that were working at the Secretariat as of the end of 1997. During the same time frame, internal and external financial challenges had to be dealt with and they were successfully mitigated. Though arduous, the Commission has succeeded in turning the challenge into an opportunity by taking various measures to maximize resource savings and efficiency gains. It has reviewed its policies, redefined its priorities, promoted internal synergies and improved its human resource management. It has also begun to streamline its procurement and outreach activities and cut travel and publication costs. At the same time, new and innovative management tools, such as results based management, project management and quality management, have been employed to provide for greater synergies and optimal use of resources.

Over the years, the Commission has worked hard to enhance oversight, transparency and accountability. States Signatories have now at their disposal many means by which they can review and monitor the performance of the Commission and actively participate in its planning. These, in brief, include Programme and Budget proposals, comprehensive Programme and Budget Performance Reports, the Medium Term Plan, a detailed annual report on human resource management and an annual report by Internal Audit.

States Signatories have continuous access online to information on 10 key performance indicators (KPIs) related to the strategic goals of the Commission through a platform presenting verification system performance in near real time. They also receive information on over fifty performance related parameters through the monthly performance reports.

All these tools have enabled the Commission to establish a strategic dialogue with States Signatories on the performance of the Commission and its future direction.

INTERNATIONAL MONITORING SYSTEM

Highlights in 2010

Political support received from several countries to install IMS facilities where the Commission could not proceed in previous years

Increased data availability at certified IMS stations

Certification of the first IMS noble gas system

The International Monitoring System (IMS) is a global network of sensors for detecting and providing evidence of possible nuclear explosions. Upon completion, the IMS will consist of 321 monitoring stations and 16 radionuclide laboratories throughout the world in locations designated by the Treaty. Many of these facilities are located in areas that are remote and difficult to access, posing major engineering and logistical challenges.

The IMS uses seismic, hydroacoustic and infrasound ('waveform') monitoring technologies to detect the energy released from an explosion or a naturally occurring event in the underground, underwater and atmospheric environments.

Radionuclide monitoring uses air samplers to collect particulate matter from the atmosphere. Samples are then analysed for evidence of physical products created by a nuclear explosion and carried through the atmosphere. The analysis of the radionuclide content can confirm whether an event recorded by the other monitoring technologies was actually a nuclear explosion. The monitoring capability of some stations is being enhanced by the addition of systems for detecting radioactive forms of noble gases that are produced by nuclear reactions.

ESTABLISHING THE INTERNATIONAL MONITORING SYSTEM

The momentum to complete the IMS network was maintained in 2010. Progress towards the completion of the IMS was made in all four technologies (seismic, hydroacoustic, infrasound and radionuclide). Four stations were installed. Thus by the end of 2010, 272 IMS stations were installed, representing 85% of the entire network. In addition, political support was received from several countries hosting IMS facilities where the Provisional Technical Secretariat (PTS) had not been able to proceed in previous years, bringing the prospect of a complete IMS network closer.

With 10 stations certified in 2010 as meeting all the stringent technical requirements of the Preparatory Commission, the total number of certified IMS stations and laboratories, which was zero in 2000, reached 264 at the end of the year. This increase in the number of certified stations has been a source of improvement for coverage and network resilience. Station design, especially in the infrasound technology, has also evolved, resulting in a higher detection capability.

As demonstrated in October 2006 at the time of the first nuclear test announced by the Democratic People's Republic of Korea, monitoring of radionuclide noble gases plays an essential role in the CTBT verification system. Greater emphasis therefore continued to be placed on this technology in 2010 with the installation of three additional noble gas systems, bringing the number of noble gas systems installed at IMS stations to 27 (68%). Moreover, the Commission reached an important milestone on 19 August 2010 with the certification of its first noble gas system at radionuclide station RN75 (Charlottesville, Virginia, United States of America). This was followed by two additional certifications of noble gas systems at RN11 (Rio de Janeiro, Brazil) and RN68 (Tristan da Cunha, United Kingdom). The addition of the noble gas systems strengthens significantly the capacity of the IMS and continues the cutting-edge approach to the establishment of the verification system.

ESTABLISHMENT, INSTALLATION AND CERTIFICATION

Establishment of a station is a general term referring to the building of a station from its initial stages until its completion. *Installation* typically refers to all work performed until the station is ready to send data to the International Data Centre (IDC). This includes, for instance, site preparation, construction and equipment installation. A station receives *certification* when it meets all technical specifications, including requirements for data authentication and transmission through the Global Communications Infrastructure (GCI) link to the IDC in Vienna. At this point the station is considered an operational unit of the IMS.

Table 1. Status of the Station Installation and Certification Programme (31 December 2010)

IMS Station Type	Installation Complete		Under Construction	Contract Under Negotiation	Not Started
	Certified	Not Certified			
Primary seismic	42	4	1	0	3
Auxiliary seismic	99	10	5	1	5
Hydroacoustic	10	1	0	0	0
Infrasound	43	0	5	1	11
Radionuclide	60	3	7	5	5
Total	**254**	**18**	**18**	**7**	**24**

Table 2. Status of Noble Gas System Installations and Certifications (31 December 2010)

Total Number of Noble Gas Systems	Installed	Certified
40	**27**	**3**

Table 3. Status of Radionuclide Laboratory Certifications (31 December 2010)

Total Number of Laboratories	Certified
16	**10**

Above: **radionuclide station RN68 on the island of Tristan da Cunha (United Kingdom) in the South Atlantic Ocean, whose noble gas measuring system was certified in December 2010.** ***Below:*** **radionuclide station RN75 at Charlottesville, Virginia, USA, whose noble gas system was the first to be certified as part of the IMS.**

These advances are not just about increases in data. They are about the effective application of monitoring technologies around the globe. They are about higher quality data reviews and data products. They are about better and more experienced data analysts and station operators.

AGREEMENTS FOR MONITORING FACILITIES

In order to carry out the functions of efficiently and effectively establishing and sustaining the IMS facilities, the Commission needs immunity from taxation, customs duties and restrictions. Consequently, facility agreements or arrangements provide for the application (with changes where appropriate) of the Convention on the Privileges and Immunities of the United Nations to the activities of the Commission and/or explicitly provide for such privileges and immunities. In practice, this may imply that the host State would adopt the necessary national measures to that effect.

The Commission has the mandate to establish procedures and a formal basis for provisional operation of the IMS, including concluding agreements or arrangements with States hosting IMS facilities to regulate activities such as site surveys, installation or upgrading work and certification, as well as post-certification activities (PCAs). The importance of concluding facility agreements and arrangements has been stressed by the Commission, which in 2000 adopted a decision calling on hosting States to negotiate and conclude such agreements or arrangements as a matter of priority. The agreements and arrangements are based on the model adopted by the Commission at its Sixth Session in 1998.

Of the 89 States hosting IMS facilities, 39 have signed a facility agreement or arrangement with the Commission, and 33 of these agreements and arrangements are in force. At the end of 2010, the Commission was in negotiation with 21 of the 50 host States which have not yet concluded a facility agreement or arrangement. States are showing increased interest in the subject and it is hoped that ongoing negotiations may be concluded in the near future and that others may be initiated soon.

In 2010, the importance of establishing facility agreements and arrangements and of their subsequent national implementation gained enhanced political visibility as it became apparent that the lack of such legal mechanisms causes substantial costs and major delays in sustaining certified IMS facilities, adversely affecting data availability of the verification system. The PTS was asked by the Commission and its subsidiary bodies to continue reporting on these matters in 2011

Radionuclide station RN58 at Ussuriysk, Russian Federation, which was certified in June 2010: changing the filter in the air sampler.

Radionuclide station RN58: filter removed from the air sampler before being compressed.

and countries hosting IMS facilities were requested to strive to resolve this issue.

AFTER CERTIFICATION

Following the certification of a station and its incorporation into the IMS, the post-certification phase of its operation is ultimately focused on delivery of data to the IDC.

PCA contracts are fixed-cost contracts between the Commission and some station operators. These contracts cover station operations and some preventive maintenance activities. The total PCA expenditure in 2010 of US$15 800 000 was distributed among 138 facilities, including the 10 certified radionuclide laboratories and one noble gas system. PCA contractual agreements covered five more stations and one noble gas system.

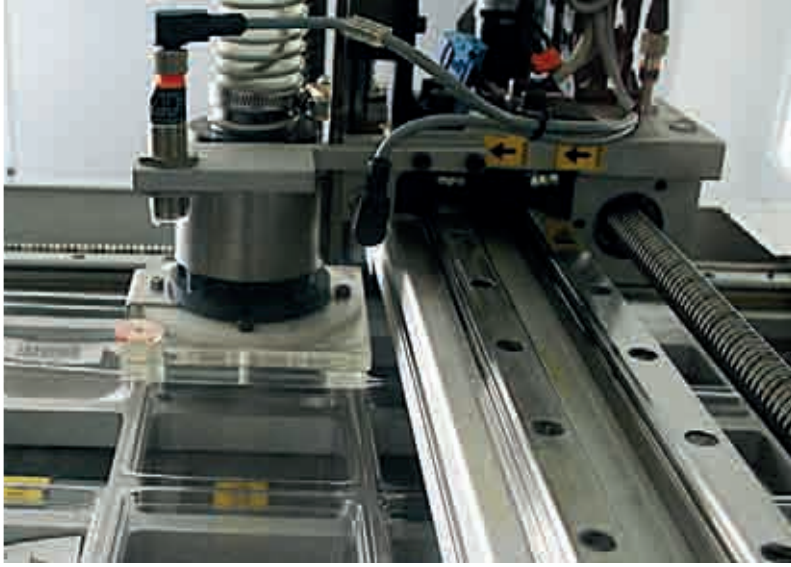
SUSTAINING MONITORING FACILITIES

Preparing a global monitoring system of 337 facilities supplemented by 40 noble gas systems is not just about building stations. It is about taking a holistic approach to establishing and sustaining an intricate 'system of systems' that can be ramped up to meet the verification requirements of the Treaty while protecting the investment already made by the Commission. This can be done by testing, evaluating and maintaining what is in place, and then further improving upon this.

The SAUNA noble gas measuring system at radionuclide station RN68, Tristan da Cunha (United Kingdom).

Primary seismic station PS44 at Alibeck, Turkmenistan, which was certified in February 2010.

Filters taken from the air sampler at radionuclide station RN53, Ponta Delgada, Sao Miguel, in the Azores (Portugal).



Robot arm for handling filter samples at RN53.

The entire life cycle of the IMS station network comprises a sequence of events from conceptual design and establishment to operation and maintenance through upgrades, replacement and repairs as required. This is commonly referred to as sustainment of a system. Sustainment of monitoring facilities and of the IMS network itself involves management, coordination and support for the full life cycle of each facility component, performed as efficiently and effectively as possible. In addition, recapitalization of all components of each IMS facility must be planned, budgeted and executed. The focus on reviewing and improving operation and support of the facilities was intensified in 2010 as the IMS network expanded further.

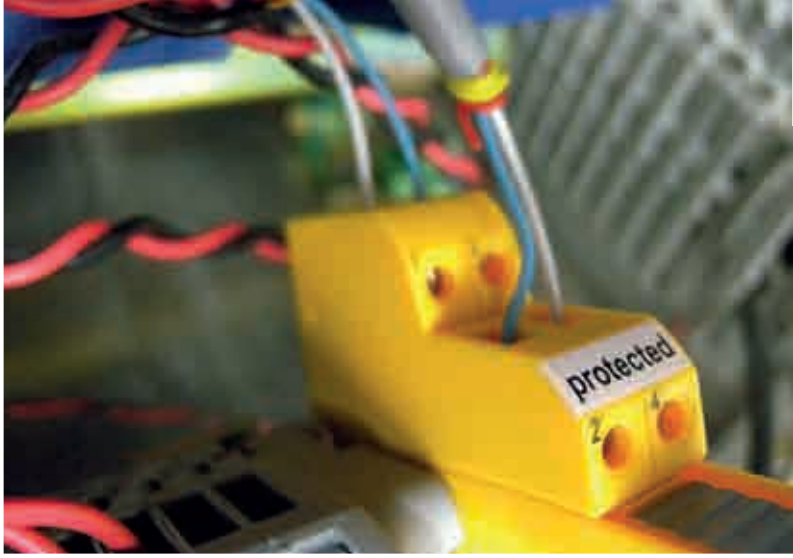
Maintenance support and technical assistance continued to be provided at IMS facilities around the globe. A total of 42 preventive and corrective maintenance visits were made to 51 IMS certified facilities. Moreover, the PTS started the largest IMS station repair/reconstruction so far in terms of financial investment at the joint site of hydroacoustic station HA3 and infrasound station IS14 in the Juan Fernández Islands (Chile), which were partly destroyed by a tsunami in 2010. This multimillion dollar project, which entails substantial technical challenges and risks, is planned to be completed in 2013. It is funded via an extrabudgetary mechanism supported by the Commission and its subsidiary bodies, demonstrating the strong international commitment to the CTBTO mission.

In order to ensure more timely preventive and corrective maintenance of IMS facilities where data availability is being affected, the PTS also continued to manage equipment support contracts with manufacturers, improving several on the basis of experience. These contracts are instrumental in ensuring timely technical assistance and equipment replacement at IMS stations at optimal cost.

In addition, the PTS continued to update and standardize the station specific operational manuals and other documentation which support the operation and maintenance relevant to each station. It also further concentrated on developing the technical capabilities of the station operators. As the entity closest to the IMS facility, the station operator is in the best position to prevent problems at stations and ensure their timely resolution when they occur. Station visits thus systematically include hands-on training for the local station operator, so that the PTS does not have to travel to a station for the same problem twice.

The long term operation and sustainment of auxiliary seismic stations continued to attract political attention in 2010. Countries hosting auxiliary seismic stations which present design deficiencies or obsolescence problems were encouraged by the Commission to review their ability to cover the cost of upgrading and sustaining their stations. However, for several host countries, obtaining the appropriate level of technical and financial support remains challenging. In this regard, the European Union provides through its Joint Action Project IV useful support for the sustainment of IMS auxiliary seismic stations which do not belong to parent networks and are hosted by developing countries or countries in transition. This initiative includes actions to return stations to an operational state and encourages host countries to secure a sustainable support structure for their auxiliary seismic facilities.

Work in the area of logistics support concentrated firstly on continuing the systematic review and formalization of shipment and of customs



Above: **maintenance visit at radionuclide station RN3, Bariloche, Argentina.**
Below: **calibration of a new detector system at radionuclide station RN17, St John's, Newfoundland, Canada.**

Above: **lightning surge protection system installed at radionuclide station RN13, Edea, Cameroon.**
Below: **maintenance visit at radionuclide station RN40, Kuwait City, Kuwait.**

clearance of IMS equipment transported to and from certified IMS facilities on a country by country basis. The PTS appealed to the host countries for support in this matter. Secondly, its efforts to optimize the advance location and storage of equipment at regional, country specific and station depots, as well as in Vienna, were intensified.

Configuration management is used to maintain an understanding of the status of complex assets with a view to ensuring the highest level of serviceability at the lowest cost. Knowing and tracking the status and associated life cycle sustainment information of the IMS network of stations and its major components are thus essential to effective planning. Efforts therefore continued in 2010 to validate, review and improve the configuration management for IMS facilities. At the end of the year, baseline data had been established in the Database of the Technical Secretariat for 249 of the 254 certified stations. The process of continuous validation via audits and reviews was also further optimized.

The engineering and development programme in 2010 focused on developing and implementing cost effective solutions to address engineering problems at certified stations, to increase the robustness and performance of facilities and to improve the capabilities of associated technologies. Significant progress was made on a number of projects. The analysis of root causes and rates of station failure led to concentration on security and alarm systems, grounding and lightning protection solutions and cooling techniques for detectors of radionuclide stations. Improved grounding and lightning protection systems were thus designed and installed at several stations. A project was initiated to enhance the security at IMS stations through the design of alarm

system standards. Progress was made in identifying alternative cooling systems to improve the reliability of radionuclide stations where the detection system, in particular the cooler, was the major cause of down-time. A new technology for electrical coolers was installed in several radio-nuclide stations and the tests gave promising results. A programme was being used to test generators for the supply of liquid nitrogen for cool-ing. In parallel, technical drawings of stations were further consolidated. Finally, several experiments were conducted at the IMS infrasound test site (Conrad Observatory, Austria), which provides useful findings to improve the performance of the IMS infrasound network.

Significant efforts were dedicated to quality management. The results of the 2009 seismic calibration experiment were reviewed by Working Group B and follow-up actions were taken with the station operators to resolve the calibration issues identified during the experiment. Calibration plays an essential role in the verification system as it determines and monitors, by measurement or comparison against a standard, parameters needed to properly interpret signals recorded by IMS facilities.

In order to meet the objectives of the Operational Manual for radionuclide monitoring, all Level 5 samples (samples with multiple anthro-pogenic nuclides, at least one of them being a fission product) from the radionuclide stations are sent to two radionuclide laboratories for independent measurements. Over the years, a quality assurance/ quality control programme to monitor the performance of the network of radionuclide particulate stations has been employed to ensure that data produced are of acceptable quality. As part of quality assurance, a grading scheme for the performance of radionuclide laboratories in the annual Proficiency Test Exercise was introduced in 2010.

The final phase in the life cycle of equipment for IMS facilities involves its replacement (recapitalization) and disposal. The PTS continued in 2010 to recapitalize IMS facility components as they reached the planned ends of their operating lives. Several recapitalization projects involved substantial planning and investment, in particular at stations PS2 and IS7 (Australia), PS9 (Canada), PS27 and PS28 (Norway), PS45 (Ukraine), IS39 (Palau) and IS52 (United Kingdom). The detector cooler was upgraded at eight radionuclide stations, leaving only three radionuclide stations with older cooling technology. The disposal of equipment and consumables was also addressed more systematically with the objective to apply the most environmentally friendly practices.

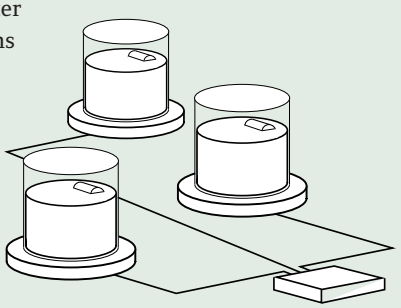
The activities mentioned above contributed to increasing the data availability of the certified IMS sta-tions in 2010, which demonstrated a durable positive trend since 2009 towards the level required by the Operational Manuals. Over the two years, in collaboration with the States hosting IMS facilities and local operators an impressive increase of over 5% in data availability of IMS stations has been achieved. In an ever growing but also ageing IMS network, activities undertaken in 2010 and in the previous year have thus not only mitigated the effects of obsolescence in the network but also reversed the decreasing trend in data availability observed in 2008.

Profiles of the Monitoring Technologies

SEISMIC STATION

The objective of seismic monitoring is to detect and locate underground nuclear explosions. Earthquakes and other natural events and events of human origin generate two main types of seismic wave: body waves and surface waves. The faster body waves travel through the interior of the earth while the slower surface waves travel along its surface. Both types of wave are looked at during analysis to collect specific information on a particular event.

The seismic technology is very efficient at detecting a suspected nuclear explosion as seismic waves travel fast and can be registered within seconds after the event. Data from IMS seismic stations provide information on the location of a suspected underground nuclear explosion and help identify the area for an on-site inspection.



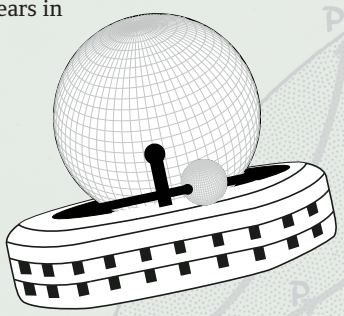
An IMS seismic station has typically three basic parts: a seismometer to measure the ground motion, a recording system which records the data digitally with an accurate time stamp, and a communication system interface.

HYDROACOUSTIC STATION

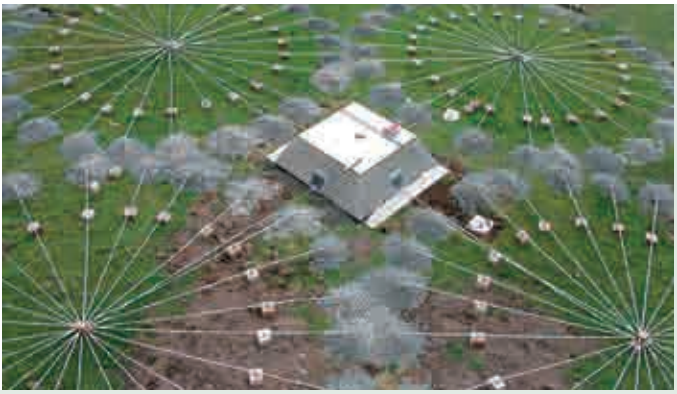
Nuclear explosions under water, in the atmosphere near the ocean surface or underground near oceanic coasts generate sound waves that can be detected by the hydroacoustic monitoring network.

Hydroacoustic monitoring involves recording signals that show changes in water pressure generated by sound waves in the water. Owing to the efficient transmission of sound through water, even comparatively small signals are readily detectable at very long distances. Thus 11 stations are sufficient to monitor all of the oceans.

There are two types of hydroacoustic station: underwater hydrophone stations and T phase stations on islands or on the coast. The hydrophone stations, involving underwater installations, are among the most challenging and most costly monitoring stations to build. The installations have to function for 20–25 years in extremely inhospitable environments, exposed to temperatures close to freezing point, huge pressures and saline corrosiveness.



The deployment of the underwater parts of a hydrophone station, i.e. placing the hydrophones and laying the cables, is a highly complex affair. It involves the hiring of ships, extensive underwater work and the use of specially designed materials and equipment.



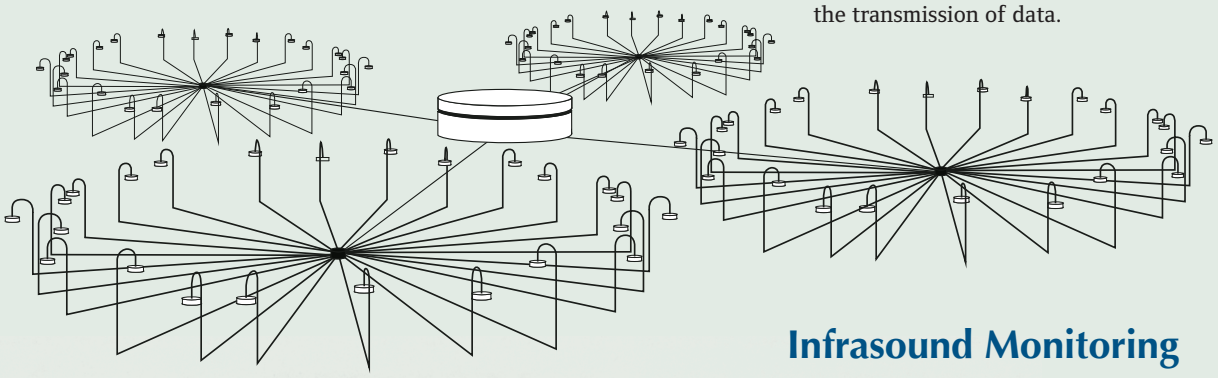
INFRASOUND STATION

Acoustic waves with very low frequencies below the frequency band audible to the human ear are called infrasound. Infrasound is produced by a variety of natural and anthropogenic sources. Atmospheric and shallow underground nuclear explosions can generate infrasound waves that may be detected by the infrasound monitoring network of the IMS.

Infrasound waves cause minute changes in the atmospheric pressure which are measured by microbarometers. Infrasound has the ability to cover long distances with little dissipation, which is why infrasound monitoring is a useful technique for detecting and locating atmospheric nuclear explosions. In addition, since underground nuclear explosions also generate infrasound, the combined use of the infrasound and seismic technologies enhances the ability of the IMS to identify possible underground tests.

Although the IMS infrasound stations exist in a wide variety of environments ranging from equatorial rainforests to remote wind-swept islands and polar ice shelves, ideal sites for deploying an infrasound station are within a dense forest, where it is protected from prevailing winds, or at locations with the lowest possible background noise in order to improve signal reception.

An IMS infrasound station (or array) typically employs several infrasound array elements arranged in different geometrical patterns, a meteorological station, a system for reducing wind noise, a central processing facility and a communication system for the transmission of data.



Infrasound Monitoring

- **60 stations in 35 countries around the world**

Seismic Monitoring

- **170 stations – 50 primary and 120 auxiliary – in 76 countries around the world**

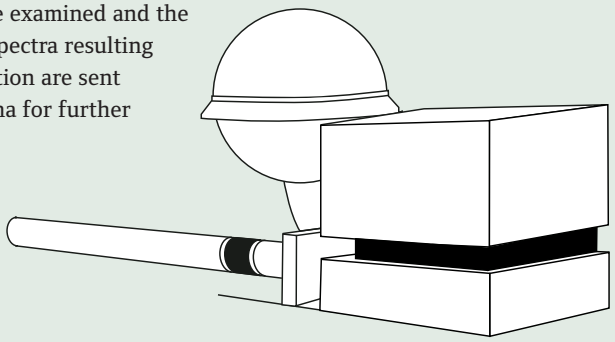
Hydroacoustic Monitoring

- **11 stations – 6 underwater hydrophone stations and 5 T phase stations on land – in 8 countries around the world**

RADIONUCLIDE STATION

The radionuclide monitoring technology is complementary to the three waveform technologies employed in the CTBT verification regime. This is the only technology that is able to confirm whether an explosion detected and located by the others is indicative of a nuclear test. It provides the means to identify the 'smoking gun' whose existence would be evidence of a possible violation of the Treaty.

Radionuclide stations detect radionuclide particles in the air. Each station contains an air sampler, detection equipment, computers and a communication set-up. At the air sampler, air is forced through a filter, which retains most particles that reach it. The used filters are examined and the gamma radiation spectra resulting from this examination are sent to the IDC in Vienna for further analysis.



NOBLE GAS DETECTION SYSTEM

By the time of entry into force of the Treaty, 40 radionuclide stations will need to have, additionally, the capability to detect radioactive forms of noble gases such as xenon and argon. Therefore special detection systems have been developed and are being deployed and tested in the radionuclide monitoring network before they are integrated into routine operations. The addition of such systems strengthens the capacity of the IMS and continues the cutting-edge approach to the creation of the verification system.

The name 'noble gases' emphasizes the fact that these chemical elements are inert and rarely react with others. Like other elements, noble gases have various naturally occurring isotopes, some of which are unstable and emit radiation. There are also radioactive noble gas isotopes which do not occur naturally but can only be produced by nuclear reactions. By virtue of their nuclear properties, four isotopes of the noble gas xenon are particularly relevant to the detection of nuclear explosions. Radioactive xenon from a well contained underground nuclear explosion can seep through layers of rock, escape into the atmosphere and be detected later thousands of kilometres away. (See also *International Data Centre:* "International Noble Gas Experiment".)

All of the noble gas detection systems in the IMS work in a similar way. Air is pumped into a charcoal-containing purification device where xenon is isolated. Contaminants of different kinds, such as dust, water vapour and other chemical elements, are eliminated. The resulting air contains higher concentrations of xenon, in both its stable and unstable (i.e. radioactive) forms. The radioactivity of the isolated and concentrated xenon is measured and the resulting spectrum is sent to the IDC for further analysis.

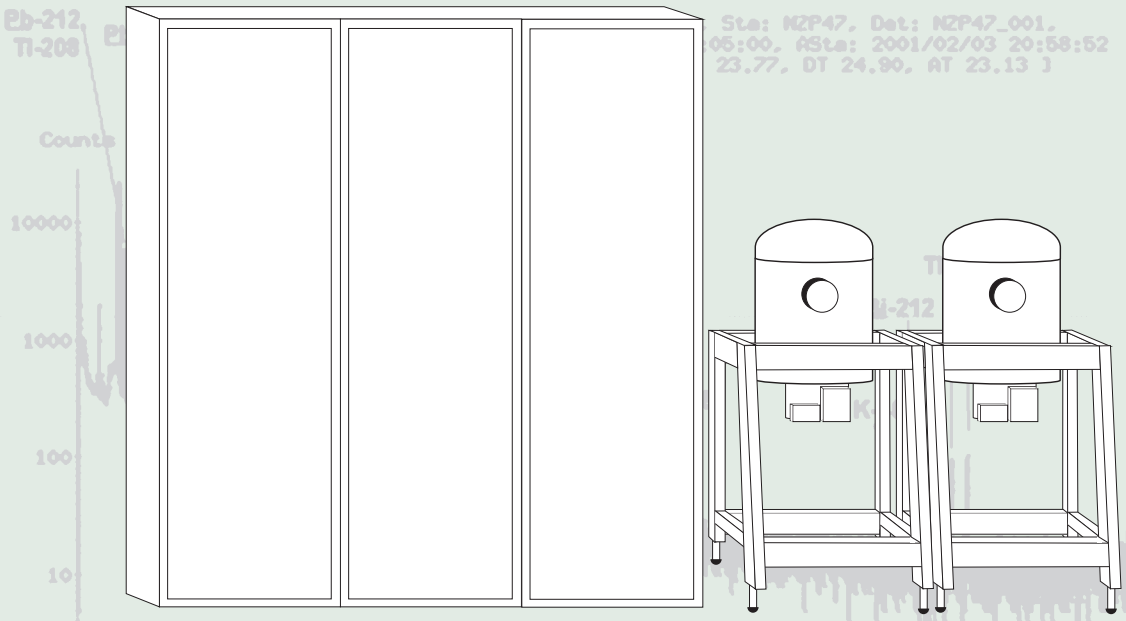
RADIONUCLIDE LABORATORY

Sixteen radionuclide laboratories, each located in a different country, support the IMS network of radionuclide monitoring stations. These laboratories have an important role in corroborating the results from an IMS station, in particular to confirm the presence of fission products and/or activation products which could be indicative of a nuclear test. In addition, they contribute to the quality control of station measurements and assessment of network performance through regular analysis of routine samples from all certified IMS stations. These world class laboratories also analyse other types of PTS sample such as samples collected during a station site survey or certification.

The radionuclide laboratories are certified by the PTS under rigid requirements for analysis of gamma spectra. The certification process gives an assurance that the results provided by a laboratory are accurate and valid. These laboratories also participate in the annual Proficiency Test Exercise.

Radionuclide Monitoring

- **80 stations and 16 laboratories in 27 countries around the world, with additional noble gas detection capabilities at 40 of the stations**



GLOBAL COMMUNICATIONS

Highlights in 2010

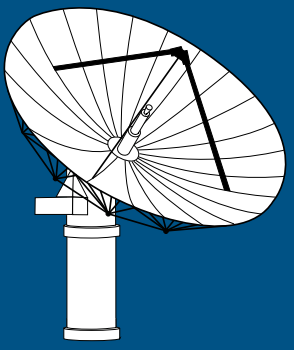
Continuing improvement in GCI availability

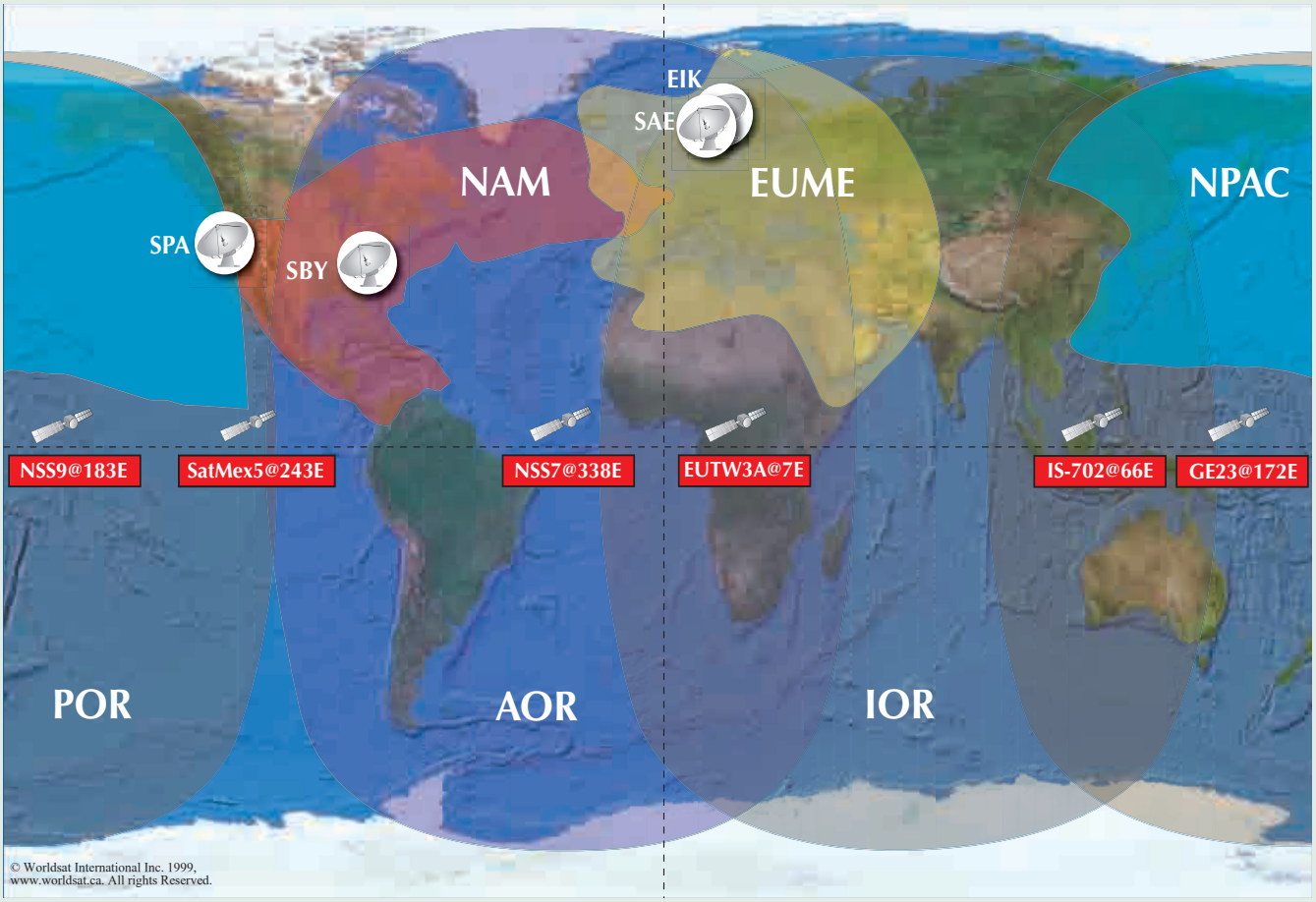
Increase in satellite and terrestrial capacity of the GCI

Addition of three very small aperture terminals (VSATs)

The Global Communications Infrastructure (GCI) is designed to transmit raw data from the 337 facilities of the International Monitoring System (IMS) in near real time to the International Data Centre in Vienna for processing and analysis. The GCI is also designed to distribute to States Signatories analysed data and reports relevant to verification of compliance with the Treaty. Digital signatures and keys are used to ensure that the transmitted data are authentic and that no one has tampered with them.

Using a combination of satellite and terrestrial communication links, this global network enables the exchange of data by IMS facilities and States in all areas of the world with the CTBTO Preparatory Commission. The GCI is required to operate with 99.50% availability for satellite communication links and 99.95% availability for terrestrial communication links, and to provide data within seconds from transmitter to receiver. It began provisional operation in mid-1999.





Satellites and satellite hubs of the Global Communications Infrastructure.

GCI TECHNOLOGY

IMS facilities and States Signatories in all but near-polar areas of the world can exchange data via their local earth stations fitted with a VSAT through one of six geostationary satellites. The satellites route the transmissions to hubs on the ground and the data are then sent to the IDC by terrestrial links.

A virtual private network (VPN) utilizes existing telecommunications networks to conduct private data transmissions. Most of the VPNs for the GCI use the basic public infrastructure of the Internet together with a variety of specialized protocols to support private and secure communications. In situations where VSATs are still not in use or not operational, VPNs provide an alternative means of communication. VPNs are also used at some sites to provide a backup redundant communication link in case of failure of a VSAT link.

Currently, the GCI includes 212 VSAT stations, 2 stand-alone VPN links, 14 backup VPN links, 5 independent subnetworks on terrestrial links using multiprotocol label switching (MPLS), a terrestrial MPLS link for US stations located in Antarctica, 4 satellite hubs (2 in Norway and 2 in the USA), 6 satellites, a network operations centre (Maryland, USA) and a service management desk (Vienna). All of these are managed by the GCI contractor. In addition, there are 29 VPN links managed by the PTS. The satellites cover the Pacific Ocean, North Pacific (Japan), North and Central America, Atlantic Ocean, Europe and Middle East, and Indian Ocean regions.

EXPANDING GLOBAL COMMUNICATIONS

In 2010, the main GCI operation and maintenance activities were focused on the improvement of site infrastructure, such as replacing AC powered systems with more reliable DC powered systems. Maintenance activities also included removing obstacles to the line of sight to satellites and relocating VSAT sites.

The satellite and terrestrial capacity of the GCI was increased in the Pacific Ocean, North and Central America, and Europe and Middle East regions. The increase was triggered by higher data volumes from upgraded IMS stations and a larger number of active National Data Centres (NDCs) requesting data and products from the IDC. The additional capacity improves the capability of the GCI to transport IMS data and IDC products in the three regions.

The Southbury Teleport (Connecticut, USA), which covers the Atlantic Ocean (West and East) Region and parts of the Pacific Ocean and Indian Ocean regions. (Courtesy of Vizada)

Above: **Setting up the GCI satellite terminal at the NDC in Abuja, Nigeria.**
Below: **GCI servers in the computer centre of the Preparatory Commission.**

Three new VSATs and two new VPN links were installed in 2010. The volume of data traffic carried by the GCI and by special links to the IDC increased during the year, as did the flow of data in the other direction from the IDC to remote sites.

GCI OPERATIONS

Various improvements in incident management involving the GCI contractor and enhancements in network monitoring were introduced in 2010. As a result of these and other activities the link availability of the GCI continued to show improvement.

A number of new network management systems were introduced which allow enhanced monitoring of independent subnetwork communication links, of the core infrastructure of the GCI managed by the PTS and of PTS Internet traffic. The new systems were integrated into the state of health system used in the IDC Operations Centre.

INTERNATIONAL DATA CENTRE

Highlights in 2010

Introduction of infrasound processing into provisional operations

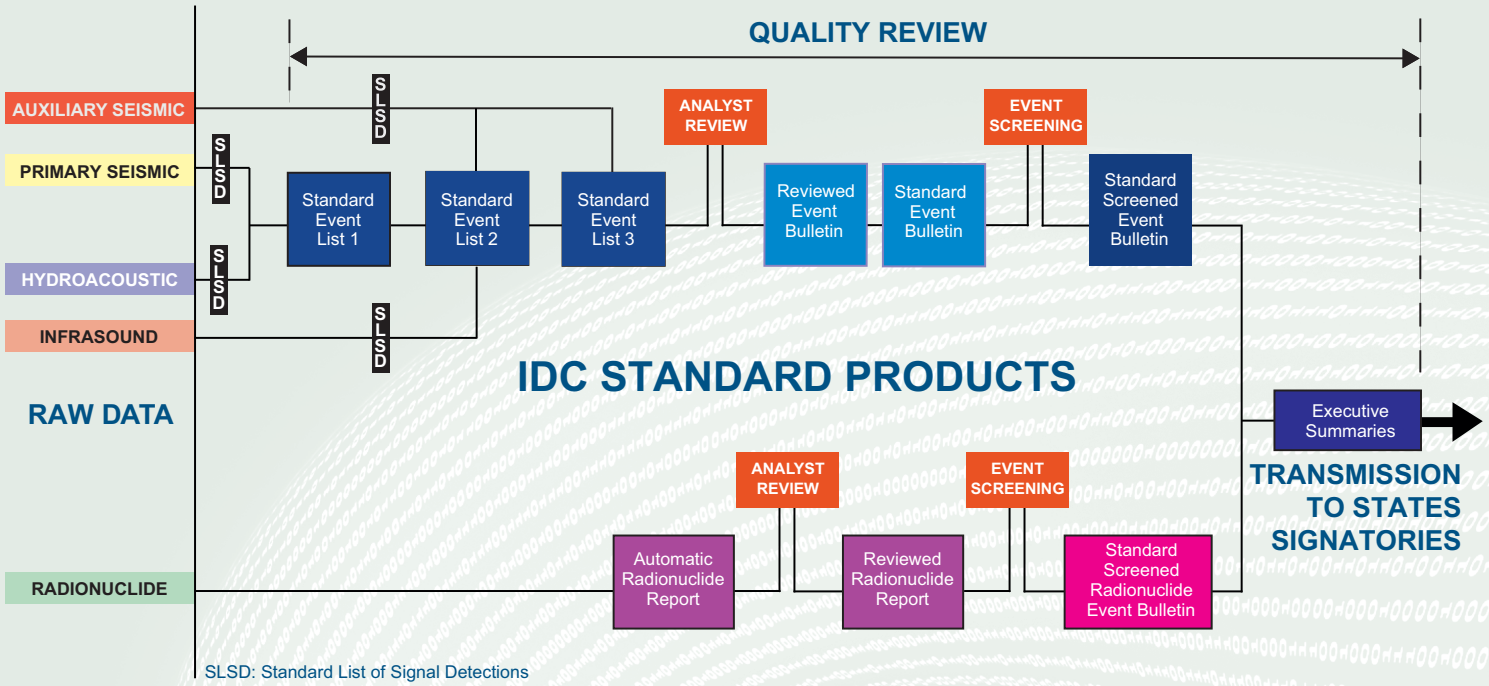
Completion of the migration to Linux for the waveform processing and analysis systems

Conclusion of tsunami warning agreement with France

The International Data Centre (IDC) is designed to collect, process, analyse and report on data received from facilities of the International Monitoring System, including the results of analyses conducted at certified radionuclide laboratories. The data and products are then made available to States Signatories for their final assessment. Data and products are received and distributed through the Global Communications Infrastructure.

The IDC is situated at the Headquarters of the CTBTO Preparatory Commission in the Vienna International Centre. A relational database management system forms the core of all information management. Full network redundancy has been created at the IDC to ensure high availability. A mass storage system provides archiving capacity for more than 10 years of verification data. The software utilized in operating the IDC is mostly developed specifically for the CTBT verification regime.

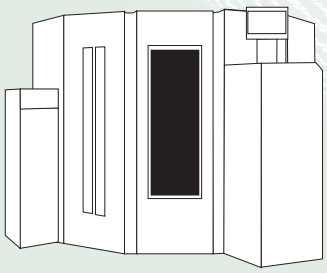
From Raw Data to Final Products

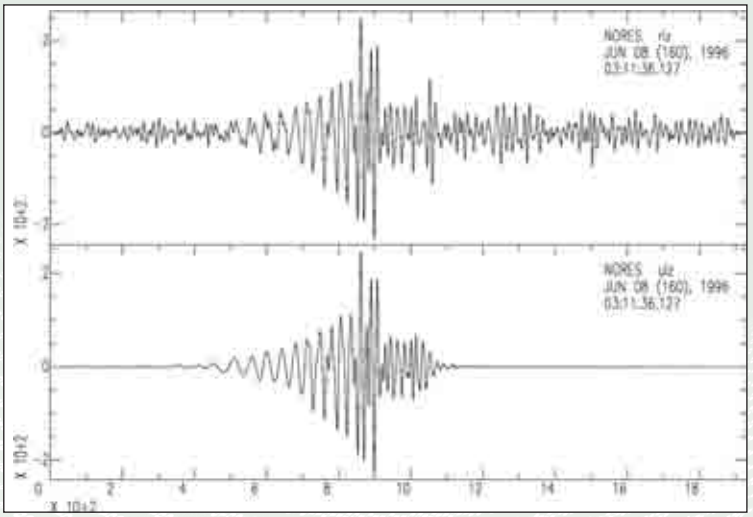


The data collected by the IMS under provisional operations are processed immediately when they reach the IDC. The first automated data product, known as Standard Event List 1 (SEL1), is completed within one hour after the data have been recorded at the station. This data product lists preliminary events recorded by the primary seismic and hydroacoustic stations.

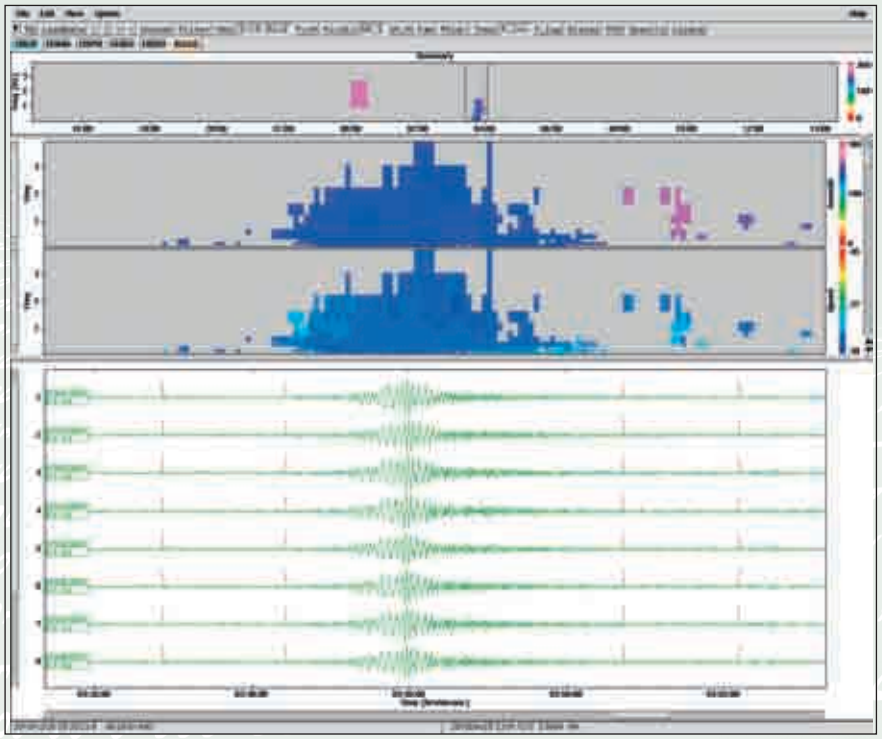
Requests are then made for data from the auxiliary seismic stations. These data, together with the data from the infrasound stations and any data arriving late, are used to produce a more complete event list, SEL2, four hours after the recording of the data. SEL2 is improved again after six hours have elapsed to incorporate any additional late-arriving data, to produce the final automated event list, SEL3.

Analysts subsequently review events recorded in SEL3 and add missed events to prepare the Reviewed Event Bulletin (REB). The REB for a given day contains all those events detected at IMS seismic,





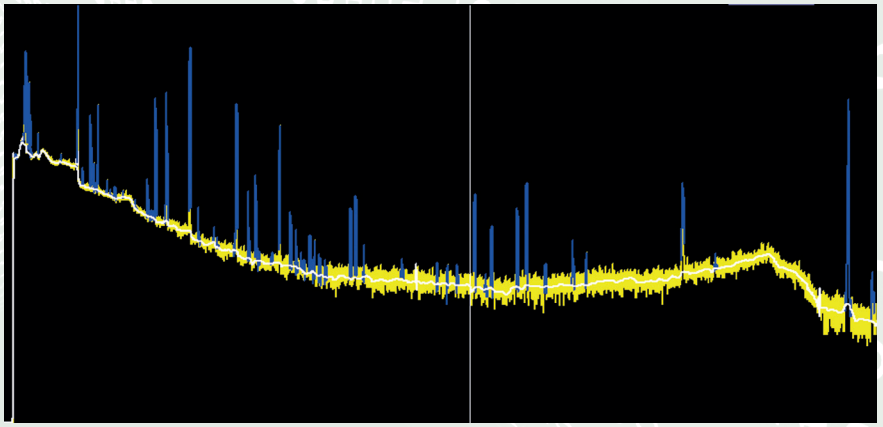
Example of a Rayleigh surface wave recorded at IMS station PS28 in Karasjok, Norway. Surface waves propagate on the surface of the earth, as opposed to body waves, which penetrate deep into the earth's interior. The upper figure shows the vertical motion data recorded on the PS28 seismometer after a nuclear test at Lop Nor, China, in 1996. The lower figure shows the same waveform after a process known as phase match filtering.



An infrasound signal recorded by IMS station IS53 in Fairbanks, Alaska, USA, together with data from 11 other infrasound stations, was associated with a suspected bolide explosion over the north Pacific Ocean on 25 December 2010. Plots are shown for the eight detector channels. The detection attributes, azimuth and speed, are displayed in time–frequency plots calculated by the IDC software.

hydroacoustic and infrasound stations which meet specific criteria. During the current provisional operating mode of the IDC, the REB is targeted to be issued within 10 days. After the Treaty enters into force, it is planned to release the REB within approximately two days.

Observations from events recorded by IMS radionuclide particulate and noble gas monitoring stations typically arrive several days later than the signals from the same events recorded by the seismic, hydroacoustic and infrasound stations. Radionuclide particulate data undergo both automatic and reviewed processing to produce an Automatic Radionuclide Report and then a Reviewed Radionuclide Report (RRR) for each full gamma ray spectrum received. The information in the REB and RRR will eventually be fused, associating seismoacoustic events with radionuclide detections.



A radionuclide gamma spectrum produced with the new IDC analysis software AutoSAINT/SAINT2, which is used for analysing data from radionuclide particulate detectors and noble gas systems based on high purity germanium gamma detectors.

SUPPORT AND BUILD-UP

In 2010, support and build-up of the IMS continued with the testing and evaluation of data from new stations. Newly installed or upgraded stations were introduced into IDC operations. Other stations were installed in the IDC test bed.

IDC application software has been converted and updated to run on open source systems (Linux). The software for waveform data, which had been thoroughly tested in 2009, was put to operational use in January 2010. The new software developed for the analysis of data from both radionuclide particulate and noble gas monitoring stations went through initial system-wide testing in October 2010. The performance of the software was found to be excellent, although some of the features still needed adjusting. The final tuning of the software is under way and the software is planned to enter provisional operations in early 2011.

Infrasound monitoring is an important verification technology as it can be used to detect and locate an atmospheric nuclear explosion. The IDC introduced routine infrasound signal analysis into operations in February 2010. The initial level of automatically detected false events and probability of detection were sufficient to allow interactive review of the infrasound results. Work will continue to improve the automatic detection of infrasound events so as to provide more accurate results to the analysts for review.

OPERATIONS CENTRE

A system for reporting and tracking problems in the IMS network was delivered to station operators. This software improves performance in PTS communications with station operators.

The state of health system was deployed in operations. The system software facilitates the tasks of monitoring and detecting incidents and problems in the IMS network (stations, GCI links, servers, databases, hardware, software, etc.).

A prototype of an 'alert manager system' was developed. It is currently in the testing phase in the Operations Centre. This system is able to detect incidents automatically on the basis of information collected in the state of health system.

A JIRA support system was fully established in operations for reporting and tracking incidents and problems. The requests sent to the PTS by authorized users, such as NDCs, station operators and Permanent Missions, are managed with this software.

NATIONAL DATA CENTRES

A National Data Centre is an organization with technical expertise in the CTBT verification technologies. Its functions may include sending IMS data to the IDC and receiving data and products from the IDC.

The PTS continued to provide the 'NDC in a box', a software package for use at NDCs, enabling them to receive, process and analyse IMS data. Efforts were also made to further improve the software.

A total of 114 secure signatory accounts, one for each requesting State Signatory, had been established by the end of the year, and 1191 users from these States Signatories had been authorized to access IMS data and IDC products and receive technical support.

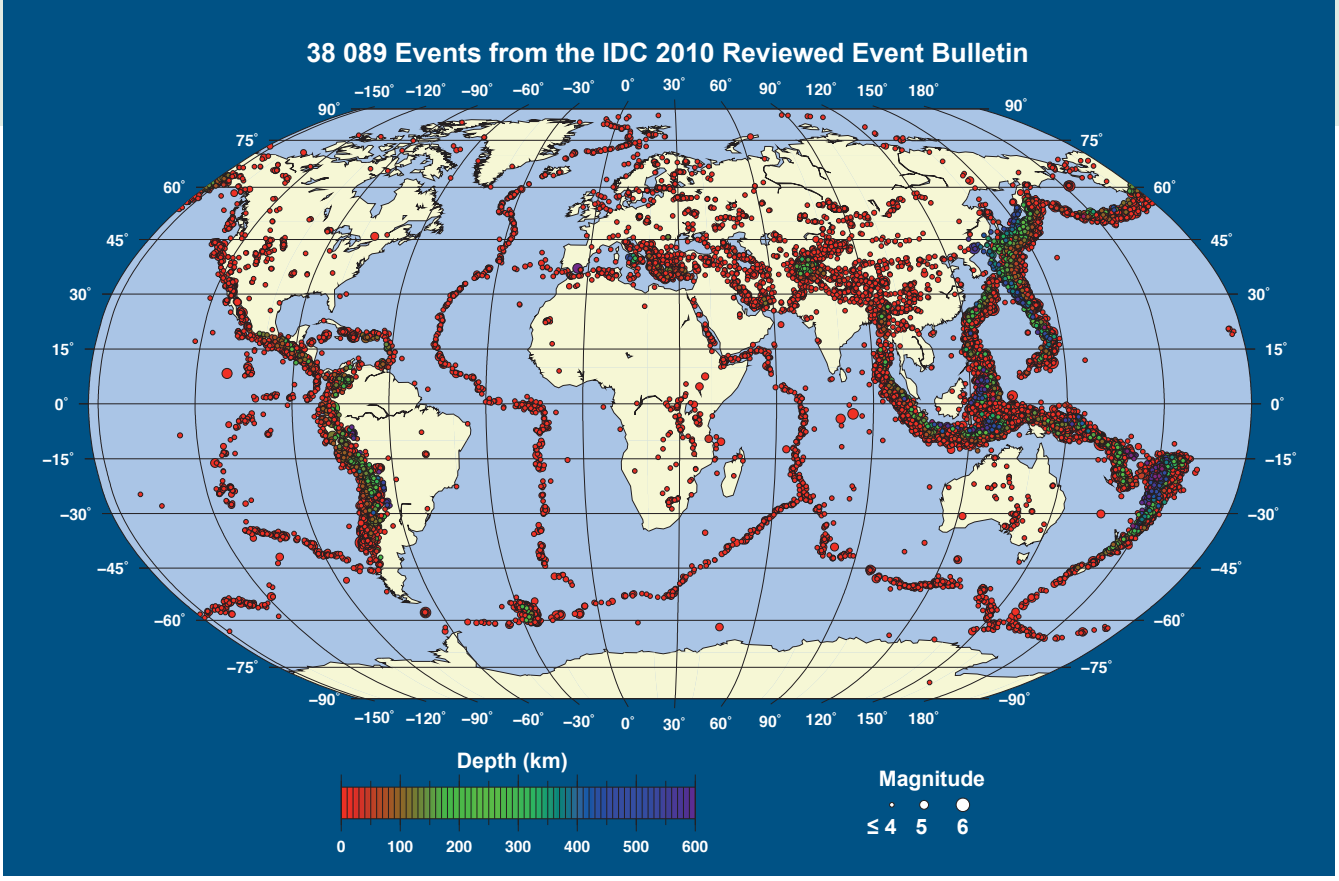
Work was continued on strengthening 14 NDCs, in particular in Africa, in Latin America and in South-East Asia, the Pacific and the Far East, by providing them with training, experts and basic equipment.

INTERNATIONAL NOBLE GAS EXPERIMENT

Additional noble gas systems were transferred into IDC operations during 2010. At the end of 2010, a total of 27 noble gas systems were in provisional operation at IMS radionuclide stations. Data from these stations are sent to the IDC and processed in the testing environment. Specific software to enable the monitoring of state of health parameters of these stations has been further developed.

Xenon analysis software for automatic and manual spectrum processing was developed further and is approaching the operational stage. Analysts were trained to use the review software. New procedures for product delivery using XML based techniques continued to be tested with some NDCs.

Distinguishing the civil anthropogenic background level of airborne radionuclides from radiation emissions due to Treaty-relevant events is still a challenging task that involves nuclear physicists, statisticians and meteorologists. The PTS has worked on understanding data collected from



the continuously increasing number of IMS noble gas systems in its database and created historical data sets for testing the method of categorization. Site specific descriptive parameters have been developed for use in attaching indicators to spectra and for distinguishing abnormal radioxenon concentrations from typical background. This has been done in cooperation with scientists from more than twenty institutions worldwide in the International Noble Gas Experiment (INGE) and discussed at workshops and scientific meetings.

Control room of the Operations Centre.

The European Union is supporting activities to explore the anthropogenic xenon background and to develop new mobile measurement systems for performing long term measurements of this noble gas in the field. In the first phase of this new project, container based noble gas measurement systems have been designed to allow autonomous operation under field conditions. The manufacture of two of these systems has been started. The systems are expected to be delivered to the PTS in mid-2011. After testing in Vienna, a two week training course is planned and thereafter the systems will be shipped to sampling locations.

Within the overall framework of quality assurance/quality control of IMS noble gas data and for the certification of noble gas systems, procedures to assess and validate the calibration of noble gas detectors have been developed. Within the regular quality assurance/quality control programme, 91 samples from

22 stations were reanalysed at five radionuclide laboratories with noble gas measurement capability. The comparison of station and laboratory analyses showed generally consistent results. The establishment of a regular scheme to remeasure samples is an important component of the quality assurance/quality control programme to ensure continued high quality of data after certification.

TRACKING RADIONUCLIDES THROUGH THE ATMOSPHERE

The CTBTO–WMO response system continued into its third year of provisional operation. This system enables the Commission to send requests for assistance in the case of suspicious radionuclide detections to nine Regional Specialized Meteorological Centres or National Meteorological Centres of the World Meteorological Organization located around the world. The centres respond to these requests by submitting their computations to the Commission with a target response time of 24 hours.

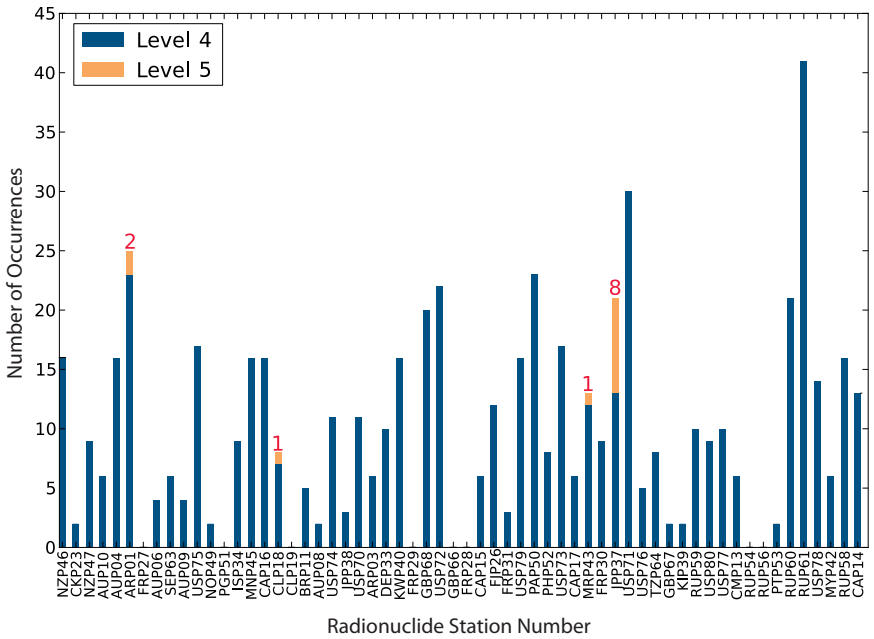
This system is intended to corroborate the backtracking calculations of the Commission, and all centres benefit from the feedback and evaluation of the backtracking systems and methods in use. To maintain the response system at a high level of preparedness, it was agreed that regular announced and/or unannounced system tests would be made.

The PTS continued to enhance its capabilities to perform atmospheric transport modelling and to reliably deliver high quality products to States Signatories. Atmospheric backtracking calculations are performed daily for each of the IMS radionuclide

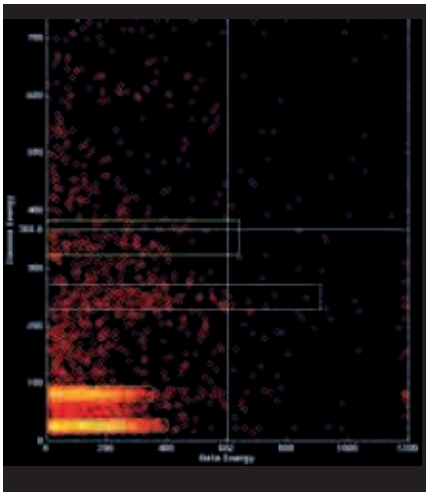
Overall Distribution of Treaty-Relevant Radionuclide Occurrences in 2010

Most detections refer to three nuclides, sodium-24, caesium-137 and cobalt-60, which are primarily due to cosmic radiation, to resuspension of fallout from the Chernobyl accident in 1986 or to historical atmospheric tests.

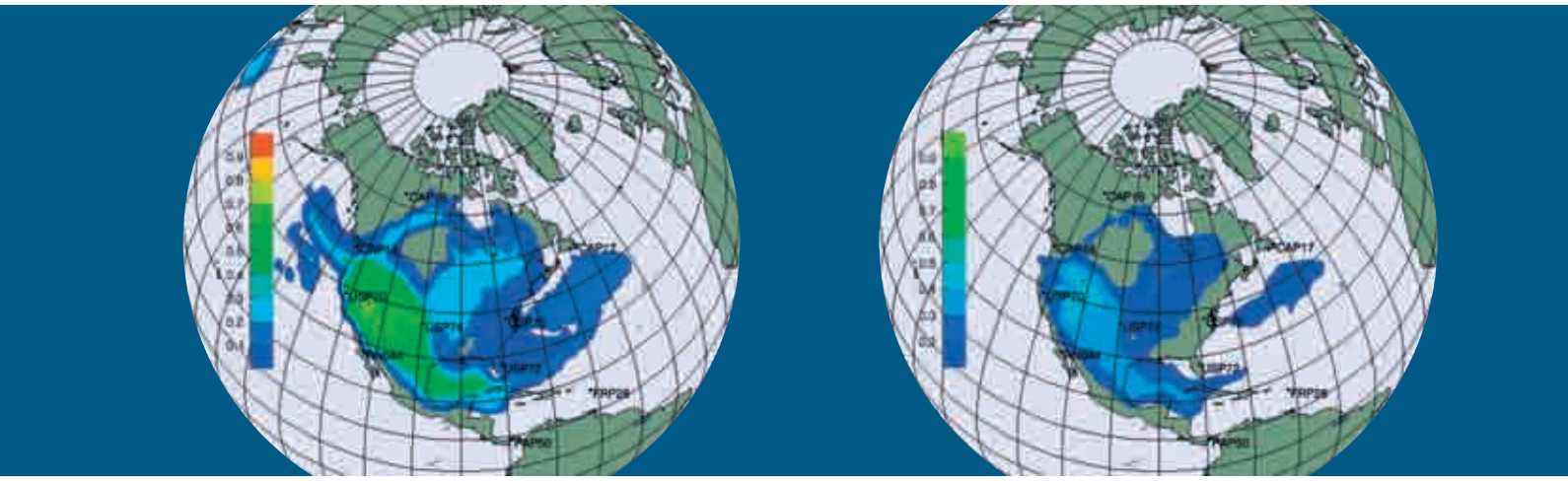
594 Level 4 and Level 5 Radionuclide Events Recorded During 2010 by IMS Stations in IDC Operations



A Level 4 radionuclide particulate spectrum indicates that the sample contains an anomalously high concentration of a single anthropogenic radionuclide (fission product or activation product) which is on the standard list of relevant radionuclides. A Level 5 radionuclide particulate spectrum indicates that the sample contains multiple anthropogenic radionuclides at anomalously high concentrations, out of which at least one is a fission product.



Coincidence histogram generated with the IDC processing package "bg_analyze/Norfy", which is used for analysing data from noble gas systems based on beta–gamma detectors.



Sample results of atmospheric transport modelling in the 2010 NDC Preparedness Exercise. The two figures present the calculated possible source region (PSR, shown in colour) for a fictitious release of radionuclides. *Left:* the PSR obtained using the backward modelling computations of the PTS. *Right:* the average PSR obtained from the backward modelling contributions of nine Regional Specialized Meteorological Centres of the WMO. In both cases the PSRs were built up by combining the projected fictitious detections made over the period 27–30 October 2010 at radionuclide stations of the IMS and using the PTS analysis software known as WEB-GRAPE. The two figures are similar, demonstrating that the WMO results confirmed the PTS calculations.

stations with near real time meteorological data obtained from the European Centre for Medium-Range Weather Forecasts. Using software developed by the PTS, States Signatories can combine these calculations with radionuclide detection scenarios and nuclide specific parameters to define regions in which sources of radionuclides are possibly located.

LESSONS LEARNED FROM THE SECOND ANNOUNCED NUCLEAR TEST BY THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

On 25 May 2009, the Democratic People's Republic of Korea announced that it had conducted its second nuclear test. The monitoring system performed well on that occasion for a variety of reasons. The IMS network had grown considerably since the announcement by the Democratic People's Republic of Korea of its first nuclear test in 2006, with 65 stations having been certified during this time. A wide range of ongoing sustainment activities helped to ensure a high level of data availability. The key systems throughout the network, including the IMS, the GCI and the IDC, as well as NDCs, were running well. Bearing in mind that the PTS is operating under guidelines for provisional operation, it was fortunate that computer systems were running normally and that key staff were available at short notice to address issues as needed.

The relevant material concerning the second test was collected and distributed in a timely manner, beginning with the initial briefing for States Signatories which was held on the morning of 25 May 2009. All relevant information was posted on the IDC secure web site, which provided an optimum means of access for all users on a single web site. This event also served to demonstrate the importance of conducting a technical review of any verification related material prior to release by the organization.

While the event in the Democratic People's Republic of Korea appeared in the Standard Screened Event Bulletin (SSEB), the values of the IDC body wave magnitude and surface wave magnitude placed the event very close to the event screening 'decision line'. Following investigations and subsequent discussions by experts, a recommendation to modify this event screening criterion was implemented.

The forward atmospheric transport modelling predictions are dependent on the assumed venting or seepage from the event and are subject to uncertainty in the meteorological fields. These points need to be clearly conveyed in order to preclude any unrealistic expectations.

Although there were no radionuclide observations which could be associated with the 2009 event in the Democratic People's Republic of Korea, the IMS noble gas stations were functioning correctly and the observed data could be used to place a constraint on the level of containment of noble gases. The lack of indicative radionuclide observations in the IMS noble gas network also

Left: **laying optical fibre cables to integrate the database grid into the infrastructure of the storage area network.** ***Right:*** **servers in the computer centre.**

shows the importance of the on-site inspection (OSI) component of the verification regime. For an OSI, the local noble gas signatures may be detectable up to 4–6 months after an underground nuclear test in the case of venting or seepage.

TSUNAMI EARLY WARNING SYSTEMS

In November 2006, the Commission endorsed a recommendation to provide continuous IMS data in real time to recognized tsunami warning organizations. The Commission subsequently entered into agreements or arrangements with a number of tsunami warning centres approved by the United Nations Educational, Scientific and Cultural Organization (UNESCO) to provide data for tsunami warning purposes. In 2010, an agreement was finalized with the tsunami warning centre in France. This brought to eight the number of such agreements or arrangements that the Commission has entered into: with Australia, France, Indonesia, Japan, the Philippines, Thailand and the USA (Alaska and Hawaii). Additional agreements or arrangements were being developed with Malaysia and Sri Lanka.

TECHNOLOGY FORESIGHT

The Commission is engaged in a technology foresight exercise in support of its commitment to uphold the relevance of its technology-intensive system, as well as to ensure awareness of developments in science and technology that could enhance performance and efficiency of systems and operations. It is a continuous process whereby scientists and technologists meet, interact, debate and jointly define future courses for Treaty related research and development. This involves an iterative cycle of workshops on various themes, definition of pilot projects and funding of these projects from various sources.

In its current phase, the technology foresight exercise is focused on identifying the scientific and technological developments that may affect future PTS operations. The aim of this phase is to deliver a medium- to long-term integrated technology forecast for the Commission. Several steps have been taken to engage the organization and the wider science and technology community in this activity. The technology foresight initiative has been presented at a number of meetings, and a paper describing the approach and initial results has been distributed. A Web based collaboration platform is being developed and is expected to become fully operational early in 2011.

SCIENCE AND TECHNOLOGY 2011

Verification of compliance with the Treaty poses challenges whose resolution depends crucially on the promotion and exploitation of scientific research and technological developments. The credibility of the verification system being established by the Commission, and its ability to detect, locate and identify nuclear explosions both rely on a continuing engagement with the specialist communities that drive advances in relevant instrumentation, processing and analysis methods. Recognizing the strategic importance of this, initiatives taken by the Commission such as "Synergies with Science" in 2006 and "International Scientific Studies" (ISS) in 2009 have provided fora for it to interact with the global scientific community.

The publication issued after the ISS Conference, entitled *Science for Security: Verifying the Comprehensive Nuclear-Test-Ban Treaty*, provided an overview of its achievements and the dialogue which took place there. The conference also allowed a synthesis to be made of potential topics in the further refinement of the verification system. This will help to guide future priorities for enhancement of verification capabilities.

The outcomes of the ISS project are helping to shape the next initiative to engage the scientific community, which will be a conference on "Science and Technology 2011", to be held at the Hofburg Congress Centre in Vienna on 8–10 June 2011. Preparations for this conference are under way. A programme committee meeting was held on 26–28 August 2010, at which the goals and themes of the conference were decided. A call for papers was launched on 1 November on the public web site, which included an area for submission of abstracts and registration. The conference will place more emphasis on oral presentations than the 2009 ISS meeting and will address the issues of data access for scientific work and funding of technical and scientific work related to the activities of the Commission. Promotional efforts included the distribution of a brochure and a poster.

A project to establish a virtual Data Exploitation Centre (vDEC) was initiated at the end of 2009 and progressed during 2010. The project included a Workshop on Machine Learning and Earth Structure in Montpellier, France, in September. A legal framework has been put in place for scientists to access data on the platform free of charge.

CONDUCTING ON-SITE INSPECTIONS

Highlights in 2010

Project oriented approach to accomplishing the OSI action plan

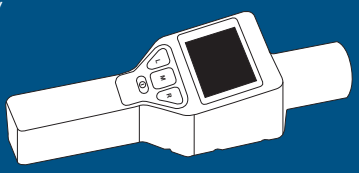
Concept development for the next Integrated Field Exercise (IFE) and build-up of operational capability

Start of the second training cycle for surrogate inspectors

The Treaty verification system monitors the world for evidence of a nuclear explosion. If such an event were to occur, concerns about possible non-compliance with the Treaty would be addressed through a consultation and clarification process. States could also request an on-site inspection (OSI), which is the final verification measure under the Treaty and can be invoked only after the Treaty has entered into force.

The purpose of an OSI is to clarify whether a nuclear explosion has been carried out in violation of the Treaty and to gather those facts which might assist in identifying any possible violator.

Since an OSI can be invoked by any State Party at any time, the capability to conduct such an inspection requires development of policies and procedures and validation of inspection techniques. In addition, OSIs call for adequately trained personnel, appropriate logistics and approved equipment to sustain a team of 40 inspectors in the field for up to 130 days. Reaching operational capability is crucial to ensuring that the Treaty time lines are kept while enforcing the highest standards of health and safety and confidentiality.



DIRECTED EXERCISE IN JORDAN

The on-site inspection (OSI) directed exercise DE10, hosted by Jordan, was conducted between 1 and 12 November 2010 in the Dead Sea area. The main aim of the exercise was the testing of ground based visual observation procedures and communications during an OSI. A total of 45 persons from 14 States Signatories participated in the exercise.

In line with the OSI action plan, the exercise had the following goals: to validate standard operating procedures for ground based visual observation; to establish standards in the search logic of the visual observation sub-team; to achieve synergy between the visual observation sub-team and the rest of the inspection team; to provide ideas for advanced training in visual observation; to produce the standard operating procedures for communication during an OSI by testing the communication concept for the inspection team; and to demonstrate the reliability of communication between all stakeholders.

The effectiveness of the developed search logic and the synergy between ground based visual observation and communication were verified during the exercise, in which communication technologies and hardware solutions to sustain an inspection were tested and validated. As a result, the tools and solutions will be adapted to fit the curriculum for the sub-teams for ground based

Directed exercise DE10 in Jordan.
Top: **using a map for orientation in the field.**
Middle: **installing a very small aperture terminal (VSAT) for satellite communication.**
Bottom: **preparing for a field mission.**

visual observation and communication as part of the training cycle.

The lessons learned from DE10 will have a vital impact on the work of the PTS and on plans for further developing operational capability and will be included in a comprehensive technical report.

To publicize the event, media representatives from the eastern Mediterranean region and the Near East were given press briefings and attended a media day, and the PTS produced television news material for distribution via UNifeed and a feature story for the television series UN in Action and for CNN Worldwide.

PROGRESS IN IMPLEMENTATION OF THE ACTION PLAN

The aim of the action plan, which was approved by the Commission in November 2009, is to provide a framework for developing the OSI regime in a project oriented manner. Resulting from the review and follow-up of the lessons learned from the 2008 IFE, the action plan outlines a total of 38 sub-projects in five main areas of development: policy planning and operations, operations support and logistics, techniques and equipment, training, and procedures and documentation. It is envisaged that the sub-projects will contribute to the build-up of OSI operational capability and assist in the preparation and conduct of the next IFE.

During 2010, a total of 28 sub-projects were initiated and 6 successfully concluded. The financial and human resource challenges experienced during the year and the limited availability of resources for 2011 necessitated an adjustment of the action plan.

CONCEPT DEVELOPMENT FOR THE NEXT INTEGRATED FIELD EXERCISE

In 2010, development of a mechanism was initiated to allow for testing and verifying action plan products and thereby facilitate the build-up of OSI operational capability in a harmonized and structured manner. As a follow-up, a draft concept was presented for further advancement of operational capability through a series of exercises prior to the next IFE. The discussions and requests for further elaboration led to a refinement of the concept.

This concept addresses individually and in a systematic way the different phases of an OSI, affording time, upon completion of specific action plan projects, to test and verify their applicability and to better prepare for conducting the next IFE. Once agreed and adopted, the concept will guide the preparations for the next IFE on the basis of both project management and results based management.

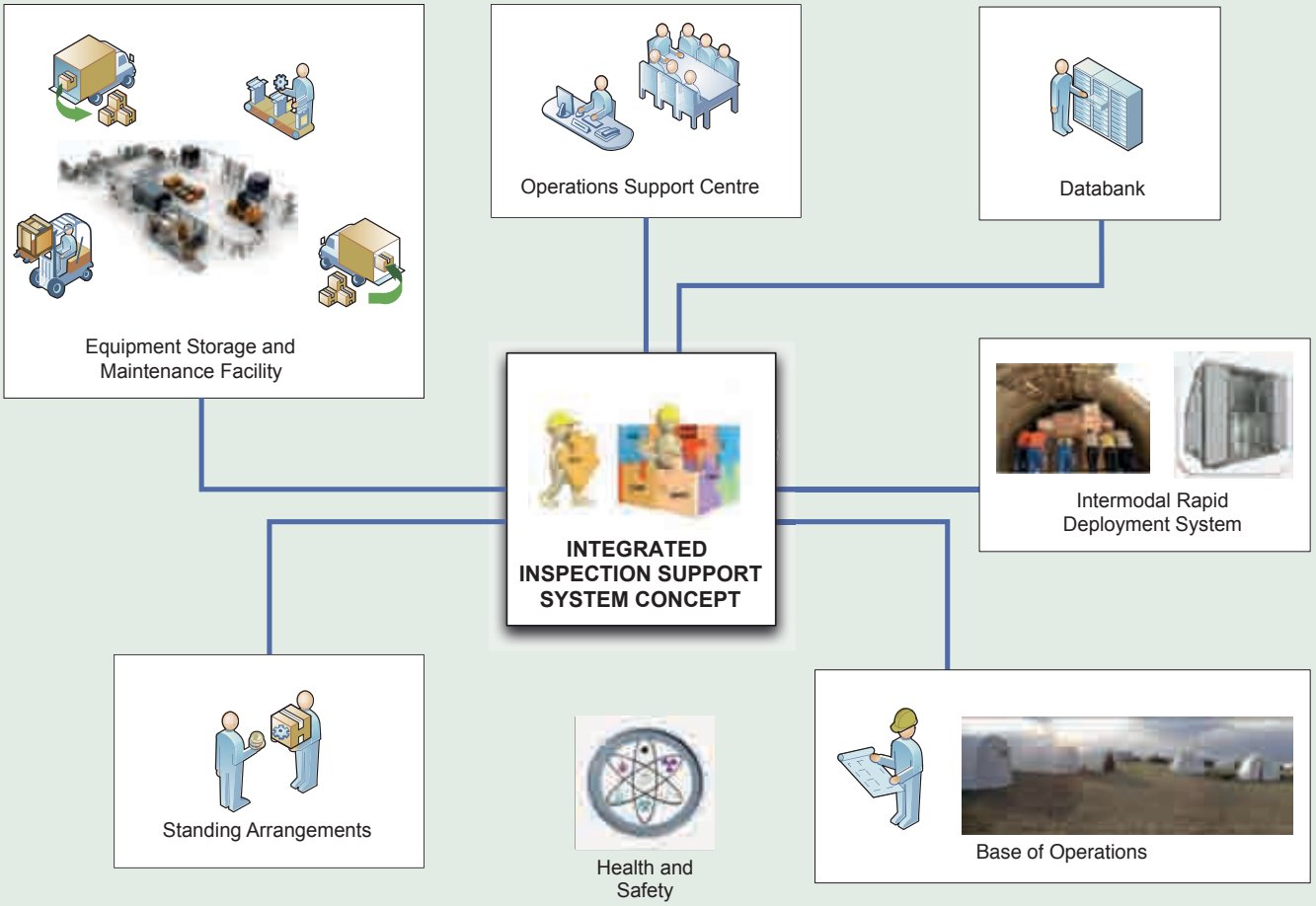
POLICY PLANNING AND OPERATIONS

Inspection policies and operational procedures were two main areas of further development during 2010. In accordance with the aims of the action plan, further conceptual and operational development was conducted in the areas of inspection team functionality and communication, data flow and the field information management system, in addition to the development of operational procedures for the pre-inspection phase, public information policy and administrative provisions during an OSI.

Lessons learned from the 2008 IFE showed that the development of procedures and techniques for real inspections needed to be supported by operational and project management procedures for exercises. An initial draft of exercise management guidance was distributed for review and is being revised according to the feedback received. It is envisaged that the final draft will be tested during the next round of exercise preparations.

Following conceptualization of the inspection team functionality in the first half of 2010, further detail to aid development was received as a result of DE10. With the aim to enable an inspection team to achieve the objectives assigned by Article IV of the Treaty, this work focuses on the initial techniques and on the prompt characterization and localization of any observable features or signatures consistent with the conduct of an underground nuclear explosion in violation of the Treaty. The PTS is in the process of consolidating requirements for individual inspection techniques, equipment specifications and sub-team compositions, as well as aspects of field planning and deployment.

Establishment of the Integrated Information Management System (IIMS) is currently in its final phase. As part of this phase, an in-house exercise took place in Vienna in December 2010 to test and evaluate the designed prototype and first operational IIMS platform. Lessons from this exercise will be applied in



the further refinement of the platform.

The main focus of the work on OSI communication in 2010 was the assessment and procurement of communication equipment, as well as continued development of communication technologies. As part of this development, two technical meetings were conducted with the Signal Corps School of the Austrian Armed Forces. Also, in the second half of 2010, the design concept and the proposed hardware solutions were tested during DE10. The exercise provided important input for the draft communication concept and standard operating procedures.

A study of information and data requirements necessary for efficient preparation of an inspection team in the pre-inspection phase was conducted. This study identified important data sources and will be used in close cooperation with the relevant Divisions of the PTS to develop standardized formats and templates, and procedures for handling, processing, archiving and disseminating OSI-relevant data.

Work to create a set of administrative provisions applicable to an OSI was initiated and proposals concerning areas for technical and developmental cooperation between the OSI Division and other Divisions of the PTS are under review.

Further development of OSI key performance indicators (KPIs) and their baselines and milestones was conducted. This was achieved by asking questions about key performance at the strategic level, aligning the action plan objectives with the OSI strategic objectives and harmonizing the KPIs for OSI with those existing for the Programme and Budget. The newly established KPIs will allow for a more structured monitoring of progress with the action plan and will ensure that results based management is applied to all activities for developing the OSI regime.

OPERATIONS SUPPORT AND LOGISTICS

As approved by the Commission, the PTS proceeded with the implementation of the Integrated

Inspection Support System. The concept covers nine major areas of operations support and logistics for the preparation, launch, conduct and recovery of an OSI: the system engineering of the Equipment Storage and Maintenance Facility (ESMF), the Operations Support Centre, the Intermodal Rapid Deployment System (IMRDS), the health and safety concept, the OSI databank, the base of operations, standing and ongoing arrangements, posture and culture, and staff duties in an OSI. Developments in 2010 focused on establishment of the ESMF and IMRDS, development of the OSI databank and the set-up of the infrastructure for the base of operations.

Greatest priority was given to the establishment of the ESMF and the infrastructure for the provisional Operations Support Centre, taking into account the interest expressed in the rental of premises for the ESMF. An adequately designed and equipped ESMF would allow integration of various parts of the Integrated Inspection Support System in a single facility through a synergetic approach and utilize existing infrastructure that might also be appropriate for OSI training and exercises.

A high level systems architecture and implementation plan were developed for the OSI databank. This will contain all the various databases needed to support the inspection team during an OSI and also to facilitate the coordination of the initial planning and preparation for an inspection.

In the framework of the IMRDS pilot project, research and development were carried out to find a solution which allows modular storage of equipment in a unit that is easily transportable and tailored specifically to the requirements of OSI techniques and technologies. It was estimated that 30 containers will be needed to transport one entire set of inspection and auxiliary equipment. Ten specially designed aircraft containers were purchased and delivered at the end of 2010. Twenty more containers have been purchased and their delivery was expected in the first half of 2011.

The layout and infrastructure requirements for the base of operations were further refined on the basis of lessons learned from the 2008 IFE to factor in climatic, topographical, cultural and geopolitical issues that have an impact on the requirements for the set-up of the infrastructure.

TECHNIQUES AND EQUIPMENT

During 2010, the development of techniques and equipment focused on noble gas monitoring techniques, multispectral and infrared monitoring technologies, refinement of continuation period techniques and finalizing the prototype of the Seismic Aftershock Monitoring System (SAMS).

Deep ranging electromagnetic sounding equipment being operated during a field test in Pecs, Hungary, September 2010. Such equipment can be used in the continuation period of an OSI for detection of anomalies caused by artificial structures and the geological equivalents of signals typical of underground nuclear explosions.

Inspection of a prototype of a radioxenon detection system (XESPM-2) during a technical visit of PTS representatives to the Chinese NDC, Beijing, March 2010.

A tabletop exercise was conducted in Baden, Austria, in November as part of the finalization of the SAMS prototype. SAMS stakeholders discussed and drafted initial change management principles to transfer the current Oracle based SAMS to a PTS-wide acceptable architecture. The SAMS software suite was installed on a high performance desktop PC to be used for further software development and small scale trials.

With respect to multispectral monitoring, reports were received from a State Signatory on a recently conducted field experiment and the findings are being used to develop the technology further. In parallel, within the framework of the preparation for a meeting in December on continuation period techniques, various OSI-relevant electromagnetic models were prepared and fine-tuned.

Concerning the development of an OSI specific radioxenon system, the procurement process for a high resolution gamma spectrometer and its auxiliaries was initiated. Through a joint venture with China, it was possible to further develop the noble gas monitoring system in 2010, conduct discussions and draft the first radioxenon system concept.

The results and lessons learned from the 2009 noble gas field operation tests were issued in a Technical Report for further discussion.

TRAINING

Training in 2010 focused on preparations for the second training cycle for surrogate inspectors, based on thorough analysis of training needs after the 2008 IFE. In this effort, a series of training planning meetings

Top: **participants in the introductory course of the second training cycle for surrogate inspectors, Varpalota, Hungary, June–July 2010.** ***Middle:*** **tabletop exercise devoted to visual observation techniques, Daejeon, Republic of Korea, August–September 2010. Trainees leave a helicopter after conducting overflight activities. The helicopter was provided as a contribution in kind by the Republic of Korea for training in overflight techniques.** ***Bottom:*** **participants in the 17th OSI workshop, Baden, Austria, May 2010.**

were conducted with stakeholders in OSI training. The process ended with an advanced training planning meeting in Baden, Austria, in early December, where all identified training requirements for OSI techniques were successfully integrated.

The main OSI training activity was held in Varpalota, Hungary, in June–July 2010, marking the start of the second training cycle with the participation of 62 trainees from 47 States Signatories. Assessment of progress made by trainees and their level of satisfaction with the programme led to the conclusion that this activity was well prepared and executed.

The 18th OSI Introductory Course was held from 13 to 16 April in Vienna for 20 diplomatic personnel from 16 Permanent Missions and 2 PTS staff members. This OSI outreach activity was well received and renewed the interest of States Signatories in participating in and supporting the implementation of the action plan projects.

In response to an offer from the Republic of Korea to host an OSI training activity, a tabletop exercise on visual observation was held in Daejeon from 30 August to 3 September. Participants learned how to apply visual observation techniques by improving operating procedures through specific problem solving assignments. A similar activity, a tabletop exercise for SAMS, was held in Baden, Austria, for experts in seismic techniques and selected trainees from the second training cycle. Through these activities the participants were successfully trained and the goals of the second training cycle for 2010 were thereby achieved.

Production of new e-learning modules continued at the request of trainees. As a result of the feedback received from participants, a module on radiation safety and a pilot module on OSI equipment (magnetometer) were approaching the trial phase.

PROCEDURES AND DOCUMENTATION

The PTS continued to provide substantive, technical and administrative assistance to Working Group B in its third round elaboration of the draft OSI Operational Manual in 2010.

The PTS conducted its 17th OSI workshop in Baden, Austria, from 3 to 7 May. The workshop brought together 73 participants from 22 States Signatories and the PTS. It focused on essential techniques, core equipment and specific applications. The workshop report made recommendations for various activities, such as the conduct of another IFE by 2014, and the development of OSI equipment for detection of radioactive xenon and argon isotopes and of an atlas of observable features and signatures indicative of an underground nuclear explosion. The recommendations were also endorsed by the Commission, without prejudice to a target date for the next IFE.

The 18th OSI workshop was held in Vienna from 22 to 26 November. A total of 52 experts from 16 States Signatories and the PTS participated in the workshop. It addressed a number of technical issues concerning the draft OSI Operational Manual, such as data handling and confidentiality of inspection team data (including the handling of digital images), inspection team communication, equipment related pre-inspection activities and the OSI equipment list. The draft PTS planning concept for preparation and conduct of the next IFE was also presented and discussed.

A list of standard operating procedures required for each inspection phase was produced in light of requirements for the next IFE and an updated list of procedures identified for development. A preliminary review of existing procedures was initiated and several meetings were held to discuss standardization and consistency checking.

In accordance with the action plan, the OSI documentation management system was updated to include revised documentation. A review of control and coding procedures for OSI quality management documentation was initiated.

CAPACITY BUILDING

Highlights in 2010

Development of country profiles and analyses for use in capacity building and training efforts for all geographical regions

Further development and use of e-learning modules as prerequisites for NDC training events

Delivery of capacity building systems to 14 NDCs

The CTBTO Preparatory Commission offers States Signatories training courses and workshops in technologies associated with the International Monitoring System (IMS), the International Data Centre (IDC) and on-site inspection, thereby assisting in the strengthening of national scientific capabilities in related areas. In some cases, equipment is provided to National Data Centres to increase their capacity to participate actively in the verification regime by accessing and analysing IMS data and IDC products. Such capacity building serves to enhance the technical capabilities of States Signatories throughout the globe, as well as those of the Commission. As technologies expand and improve, so too do the knowledge and experience of designated personnel. Training courses are held at the Headquarters of the Commission, as well as in numerous external locations, often with the assistance of hosting States. The European Union also continues to contribute to the capacity building programme of the Commission.

Participants in a technical training course for station operators held in Vienna in 2010. *Left:* calibration of an infrasound barometer. *Right:* replacing the bearings and the air sampler in a radionuclide monitoring unit.

CAPACITY BUILDING PHASES

The capacity building programme of the Commission for States Signatories includes training courses and workshops, equipment donations and technical follow-up visits. The programme, which continues to be supported by contributions from the European Union, consists of various phases:

- Development of country profiles for all States Signatories
- Provision of a regional NDC development workshop
- Provision of a two week training course for NDC technical staff
- Provision of one or more experts
- Provision of basic NDC computer equipment.

The programme has been considerably enhanced with e-learning, which is being used on a routine basis and as a prerequisite for all training events for NDC technical staff, station operators and OSI inspectors.

COUNTRY PROFILES

A standard country profile for all States Signatories has been developed. This profile contains the information available at the PTS regarding the number of authorized users that the State has, the use of IMS data and IDC products, and participation in previous training events. The profiles serve as a reference before and during events and meetings with States.

NDC DEVELOPMENT WORKSHOPS

Three NDC development workshops were conducted in 2010, in Australia (29 participants), in Jordan (19 participants) and in Vienna for the Eastern Europe region (12 participants). Their purpose was to promote understanding of the Treaty and the work of the Commission, to enhance national capabilities of States Signatories in the implementation of the Treaty, to promote the exchange of experience and expertise among States Signatories in the establishment, operation and management of an NDC, and to promote the application of verification data for civil and scientific purposes. The workshops included presentations from the Commission emphasizing the information needed to build and sustain NDCs, and presentations from representatives of NDCs in all stages of development. They also provided opportunities to collect additional information for the country profiles.

TRAINING NDC TECHNICAL STAFF

Following an NDC development workshop, NDC technical staff are trained over a two week period in accessing IMS data and IDC products, downloading and installing the NDC in a box software, and analysing data with the tools provided. A total of 62 NDC technical staff were trained in three two-week advanced courses held during 2010 in Malaysia, Spain and Vienna.

NDC TECHNICAL VISITS

Following an advanced training course, a consultant is provided to the recipient country to assess how the participants are making use of what was learned at the course. The objective is to ensure that the trainees can routinely use data and products of the Commission. Specific needs and interests are also addressed during this visit.

NDC CAPACITY BUILDING EQUIPMENT

As part of the capacity building strategy of the Commission, several sets of equipment necessary for establishing an adequate technical infrastructure at NDCs were purchased by means of the Regular Budget and Joint Action Projects III and IV of the European Union. The equipment has been delivered to 14 NDCs, and several more deliveries are planned for 2011. The equipment, provided as part of the technical assistance given to States Signatories to establish or strengthen their NDCs, enhances the capacity of an NDC to participate in the verification regime and to develop civil and scientific applications in accordance with the perceived needs.

TRAINING STATION OPERATORS

A diverse range of training events for station operators and NDC technical staff was provided in 2010. A total of

Participants in the 2010 Workshop on Noble Gas Monitoring and IMS Radionuclide Laboratories, Buenos Aires, November 2010.

73 station operators benefited from nine courses, largely on the use and maintenance of equipment, but also covering procedures relating to reporting and communication with the PTS.

WORKSHOPS ON MONITORING TECHNOLOGIES

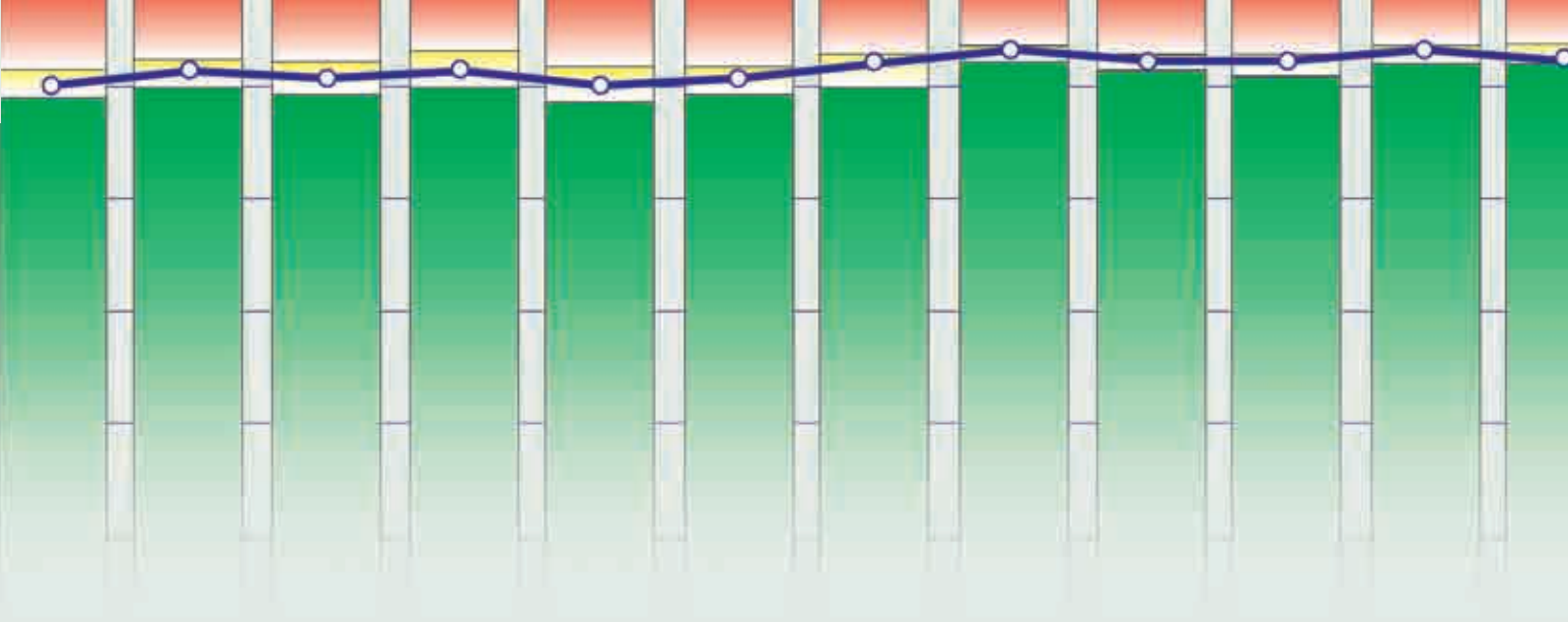
Infrasound Technology Workshop 2010, organized by the Tunisian NDC, the Centre national de la cartographie et de la télédétection, with the support of the Commission, took place in Tunis from 18 to 22 October. Highly acclaimed scientists from approximately 25 countries presented their work on the latest advances in infrasound technology. Major topics covered at the workshop included the status of the IMS infrasound network, the status of the IDC infrasound projects, sensor technology, network detection capabilities, data processing, modelling, comparison of infrasound and seismic signals, and volcanic signal analysis.

The Nuclear Regulatory Authority of Argentina hosted the 2010 Workshop on Noble Gas Monitoring and IMS Radionuclide Laboratories in Buenos Aires from 1 to 5 November with the support of the Commission. A total of 80 experts from around the globe in the field of noble gas monitoring and radionuclide laboratories attended the workshop. Research results, operational experience and information on procedures were exchanged and recommendations formulated on the following topics: science and technology, data analysis, the background xenon level, operation and failure analysis, certification, new and future developments in atmospheric transport modelling, OSI, laboratory quality assurance/quality control with respect to noble gas monitoring, the 2009 Proficiency Test Exercise and laboratory techniques.

E-LEARNING

The e-learning system was put into preliminary operation at the end of 2009 and its use increased throughout 2010. The development of e-learning modules with support from the European Union continued and with the available funds it was possible to expand the number of courses from that originally planned. By the end of 2010, 26 courses were available and 12 of them had been translated into the official languages of the United Nations.

This e-learning system is being used for the training of NDC technical staff, station operators and OSI inspectors. The modules are made available for authorized users, station operators, OSI inspectors and PTS staff.



IMPROVING PERFORMANCE AND EFFICIENCY

Highlights in 2010

Completion of the PTS Process Metrics Manual

Further development of procedures related to the Quality Management System

NDC Evaluation Workshop in Nairobi

Throughout the process of establishing the verification system, the Provisional Technical Secretariat of the CTBTO Preparatory Commission aims for effectiveness, efficiency and continual improvement through the implementation of its Quality Management System. This system is focused on customers, such as States Signatories and National Data Centres, and aims at fulfilling the responsibilities of the Commission in establishing the CTBT verification regime in compliance with the requirements set forth in the Treaty, its Protocol and relevant documents of the Commission.

Sample screenshot of verification system metrics displayed by the Performance Reporting Tool (PRTool). *Top left:* evolution of data availability of IMS radionuclide stations from 2000 to 2010. *Top right:* distribution of reports, requests and notifications, by type, received in IDC operations from all IMS facilities in 2010. *Bottom:* cumulative numbers of certified IMS stations, by technology, from 2000 to 2010.

Participants of the 2010 Quality Management Workshop, Vienna, November–December 2010.

DEVELOPING THE QUALITY MANAGEMENT SYSTEM

The function of the Quality Management System is to identify and put into effect KPIs for evaluating PTS processes and products, thus facilitating management review and continual improvement. KPIs are metrics used to quantify progress in reaching objectives and to indicate the strategic performance of an organization. They are primarily employed to assess the status of an organization and to prescribe a course of action. The aim of the Quality Management System is to support the objective of consistently meeting verification system requirements. It encompasses all contributing PTS processes and work products.

In 2010, the KPIs for radionuclide and waveform data and products, as well as for the related PTS supporting processes, were subject to peer reviews by expert panels. The corresponding reports and recommendations were made available to the participants in the 2010 Quality Management Workshop.

The peer review panels concluded that KPIs are those needed by stakeholders to ensure that the verification system is functioning satisfactorily according to the requirements of the Treaty. The panel for radionuclide KPIs analysed them with respect to their priority for the main stakeholders. The panel for waveform KPIs

recommended revising the structure of the indicators with respect to key performance areas or processes and to key performance goals and metrics, as well as simplifying the KPI system.

The 2010 Quality Management Workshop was held from 29 November to 1 December in Vienna. Over 35 participants representing 10 States Signatories, two international organizations and the PTS attended the workshop.

The workshop endorsed the PTS Process Metrics Manual and recommended, inter alia, the adoption of the following general processes/performance goals: to complete and provide access for authorized users to the re-engineered Web based platform displaying the values of the KPIs; and to further develop, test and validate the necessary measurement tools, baselines and KPIs for network capabilities.

The workshop recognized that the system of indicators in the PTS Process Metrics Manual should be at the centre of the framework within which the technical Divisions of the PTS perform self-evaluation activities. It also noted that the PTS evaluation function was needed to support the technical Divisions in such activities and to provide, to both the technical Divisions and the Commission, feedback on the consistency of these activities with the evaluation framework.

The glossary of terms used in the CTBTO community was discussed during the workshop and will be further elaborated in accordance with the recommendations of the participants.

With a view to normalizing and harmonizing the evaluation functions across the United Nations, the United Nations Evaluation Group (UNEG) agreed upon norms and standards for evaluation in the United Nations system in 2005. On the basis of these norms and standards and the mandate given by the Commission, a self-assessment was carried out, which became a subject of discussion during the workshop.

It became apparent that self-evaluations are widely implemented by PTS technical Divisions and that great emphasis is given to defining the framework for these Divisions to perform self-evaluation.

External evaluations by users of data and products and subsequent monitoring of the implementation of recommendations were also recognized as core features of the PTS evaluation system.

It was found that the Quality Management System and relevant procedures provide a good basis for implementing evaluations that are credible, useful and independent. However, it was agreed that consideration should be given to developing an evaluation manual for further defining and providing guidelines, in conformity with UNEG norms and standards, concerning what should be evaluated, how and by whom, and including the different evaluation approaches and tools.

Participants in the 2010 NDC Evaluation Workshop, Nairobi, May 2010.

EVALUATING ON-SITE INSPECTION ACTIVITIES

The evaluation of OSI activities focused on the preparation of the evaluation framework for the 2010 directed exercise and tabletop exercise devoted to ground based visual observation.

FEEDBACK FROM NATIONAL DATA CENTRES

The 2010 NDC Evaluation Workshop was hosted by the Government of Kenya and jointly organized by the Government and the Commission. Over 75 participants representing 30 States Signatories, NDCs and the PTS met in Nairobi from 10 to 14 May.

In its Quality Policy, the PTS underlines its focus on customers. NDCs, as the main users of PTS products and services, meet in annual NDC evaluation workshops in order to provide their feedback to the PTS. In Nairobi, the feedback from the 2009 NDC Preparedness Exercise (NPE) and other NDC input were fundamental to achieving this objective. The workshop recognized that the NPE is an activity, planned and run by NDCs, which should continue with PTS support and underlined the need for a data fusion product to be discussed and defined with respect to content and format. While the 2009 NPE included infrasound data for the first time, it was clear that use of infrasound data was at an early stage and there was a need for additional tools for NDCs in this regard. The 2010 NPE was planned to take place in the fourth quarter of 2010 and to be based on synthetic radionuclide observations. It was suggested that use of auxiliary seismic data in the IDC automatic processing could be a topic of interest for the waveform expert group of Working Group B.

The workshop recognized that the performance testing framework is being consolidated by a number of initiatives related to the development and implementation of tests and monitoring tools and processes. NDCs were strongly encouraged to become familiar with the PTS performance reporting tool (PRTool) and the capabilities that it offers. The participants noted that KPIs related to data and products are of primary importance to NDCs and should be given the highest priority in the development of PRTool.

The workshop recommended that the status of implementation of recommendations by previous workshops be reviewed at the next NDC evaluation workshop.

As a follow-up of a recommendation made at the 2009 NDC Evaluation Workshop in Beijing, an unprecedented example of support among NDCs took place in which one NDC assisted others: hosted by the University of Nairobi, the Italian National Institute of Geophysics and Volcanology (INGV) guided participating NDCs in the analysis of an NPE-like event, which involved applying virtual machine software based on Geotool (provided by the PTS). This 'horizontal support' was expected to result in additional NDCs participating in the 2010 NPE, regardless of their hardware and software limitations. The NDC forum proved to be a key element in the continuously growing cooperation among NDCs as well as a fundamental support for the NPEs.

CONTRIBUTION TO THE WORK OF THE UNITED NATIONS EVALUATION GROUP

UNEG brings together the units responsible for evaluation in the United Nations system, including the specialized agencies, programmes and affiliated organizations. It aims to strengthen the objectivity, effectiveness and visibility of the evaluation function across the United Nations system and to advocate the importance of evaluation for learning, decision making and accountability. UNEG provides a forum for members to share experience and information, discuss the latest evaluation issues and promote simplification and harmonization of reporting practices.

The 2010 annual meeting of UNEG was held in Vienna in early May. The meeting was opened by the Executive Secretary of the Preparatory Commission on behalf of the organizations based at the Vienna International Centre. In his remarks, the Executive Secretary emphasized the key role that evaluation plays in the PTS to assist in fulfilling the provisions of the Treaty, namely to monitor, assess and report on the overall performance of the verification system.

POLICY MAKING

Highlights in 2010

Further expansion of the project to promote the participation of developing countries in official technical meetings of the Commission through support of 10 experts for the first time

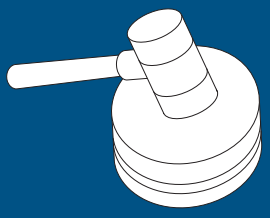
Appointment of Ambassador Antonio Guerreiro (Brazil) as Chairperson of Working Group A

Further advances in establishing the Information System with Hyperlinks on Tasks Assigned by the Resolution Establishing the Preparatory Commission (ISHTAR)

The plenary body of the CTBTO Preparatory Commission, which is composed of all States Signatories, provides political guidance and oversight to the Provisional Technical Secretariat. The plenary, as the Policy Making Organ, is assisted by two Working Groups.

Working Group A deals with budgetary and administrative matters facing the organization, while Working Group B considers scientific and technical issues related to the Treaty. Both Working Groups submit proposals and recommendations for consideration and adoption by the Commission.

In addition, an Advisory Group of qualified experts serves in a supporting role, advising the Commission through its Working Groups on financial, budgetary and associated administrative matters.



MEETINGS IN 2010

In 2010, the Thirty-Fourth Session of the Preparatory Commission was held on 28–29 June and was chaired by Ambassador Selma Ashipala-Musavyi, Permanent Representative of Namibia. The Thirty-Fifth Session of the Commission was held on 8–9 November with Ambassador Xolisa Mabhongo, Permanent Representative of South Africa, as Chairperson.

Working Group A was chaired by Ambassador Antonio Guerreiro (Brazil) and held its Thirty-Seventh Session from 7 to 8 June and its Thirty-Eighth Session from 4 to 5 October. Working Group B was chaired by Mr Hein Haak (Netherlands) and held its Thirty-Fourth Session from 15 February to 5 March and its Thirty-Fifth Session from 16 August to 3 September. Joint meetings of Working Groups A and B were held on 1 March, 3 June and 30 August. In addition, informal open-ended consultations on various Working Group B issues were held from 31 May to 2 June. The Advisory Group, chaired by Mr Michael Weston (United Kingdom), held the first and second parts of its Thirty-Fourth Session from 22 to 23 April and from 10 to 14 May and its Thirty-Fifth Session from 6 to 8 September.

Delegates at the Thirty-Fifth Session of the Preparatory Commission in November 2010.

EXPANDING THE PARTICIPATION OF EXPERTS FROM DEVELOPING COUNTRIES

The PTS continued the implementation of a project, initiated in 2007, to facilitate the participation of experts from developing countries in official technical meetings of the Commission. The stated aim of this project is to strengthen the universal character of the Commission and capacity building in developing countries.

The PTS introduced a number of further improvements to the implementation of the project. These included arranging an orientation briefing during the Thirty-Fifth Session of Working Group B to provide the new experts with an overview of the mandate and work

of the Commission, taking a more targeted approach to identifying, in consultation with donor countries as appropriate, possible intersessional events (including regional technical meetings and workshops) in which the experts could participate under the project, and seeking feedback from previously supported experts concerning their continuing links with Treaty related issues, with a view to gauging the sustainability of the benefits of participation in the project.

In 2010, four experts supported in 2008 and 2009 left the project and five new experts were selected, bringing the total number of experts supported to 10 for the first time (one each from Bolivia (Plurinational State of), Brazil, Indonesia, Kenya, Madagascar, Papua New Guinea, the Philippines, Samoa, Sri Lanka and Tunisia). Experts from two least developed countries were therefore supported under the project.

The experts took part in sessions of Working Group B and other technical meetings, including informal consultations on issues related to Working Group B in May–June, the NDC Evaluation Workshop in May and the Quality Management Workshop in November–December. In addition, the experts benefited from a series of technical discussions with the PTS on key verification related issues. The expert from Kenya continued to lead discussions as the Task Leader for Issues Related to NDCs at both of the regular sessions of Working Group B.

The project was financed in 2010 by voluntary contributions from Austria, China, Finland, Hungary, Indonesia, Luxembourg, Malaysia, Morocco, the Netherlands, New Zealand, Norway, Oman, Qatar, the Republic of Korea, Slovenia, South Africa, Spain, Turkey and the United Kingdom, as well as from the OPEC Fund for International Development.

On the basis of an implementation report prepared by the PTS, at its November session the Commission expressed support for the project and further commitments for its implementation were announced. The Commission also expressed its appreciation to the donor countries for their contributions and to the PTS for its reports on, and management of, the project.

SUPPORTING THE PREPARATORY COMMISSION AND ITS SUBSIDIARY BODIES

The PTS is the body that executes the decisions adopted by the Commission. It is multinational in composition: staff are recruited from States Signatories on as wide a geographical basis as possible. As far as the meetings of the Commission and its subsidiary bodies are concerned, the role of the PTS is to provide substantive and organizational support. From organizing conference facilities and arranging interpretation to drafting official documents of the various sessions and advising the Chairpersons, the PTS is a vital element in the work of the Commission and its subsidiary bodies.

The PTS provided substantive and organizational support to the coordinators of the Article XIV process in connection with the holding of informal consultations of States ratifiers. A decision was taken by the Commission on the financing of an Article XIV conference in the event that the Secretary-General of the United Nations, as Depositary of the Treaty, is requested by a majority of ratifying States to convene such a conference in 2011.

Information System on Progress in Fulfilling the Mandate of the Treaty

Further advances were made in establishing ISHTAR. Using hyperlinks to the official documentation of the Commission as its basis, the aim of the ISHTAR project is to monitor progress achieved in accordance with the mandate of the Treaty, the Resolution establishing the Commission and the guidance of the Commission and its subsidiary bodies. Its overall purpose is to enable the Commission to determine which tasks remain to be completed in terms of preparations for the establishment of the CTBTO at entry into force.

Virtual Working Environment

The PTS provides a virtual working environment for those unable to attend regular meetings of the Commission and its subsidiary bodies. State of the art technologies are employed to transmit the proceedings of each official plenary

meeting around the globe in real time. Meetings are recorded and transmitted live via the Experts Communication System (ECS) before being archived for reference purposes. In addition, supporting documents related to each particular session are distributed to States Signatories through the ECS, and participants are notified of new documents by email alerts. In 2010, the PTS started distributing on DVDs all documents of and presentations to the Commission and its subsidiary bodies at the beginning of each of their sessions.

OUTREACH

Highlights in 2010

Sustained commitment to the Treaty and its entry into force

Ratification of the Treaty by the Central African Republic and Trinidad and Tobago, and commitments to ratify by Guatemala, Indonesia, Iraq, Papua New Guinea and Thailand

Launch of video–audio project to improve worldwide media coverage of the Treaty and its verification regime

A key mandate of the Provisional Technical Secretariat of the CTBTO Preparatory Commission is to promote understanding of the objectives and principles of the Treaty, the functioning of the Commission, the global CTBT verification regime, and the civil and scientific applications of the International Monitoring System. This is done through interaction with the international community, including States, international organizations, academic institutions, non-governmental organizations, the media and the general public. The outreach activities involve promoting signature and ratification of the Treaty by States, educating the general public about the work of the Commission and fostering international cooperation in the exchange of verification related technologies.

SUPPORT FOR THE TREATY

Over the years, the Commission has energetically pursued its objectives of raising awareness and enhancing understanding of the Treaty, establishing the verification regime and installing IMS facilities, and promoting signature and ratification. Although events in 2009 heightened the salience of the CTBT as never before, the renewed momentum created for its entry into force and universality was equally sustained in 2010 as a result of several developments that have consolidated the political determination of the international community in favour of the Treaty. The States parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) affirmed the vital importance of the entry into force of the CTBT as a core element of the nuclear non-proliferation and disarmament regime at the 2010 NPT Review Conference. Significantly, Indonesia, an Annex 2 State, announced its intention to initiate the ratification process for the Treaty. Over seventy countries attended the fifth Ministerial Meeting to promote the entry into force of the Treaty, of which 24 were represented at the ministerial level. The Treaty promises to remain, as it has always been, a uniting force in the multilateral system, and these events clearly demonstrated that the Treaty continues to be a rallying point for nuclear non-proliferation and disarmament.

The political support for the Treaty and the work of the Commission has reached an unprecedented level, as evinced by the near universal recognition in the international community that the Treaty is an effective instrument of collective security and an important pillar of the nuclear non-proliferation and disarmament regime. A growing number of States, politicians and representatives of civil society are spearheading the campaign for ratification of the Treaty by the remaining States, including the Annex 2 States. Through their efforts, the international community is sending a resounding message that the Treaty has a critical role to play in today's security environment. A strong and verifiable final barrier to acquiring a nuclear weapons capability is of vital importance for a comprehensive approach to addressing common security challenges. An all-inclusive and non-discriminatory legal instrument, the Treaty constitutes a unique political and scientific arrangement in the area of cooperative security. The political determination to bring this instrument into full legal standing is based on a strong belief in the multilateral security architecture buttressed by verifiable and enforceable treaties, the desire to put an end to nuclear weapons testing by codifying the international norm against nuclear testing, and the drive to achieve the vision of a world free of nuclear weapons.

Maintaining and building on the momentum created in support of the Treaty requires the Commission to seize upon every suitable occasion to further its objectives and explore modalities of engagement with States, as well as with civil society and the international scientific community. Any worthwhile endeavour – and bringing about an end to nuclear testing constitutes such an endeavour – is achieved only through sustained investment in its realization. In terms of the Treaty, what is necessary now and in the future is sustained political, technical and financial investment in the Treaty and its verification regime. This investment will pay dividends not only through enhancing international peace and security by verifiably ending nuclear testing, but also by building on the multilateral security architecture designed to create the conditions for a world free of nuclear weapons.

TOWARDS ENTRY INTO FORCE AND UNIVERSALITY OF THE TREATY

The Treaty moved closer to universalization in 2010 with ratification by the Central African Republic and Trinidad and Tobago. Indonesia announced its intention to pursue and complete the ratification process. In addition, during the 2010 NPT Review Conference, Guatemala, Iraq, Papua New Guinea and Thailand announced their intentions to ratify the Treaty.

As of 31 December 2010, the Treaty had been signed by 182 States and ratified by 153 States, including 35 of the 44 States listed in Annex 2 to the Treaty, whose ratification is required for the Treaty to enter into force.

INTERACTING WITH THE INTERNATIONAL COMMUNITY

Continuing in its efforts to facilitate the implementation of the decisions of the Commission on the establishment of the verification regime and to promote participation in the work of the Commission, in 2010 the PTS maintained a dialogue with States through bilateral visits in capitals and interactions with Permanent Missions in Vienna, Berlin, Geneva and New York. The major focus of such

interactions was on States hosting IMS facilities and States that have not yet signed or ratified the Treaty (particularly those listed in Annex 2). The PTS also took advantage of various international, regional and subregional conferences and other gatherings to enhance understanding of the Treaty and to advance its entry into force and the building of the IMS.

The Executive Secretary of the Preparatory Commission visited France, Germany, Ireland, Israel, Japan, Jordan, Kazakhstan, Kenya, Morocco, Norway, the Philippines, Switzerland, Thailand and the USA with a view to strengthening their interaction with the Commission and highlighting the significance of entry into force of the Treaty.

NPT Review Conference

On 6 May 2010, the Executive Secretary addressed the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons at the United Nations Headquarters in New York. The NPT States parties stood firm in their resolve to overcome their failure in 2005 and they granted the NPT a renewed lease of life. The conference unanimously adopted a Final Document that contained conclusions and recommendations with an action plan on nuclear disarmament and non-proliferation, where the CTBT was prominently featured.

The CTBT received unprecedented high level attention during the conference. The announcement by the Foreign Minister of Indonesia that his country intends to ratify the Treaty created a positive atmosphere from the outset. In the Final Document, States parties reaffirmed the essential

Top: **delegates at the NPT Review Conference, New York, May 2010.** ***Middle:*** **among the invited guests at the opening of the exhibition, "Putting an End to Nuclear Explosions", were (*from left to right*) Michael Douglas, United Nations Messenger of Peace, Marty Natalegawa, Minister for Foreign Affairs of Indonesia, Ban Ki-moon, United Nations Secretary-General, Taïb Fassi Fihri, Minister of Foreign Affairs and Cooperation of Morocco, and Sergio Duarte, United Nations Under-Secretary-General and High Representative for Disarmament Affairs.** ***Bottom:*** **the Executive Secretary of the CTBTO Preparatory Commission, Tibor Tóth, in discussion with the United Nations Secretary-General.**

role of the CTBT in the nuclear disarmament and non-proliferation regime and the vital importance of its entry into force. Moreover, NPT States agreed that the CTBT plays a significant role in constraining the development of nuclear weapons as well as the acquisition of nuclear weapons capability. It is imperative that the international community implement the undertakings set forth in the action plan. There is no shortcut to implementation of these commitments. The CTBT can only exist with a strong NPT regime. As the last barrier against nuclear weapons, the CTBT offers a systematic approach to addressing the challenges to the nuclear non-proliferation regime.

The PTS conducted a comprehensive and proactive media campaign before, during and after the conference. The opening of a CTBT exhibition in the visitors' lobby of the United Nations Headquarters in the first week of the conference attracted over three hundred guests, including foreign ministers, ambassadors and delegates, and representatives of civil society, academic institutions and the media. The exhibition served as an effective outreach tool, providing the setting for events such as guided tours and briefings on the CTBT. It remained open for the public until the end of June and attracted about one hundred thousand visitors.

Fifth Ministerial Meeting on Promoting the Entry into Force of the Treaty

On the eve of the 14th anniversary of its opening for signature, foreign ministers gathered for the fifth Ministerial Meeting on promoting the entry into force of the CTBT in New York. The biennial meeting, held on 23 September 2010, was convened by Australia, Canada, Finland, France, Japan, Morocco and the Netherlands. More than seventy countries participated in the meeting, of which 24 were represented at the ministerial level. The Executive Secretary joined the United Nations Secretary-General, Ban Ki-moon, and the Australian Foreign Minister and chairperson of the meeting, Kevin Rudd, for the high level meeting. In a Joint Ministerial Statement released at the meeting, foreign ministers committed themselves to making the Treaty a focus of attention at the highest political level and implementing measures to facilitate the signature and ratification process as recommended in the Final Document of the 2010 NPT Review Conference. More than seventy countries have officially endorsed the Joint Ministerial Statement.

International Day Against Nuclear Tests

The first observance of the International Day against Nuclear Tests on 29 August was marked by a comprehensive public information campaign which included activities both in Vienna and in New York as well as a broad use of social and other Web based media. The PTS maintained a dedicated area on its public web site; contributed to the special web site of the United Nations, the production of a film, presentations in

"As we mark the first International Day against Nuclear Tests, I look forward to working with all partners to rein in spending on nuclear weapons and rid the world of this nuclear threat. A central pillar of this strategy is the Comprehensive Nuclear-Test-Ban Treaty (CTBT)… We cannot pass these challenges to succeeding generations. We must each do our part to build a safer, more secure world today."

Ban Ki-moon,
United Nations Secretary-General

New York and Astana and an exhibition in the Vienna International Centre initiated by Kazakhstan; provided video and photographic packages for journalists; and launched a campaign on Facebook.

United Nations

The Executive Secretary visited the United Nations in New York on several occasions during 2010. On 8 January, he met with the Secretary-General and with heads of other intergovernmental organizations in the field of disarmament and non-proliferation for a round table discussion and a general exchange of views on subjects of common interest. On 3 February, in Paris, the Executive Secretary signed a cooperation agreement between the Commission and the United Nations Educational, Scientific and Cultural Organization (UNESCO) and held meetings with UNESCO officials. On 14 July, the Executive Secretary visited the headquarters of the United Nations Office for Project Services (UNOPS) in Copenhagen and held discussions with its Executive Director, Jan Mattsson, with a view to deepening the relationship between the Commission and UNOPS.

The Executive Secretary took part in the sixty-fifth session of the United Nations General Assembly in New York from 22 to 25 September. On the margins of the session, he met with a number of senior officials and government representatives. The Executive Secretary addressed the High-Level Meeting on Revitalizing the Work of the Conference on Disarmament and Taking Forward Multilateral Disarmament Negotiations convened by the Secretary-General on 24 September. On 13 October, the Executive Secretary participated in a panel of the First Committee of the United Nations General Assembly to discuss the "Current State of Affairs in the Field of Arms Control and Disarmament and the Role of the Respective Organizations".

On 13 December, the Executive Secretary addressed the United Nations General Assembly on cooperation between the United Nations and the Commission. The General Assembly subsequently adopted its resolution on "Cooperation between the United Nations and the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization" without a vote. On the same day, the Executive Secretary again met with the Secretary-General to discuss an increased level of cooperation between the two organizations.

During the year, PTS representatives participated in several conferences sponsored by the United Nations with the aim of strengthening cooperation with academics and practitioners in the field of disarmament and non-proliferation.

International Atomic Energy Agency

The Executive Secretary delivered his traditional address to the annual General Conference of the International Atomic Energy Agency (IAEA) in Vienna on 21 September. On the margins of the General Conference, the Executive Secretary held meetings with high level officials, including the Executive Director of the Chilean Nuclear Energy Commission, the Director General of the Israel Atomic Energy Commission, the Deputy Minister of Science and Technology of Iraq, the Deputy Minister of Foreign Affairs of the Islamic Republic of Iran, the Director General of the Kuwait Institute for Scientific Research, the Minister for Higher Education and Science and Technology of Kenya, the Secretary of Energy of the USA and the Director-General of Energy in the Ministry of Foreign Affairs of Uruguay.

Multilateral Organizations

The Executive Secretary attended the 122nd and the 123rd Assembly of the Inter-Parliamentary Union (IPU), which were held from 27 March to 1 April in Bangkok and from 4 to 6 October in Geneva. On the margins of the IPU events, the Executive Secretary met with legislators from France, Ghana, Indonesia, Morocco, Nepal, Sri Lanka, Thailand and Timor-Leste, as well as representatives from the IPU Secretariat.

The Executive Secretary participated in the 5th Plenary Session of the Parliamentary Assembly of the Mediterranean (PAM), held from 28 to 30 October in Rabat. During the meeting, he delivered the keynote address at the 1st Standing Committee of the PAM on matters pertaining to political and security related cooperation.

Further Activities

The Executive Secretary participated as a speaker on the first day of a workshop entitled "Working Towards a Successful 2010 NPT Review Conference", which was held in Manila from 1 to 2 February.

United States Senator Robert P. Casey Jr (*third from left*), Chairman of the Subcommittee on Near Eastern and South and Central Asian Affairs of the Foreign Relations Committee, accompanied by Damian Murphy (*second from left*), Legislative Assistant for Foreign Policy, National Security and Homeland Security, during a visit to the Headquarters of the Commission, 29 March 2010. They are pictured with (*left*) the Executive Secretary of the CTBTO Preparatory Commission, Tibor Tóth, and four of the Directors of the PTS (*from left to right*): John Sequeira (Division of Administration), Lassina Zerbo (IDC Division), Federico Guendel (IMS Division) and Genxin Li (Legal and External Relations Division).

On 17 November 2010, Juha Auvinen (*left*), Head of Unit for Common Foreign and Security Policy Operations at the European Commission, and Tibor Tóth, Executive Secretary of the CTBTO Preparatory Commission, signed an agreement whereby the Preparatory Commission would receive €5.3 million from the Council of the European Union to strengthen its monitoring and verification capabilities.

From 2 to 4 February, the Executive Secretary attended the Global Zero Summit in Paris, which gathered more than two hundred current and former political and military leaders, diplomats, clerics, academics and arms control experts from around the world for discussions on advancing global nuclear disarmament. During the summit, he participated in a panel discussion on "Verifying Nuclear Arms Reductions" together with Gareth Evans, the former Australian Foreign Minister, and Hans Blix, the former Director General of the IAEA.

On 23 March, the Executive Secretary travelled to Dublin to participate in a seminar held by the Institute of International and European Affairs (IIEA), which was one of a series of events held by the IIEA in 2010 to strengthen the global nuclear non-proliferation regime. The Executive Secretary briefed members regarding, inter alia, the status of the Treaty, its prospects for entry into force and progress in establishing the verification regime.

The Executive Secretary addressed the conference on "Semipalatinsk: From Rehabilitation to Development", convened in Astana on 26 August. The conference was held shortly before the International Day against Nuclear Tests.

On 9 September, the Executive Secretary participated in a high level workshop organized by the EastWest Institute in New York, entitled "Prioritizing the NPT Action Plan". During the workshop, participants discussed the opportunities and challenges associated with implementing the action plan in the Final Document of the NPT Review Conference, as well as identifying leadership opportunities in global efforts towards nuclear disarmament and non-proliferation.

The Executive Secretary visited Oslo on 12 October to participate in an international conference on "A Nuclear Weapon-Free World: Nuclear Disarmament Strategies, Non-Proliferation and Export Control". The Government of Kazakhstan, the Norwegian Ministry of Foreign Affairs and the Norwegian Institute of International Affairs jointly convened the conference.

On 13 November, the Executive Secretary participated in the 10th World Summit of Nobel Peace Laureates entitled "The Legacy of Hiroshima: a World without Nuclear Weapons". He delivered a speech at the fourth session of the summit on "Progress towards a world without nuclear weapons: the results of the ongoing international negotiations and the role of cities and of civil society".

CTBT Regional Workshop for Senior African Officials, Rabat, October 2010. *Left:* Florence Mangin, Permanent Representative of France, speaking at a press briefing at the Moroccan Ministry of Foreign Affairs and Cooperation. Also shown are (*on the left*) Xolisa Mabhongo, Permanent Representative of South Africa and Chairperson of the Preparatory Commission, and (*on the right*) Tibor Tóth, Executive Secretary of the CTBTO Preparatory Commission, and Omar Zniber, Permanent Representative of Morocco. *Right:* participants in the workshop.

INTERNATIONAL COOPERATION WORKSHOPS

The PTS holds regional and subregional workshops with the overall aim of encouraging political and technical cooperation in areas related to the Treaty, reviewing Treaty related achievements in support of the nuclear non-proliferation regime and promoting the entry into force and universality of the Treaty. Other objectives include enhancing the understanding of the Treaty as a regional security and confidence building measure, and developing national capabilities in the region for implementing the Treaty and participating in the verification regime. Participants also explore means of promoting the application of PTS data and products for civil and scientific purposes, and ways in which experience and expertise can be exchanged between the PTS and the relevant national agencies, as well as between the participating States.

In 2010, the PTS held two such international cooperation workshops: a Regional Workshop on CTBTO International Cooperation in Ulaanbaatar from 15 to 16 March, and a CTBT Regional Workshop for Senior African Officials in Rabat from 28 to 29 October.

Jointly organized by the Commission and the Mongolian Ministry of Foreign Affairs, the workshop in Ulaanbaatar gathered about fifty participants from over twenty countries, including representatives of the diplomatic corps and experts from the Mongolian Academy of Sciences. Participants conveyed the importance of sustaining the political momentum surrounding the Treaty as well as signature and ratification by Annex 2 States and non-Annex-2 States that had yet to join the Treaty.

During the workshop in Rabat, delegates from seven African ratifying States joined Commission representatives in efforts to bring forth ratifications from the remaining countries. The current Chairperson of the Commission, Ambassador Xolisa Mabhongo (South Africa), was present, as were representatives from Morocco, which, along with France, is currently jointly coordinating the entry into force process of the Treaty. Representatives of eight non-ratifying countries took part in the workshop and learned about the political and technical advantages of the Treaty.

The opportunity was used to raise awareness about the Treaty and its verification regime among parliamentarians and the media by holding an exhibition at the Moroccan Parliament and giving background briefings. A media

briefing took place during the workshop.

INTRODUCTORY COURSE ON THE TREATY

From 18 to 22 October, the Commission held an introductory course at its Headquarters entitled "Strengthening Verification, Enhancing Security: The Science and Political Significance of the CTBT". The course was designed to strengthen and broaden participation in global monitoring and verification efforts. It involved legal, political and security related aspects of the Treaty, as well as the scientific and technological issues that underpin the verification regime designed to monitor compliance with the Treaty. More than fifty participants attended the course. They included ambassadors as well as representatives from Permanent Missions, embassies, international organizations, foreign ministries and academia. For those who were unable to attend the course, lectures, presentations and course materials were provided through the public web site. Dozens of academic institutions around the world, as well as numerous think tanks, non-governmental organizations and international organizations, were engaged in order to promote the course and attract 'virtual' participation.

PROMOTING THE TREATY AND THE COMMISSION

Public information activities have become an integral part of the outreach efforts of the Commission in the political arena as well as in verification related fields. This is a direct consequence of a planned approach in which special campaigns for particular events and developments are elaborated in advance, proactively and strategically.

Public information efforts were increasingly proactive and targeted in 2010. They included briefings of journalists and interaction with States and civil society. Articles by leading personalities and CTBT experts were published in influential media outlets. The public web site, print products such as the publication *Spectrum* and the CTBT exhibition remained cornerstones of the outreach activities. The continuous use of social media and the "CTBTO Newsroom" for journalists on the web site resulted in a growing interest in the work of the organization. The PTS also continued to provide presentations to a wide variety of interested audiences.

Video–Audio Project

Over the year, the video–audio project became a centrepiece of efforts by the PTS to raise awareness of the Treaty. The PTS continued to produce and provide tailored television and radio materials and reports on the Treaty, the activities of the Commission and the verification system for use by broadcasters worldwide as well as for publication via web sites and social media.

MANAGEMENT

Highlights in 2010

Further strengthening of oversight

Zero real growth Programme and Budget

Approval by the Commission of financing for the reconstruction of IMS stations HA3 and IS14 (US$15.0 million) and the implementation of an Enterprise Resource Planning system compliant with International Public Sector Accounting Standards ($8.9 million)

Effective and efficient management of the activities of the Provisional Technical Secretariat of the CTBTO Preparatory Commission, including support of the Commission and its subsidiary bodies, is ensured mainly through the provision of administrative, financial and legal services.

A wide variety of general services are also provided, from arrangements concerning shipments, customs formalities, visas, identity cards, laissez-passer and low value purchases to insurance, tax, travel and telecommunication services, as well as standard office and information technology support and asset management. Services provided by external entities are continuously monitored to ensure that these are being provided in the most efficient, effective and economical way.

Management also involves coordinating with the other international organizations located in the Vienna International Centre over planning of office and storage space, maintenance of the premises and common services, and enhancement of security efforts.

OVERSIGHT

Oversight is a key component of the strategic approach of the Commission to ensure the effectiveness of the organization and good governance. In 2010, five audit activities were undertaken. Recommendations were made to improve the effectiveness of internal controls in these areas and the implementation of recommendations from previous years was followed up. Several management support activities were also undertaken by Internal Audit in the area of risk management and process improvement, such as the procurement process, which will strengthen the effectiveness of internal controls. Internal Audit also facilitated a PTS initiative in ensuring proper integration and maximizing of synergies among several key areas. These areas include Enterprise Resource Planning, project management, planning and results based management, quality management, knowledge management, professional performance management and risk management.

The 1998 Internal Audit Charter was updated in 2010 to clarify the responsibilities of Internal Audit and further enhance its independence and objectivity. The Charter sets out the reporting procedures, authorizes access to relevant records, personnel and physical assets, and defines the scope of auditing activities. The Charter is available to all staff. Work on development of an Internal Audit page on the PTS Intranet was completed in 2010. The page provides information for staff regarding the mandates, activities, auditing process and other matters relevant to Internal Audit. The page also offers a facility for staff to report, in confidence, suspected wrongdoings or irregularities to the Chief of Internal Audit. In the Whistleblower Protection Policy issued by the PTS in 2007, Internal Audit is designated as the entity responsible for investigating reported complaints and allegations concerning violations which pose a significant risk to the compliance, efficiency, effectiveness and credibility of the Commission. Furthermore, in collaboration with the Evaluation Section, a database for monitoring and reporting of oversight (audit and evaluation) recommendations was completed in 2010.

Internal Audit established a quality assurance improvement programme to monitor the effectiveness of its performance. One of the elements of the programme is for Internal Audit to conduct a self-assessment of its practices against the International Standards for the Professional Practice of Internal Auditing. This was undertaken in 2010.

FINANCE

2010 Programme and Budget

The 2010 Programme and Budget was prepared at a level corresponding to slightly less than zero real growth and maintained the split currency system (US dollar and euro) for assessing the contributions due from States Signatories. This system was introduced in 2005 to lessen the exposure of the Commission to the effects of fluctuations in the value of the US dollar against the euro.

The Budget for 2010 amounted to US$45 595 100 and €55 702 800. At the budget exchange rate of 0.7960 euro to 1 US dollar, the total US dollar equivalent of the 2010 Budget was $115 579 600, representing a nominal growth of 1.8% but almost constant in real terms (a decrease of $108 300 or 0.1%).

Table 4. Distribution of 2010 Budget

Area of Activity	U$$ (millions)[a]
International Monitoring System	38.7
International Data Centre	44.5
On-Site Inspection	9.1
Evaluation and Audit	2.0
Policy Making Organ Support	4.9
Administration, Coordination and Support	15.9
Legal and External Relations	4.1
Total	**119.2**

[a] An average exchange rate of 0.7561 euro to 1 US dollar was used to convert the euro component of the 2010 Budget.

On the basis of the actual average exchange rate in 2010 of 0.7561 euro to 1 US dollar, the final total US dollar equivalent of the 2010 Budget was $119 266 308 (Table 4). Of the total Budget, 79.09% originally was allocated to verification related activities, including an allocation of $18 383 052 to the Capital Investment Fund (CIF), established for the build-up of the IMS. This increased to $33 383 052 after the approval of supplementary appropriations of $15 000 000.

Assessed Contributions

As of 31 December 2010, the collection rates of the assessed contributions for 2010 amounted to 97.9% of the US dollar portion and 76.4% of the euro portion. In comparison, the 2009 collection rates as of 31 December 2009 were 84.8% and 75.1% respectively. The combined

Staff Members in the Professional Category by Geographical Region as of 31 December 2010 (Percentages as of 31 December 2009 are shown in brackets.)

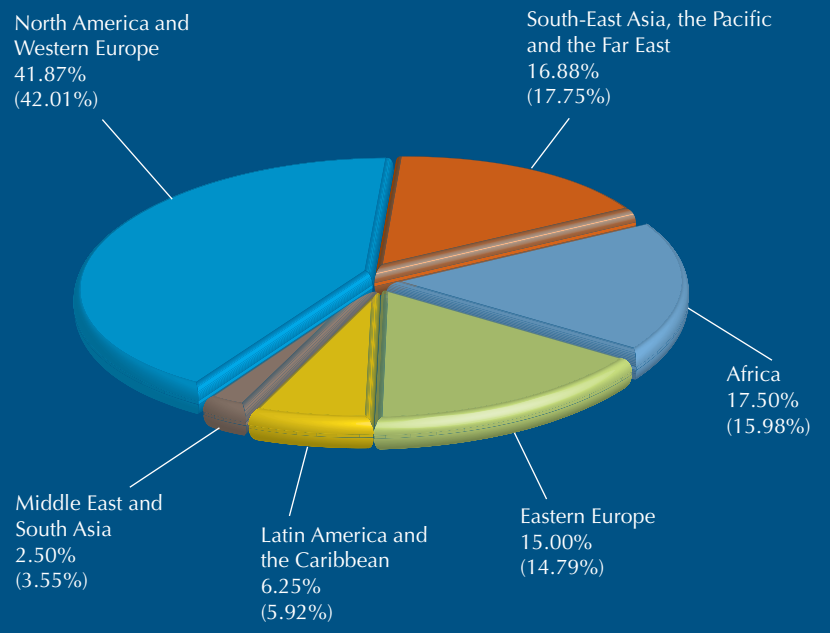


Table 5. Regular Staff Members by Field of Work (31 December 2010)

Field of Work	Professional	General Service	Total
Evaluation Section	3	1	4
InternationalM onitoringSys tem Division	35	21	56
International Data Centre Division	65	16	81
On-Site Inspection Division	16	6	22
Total, verification related	***119 (74.38%)***	***44 (51.16%)***	***163 (66.26%)***
Office of the Executive Secretary	4	3	7
Internal Audit	2	1	3
Division of Administration	19	23	42
Legal and External Relations Division	16	15	31
Total, non-verification-related	***41 (25.62%)***	***42 (48.84%)***	***83 (33.74%)***
Total	**160**	**86**	**246**

collection rate for the US dollar and euro portions in 2010 was 84.5%, compared with 79.2% in 2009.

The number of States that had paid their 2010 assessed contributions in full as of 31 December 2010 was 101, higher than 96 in 2009. Regarding 2009 assessed contributions, the collection rate as of 31 December 2010 amounted to 99.2%.

Expenditure

The expenditure for the Programme and Budget in 2010 amounted to $112 578 374, of which $17 170 334 was from the CIF. For the General Fund, the unused budget amounted to $5 475 215. For the CIF, approximately 35.4% of the allotment was executed by the end of 2010. More detailed information on budget implementation can be found in the 2010 Programme and Budget Performance Report.

PROCUREMENT

In 2010, the PTS obligated approximately $46.7 million through 647 contractual instruments and approximately $2.5 million for small value purchases. At the end of the year, there were 93 open requisitions for future obligation in the procurement pipeline with a total value of approximately $29.1 million: $26.5 million for the CIF, $1.5 million for the General Fund and $1.1 million for voluntary contributions.

Five new IMS stations and three noble gas systems were brought under contract for testing and evaluation and/or PCAs. As of 31 December 2010, 128 IMS stations, 9 radionuclide laboratories and the

testing of 26 noble gas systems were under such contracts.

HUMAN RESOURCES

The PTS secured the human resources for its operations by recruiting and maintaining highly competent and diligent staff for all programmes. Recruitment was based on securing the highest standards of professional expertise, experience, efficiency, competence and integrity. Due regard was paid to the principle of equal employment opportunity, to the importance of recruiting staff on as wide a geographical basis as possible, and to other criteria stipulated in the relevant provisions of the Treaty as well as the Staff Regulations.

As of 31 December 2010, the PTS had 246 staff members from 70 countries, compared with 262 staff members from 74 countries at the end of 2009. The chart on the previous page shows the distribution of staff members in the Professional category by geographical region. Table 5 shows the distribution of regular staff members by field of work.

The PTS continued its efforts to increase the representation of women in the Professional category. At the end of 2010, there were 47 women in Professional positions, corresponding to 29.38% of the Professional staff. In comparison with 2009, there was an increase of 16.67% in the number of female staff members at the P5 level. However, there were decreases of 20.00% and 10.00% in the numbers of female staff members at the P4 and P3 levels respectively. At the P2 level, the representation of women remained the same as in the previous year.

The staff were provided with opportunities to increase their skills in areas relevant to achieving the objectives of the organization. A variety of programmes were delivered in 2010 which were tailored for the benefit of the PTS in carrying out its work programmes and to enhance job performance and career development.

Signature and Ratification

STATES WHOSE RATIFICATION IS REQUIRED FOR THE TREATY TO ENTER INTO FORCE (31 DECEMBER 2010)

State	Date of Signature	Date of Ratification
Algeria	15 Oct. 1996	11 Jul. 2003
Argentina	24 Sep. 1996	4 Dec. 1998
Australia	24 Sep. 1996	9 Jul. 1998
Austria	24 Sep. 1996	13 Mar. 1998
Bangladesh	24 Oct. 1996	8 Mar. 2000
Belgium	24 Sep. 1996	29 Jun. 1999
Brazil	24 Sep. 1996	24 Jul. 1998
Bulgaria	24 Sep. 1996	29 Sep. 1999
Canada	24 Sep. 1996	18 Dec. 1998
Chile	24 Sep. 1996	12 Jul. 2000
China	24 Sep. 1996	
Colombia	24 Sep. 1996	29 Jan. 2008
Democratic People's Republic of Korea		
Democratic Republic of the Congo	4 Oct. 1996	28 Sep. 2004
Egypt	14 Oct. 1996	
Finland	24 Sep. 1996	15 Jan. 1999
France	24 Sep. 1996	6 Apr. 1998
Germany	24 Sep. 1996	20 Aug. 1998
Hungary	25 Sep. 1996	13 Jul. 1999
India		
Indonesia	24 Sep. 1996	
Iran (Islamic Republic of)	24 Sep. 1996	
Israel	25 Sep. 1996	
Italy	24 Sep. 1996	1 Feb. 1999
Japan	24 Sep. 1996	8 Jul. 1997
Mexico	24 Sep. 1996	5 Oct. 1999
Netherlands	24 Sep. 1996	23 Mar. 1999
Norway	24 Sep. 1996	15 Jul. 1999
Pakistan		
Peru	25 Sep. 1996	12 Nov. 1997
Poland	24 Sep. 1996	25 May 1999
Republic of Korea	24 Sep. 1996	24 Sep. 1999
Romania	24 Sep. 1996	5 Oct. 1999
Russian Federation	24 Sep. 1996	30 Jun. 2000
Slovakia	30 Sep. 1996	3 Mar. 1998
South Africa	24 Sep. 1996	30 Mar. 1999
Spain	24 Sep. 1996	31 Jul. 1998
Sweden	24 Sep. 1996	2 Dec. 1998
Switzerland	24 Sep. 1996	1 Oct. 1999
Turkey	24 Sep. 1996	16 Feb. 2000
Ukraine	27 Sep. 1996	23 Feb. 2001
United Kingdom	24 Sep. 1996	6 Apr. 1998
United States of America	24 Sep. 1996	
Viet Nam	24 Sep. 1996	10 Mar. 2006

35 Ratified

41 Signed

3 Not signed

9 Not ratified

Africa
(53 States)

51 Signatories
38 Ratifiers

Eastern Europe
(23 States)

23 Signatories
23 Ratifiers

STATUS OF SIGNATURE AND RATIFICATION OF THE TREATY (31 DECEMBER 2010)

State	Date of Signature	Date of Ratification
Afghanistan	24 Sep. 2003	24 Sep. 2003
Albania	27 Sep. 1996	23 Apr. 2003
Algeria	15 Oct. 1996	11 Jul. 2003
Andorra	24 Sep. 1996	12 Jul. 2006
Angola	27 Sep. 1996	
Antigua and Barbuda	16 Apr. 1997	11 Jan. 2006
Argentina	24 Sep. 1996	4 Dec. 1998
Armenia	1 Oct. 1996	12 Jul. 2006
Australia	24 Sep. 1996	9 Jul. 1998
Austria	24 Sep. 1996	13 Mar. 1998
Azerbaijan	28 Jul. 1997	2 Feb. 1999
Bahamas	4 Feb. 2005	30 Nov. 2007
Bahrain	24 Sep. 1996	12 Apr. 2004
Bangladesh	24 Oct. 1996	8 Mar. 2000
Barbados	14 Jan. 2008	14 Jan. 2008
Belarus	24 Sep. 1996	13 Sep. 2000
Belgium	24 Sep. 1996	29 Jun. 1999
Belize	14 Nov. 2001	26 Mar. 2004
Benin	27 Sep. 1996	6 Mar. 2001
Bhutan		
Bolivia (Plurinational State of)	24 Sep. 1996	4 Oct. 1999
Bosnia and Herzegovina	24 Sep. 1996	26 Oct. 2006
Botswana	16 Sep. 2002	28 Oct. 2002
Brazil	24 Sep. 1996	24 Jul. 1998
Brunei Darussalam	22 Jan. 1997	
Bulgaria	24 Sep. 1996	29 Sep. 1999
Burkina Faso	27 Sep. 1996	17 Apr. 2002
Burundi	24 Sep. 1996	24 Sep. 2008
Cambodia	26 Sep. 1996	10 Nov. 2000
Cameroon	16 Nov. 2001	6 Feb. 2006
Canada	24 Sep. 1996	18 Dec. 1998
Cape Verde	1 Oct. 1996	1 Mar. 2006
Central African Republic	19 Dec. 2001	26 May 2010
Chad	8 Oct. 1996	

State	Date of Signature	Date of Ratification
Chile	24 Sep. 1996	12 Jul. 2000
China	24 Sep. 1996	
Colombia	24 Sep. 1996	29 Jan. 2008
Comoros	12 Dec. 1996	
Congo	11 Feb. 1997	
Cook Islands	5 Dec. 1997	6 Sep. 2005
Costa Rica	24 Sep. 1996	25 Sep. 2001
Côte d'Ivoire	25 Sep. 1996	11 Mar. 2003
Croatia	24 Sep. 1996	2 Mar. 2001
Cuba		
Cyprus	24 Sep. 1996	18 Jul. 2003
Czech Republic	12 Nov. 1996	11 Sep. 1997
Democratic People's Republic of Korea		
Democratic Republic of the Congo	4 Oct. 1996	28 Sep. 2004
Denmark	24 Sep. 1996	21 Dec. 1998
Djibouti	21 Oct. 1996	15 Jul. 2005
Dominica		
Dominican Republic	3 Oct. 1996	4 Sep. 2007
Ecuador	24 Sep. 1996	12 Nov. 2001
Egypt	14 Oct. 1996	
El Salvador	24 Sep. 1996	11 Sep. 1998
Equatorial Guinea	9 Oct. 1996	
Eritrea	11 Nov. 2003	11 Nov. 2003
Estonia	20 Nov. 1996	13 Aug. 1999
Ethiopia	25 Sep. 1996	8 Aug. 2006
Fiji	24 Sep. 1996	10 Oct. 1996
Finland	24 Sep. 1996	15 Jan. 1999
France	24 Sep. 1996	6 Apr. 1998
Gabon	7 Oct. 1996	20 Sep. 2000
Gambia	9 Apr. 2003	
Georgia	24 Sep. 1996	27 Sep. 2002
Germany	24 Sep. 1996	20 Aug. 1998
Ghana	3 Oct. 1996	

Latin America and the Caribbean (33 States)

31 Signatories
30 Ratifiers

State	Date of Signature	Date of Ratification
Greece	24 Sep. 1996	21 Apr. 1999
Grenada	10 Oct. 1996	19 Aug. 1998
Guatemala	20 Sep. 1999	
Guinea	3 Oct. 1996	
Guinea-Bissau	11 Apr. 1997	
Guyana	7 Sep. 2000	7 Mar. 2001
Haiti	24 Sep. 1996	1 Dec. 2005
Holy See	24 Sep. 1996	18 Jul. 2001
Honduras	25 Sep. 1996	30 Oct. 2003
Hungary	25 Sep. 1996	13 Jul. 1999
Iceland	24 Sep. 1996	26 Jun. 2000
India		
Indonesia	24 Sep. 1996	
Iran (Islamic Republic of)	24 Sep. 1996	
Iraq	19 Aug. 2008	
Ireland	24 Sep. 1996	15 Jul. 1999
Israel	25 Sep. 1996	
Italy	24 Sep. 1996	1 Feb. 1999
Jamaica	11 Nov. 1996	13 Nov. 2001
Japan	24 Sep. 1996	8 Jul. 1997
Jordan	26 Sep. 1996	25 Aug. 1998
Kazakhstan	30 Sep. 1996	14 May 2002
Kenya	14 Nov. 1996	30 Nov. 2000
Kiribati	7 Sep. 2000	7 Sep. 2000
Kuwait	24 Sep. 1996	6 May 2003
Kyrgyzstan	8 Oct. 1996	2 Oct. 2003
Lao People's Democratic Republic	30 Jul. 1997	5 Oct. 2000
Latvia	24 Sep. 1996	20 Nov. 2001
Lebanon	16 Sep. 2005	21 Nov. 2008
Lesotho	30 Sep. 1996	14 Sep. 1999
Liberia	1 Oct. 1996	17 Aug. 2009
Libyan Arab Jamahiriya	13 Nov. 2001	6 Jan. 2004
Liechtenstein	27 Sep. 1996	21 Sep. 2004
Lithuania	7 Oct. 1996	7 Feb. 2000
Luxembourg	24 Sep. 1996	26 May 1999
Madagascar	9 Oct. 1996	15 Sep. 2005

Middle East and South Asia (26 States)

21 Signatories
15 Ratifiers

State	Date of Signature	Date of Ratification
Malawi	9 Oct. 1996	21 Nov. 2008
Malaysia	23 Jul. 1998	17 Jan. 2008
Maldives	1 Oct. 1997	7 Sep. 2000
Mali	18 Feb. 1997	4 Aug. 1999
Malta	24 Sep. 1996	23 Jul. 2001
Marshall Islands	24 Sep. 1996	28 Oct. 2009
Mauritania	24 Sep. 1996	30 Apr. 2003
Mauritius		
Mexico	24 Sep. 1996	5 Oct. 1999
Micronesia (Federated States of)	24 Sep. 1996	25 Jul. 1997
Monaco	1 Oct. 1996	18 Dec. 1998
Mongolia	1 Oct. 1996	8 Aug. 1997
Montenegro	23 Oct. 2006	23 Oct. 2006
Morocco	24 Sep. 1996	17 Apr. 2000
Mozambique	26 Sep. 1996	4 Nov. 2008
Myanmar	25 Nov. 1996	
Namibia	24 Sep. 1996	29 Jun. 2001
Nauru	8 Sep. 2000	12 Nov. 2001
Nepal	8 Oct. 1996	
Netherlands	24 Sep. 1996	23 Mar. 1999
New Zealand	27 Sep. 1996	19 Mar. 1999
Nicaragua	24 Sep. 1996	5 Dec. 2000
Niger	3 Oct. 1996	9 Sep. 2002
Nigeria	8 Sep. 2000	27 Sep. 2001
Niue		
Norway	24 Sep. 1996	15 Jul. 1999
Oman	23 Sep. 1999	13 Jun. 2003
Pakistan		
Palau	12 Aug. 2003	1 Aug. 2007
Panama	24 Sep. 1996	23 Mar. 1999
Papua New Guinea	25 Sep. 1996	
Paraguay	25 Sep. 1996	4 Oct. 2001
Peru	25 Sep. 1996	12 Nov. 1997
Philippines	24 Sep. 1996	23 Feb. 2001
Poland	24 Sep. 1996	25 May 1999
Portugal	24 Sep. 1996	26 Jun. 2000

North America and Western Europe (28 States)

28 Signatories
27 Ratifiers

State	Date of Signature	Date of Ratification
Qatar	24 Sep. 1996	3 Mar. 1997
Republic of Korea	24 Sep. 1996	24 Sep. 1999
Republic of Moldova	24 Sep. 1997	16 Jan. 2007
Romania	24 Sep. 1996	5 Oct. 1999
Russian Federation	24 Sep. 1996	30 Jun. 2000
Rwanda	30 Nov. 2004	30 Nov. 2004
Saint Kitts and Nevis	23 Mar. 2004	27 Apr. 2005
Saint Lucia	4 Oct. 1996	5 Apr. 2001
Saint Vincent and the Grenadines	2 Jul. 2009	23 Sep. 2009
Samoa	9 Oct. 1996	27 Sep. 2002
San Marino	7 Oct. 1996	12 Mar. 2002
Sao Tome and Principe	26 Sep. 1996	
Saudi Arabia		
Senegal	26 Sep. 1996	9 Jun. 1999
Serbia	8 Jun. 2001	19 May 2004
Seychelles	24 Sep. 1996	13 Apr. 2004
Sierra Leone	8 Sep. 2000	17 Sep. 2001
Singapore	14 Jan. 1999	10 Nov. 2001
Slovakia	30 Sep. 1996	3 Mar. 1998
Slovenia	24 Sep. 1996	31 Aug. 1999
Solomon Islands	3 Oct. 1996	
Somalia		
South Africa	24 Sep. 1996	30 Mar. 1999
Spain	24 Sep. 1996	31 Jul. 1998
Sri Lanka	24 Oct. 1996	
Sudan	10 Jun. 2004	10 Jun. 2004
Suriname	14 Jan. 1997	7 Feb. 2006
Swaziland	24 Sep. 1996	
Sweden	24 Sep. 1996	2 Dec. 1998

South-East Asia, the Pacific and the Far East (32 States)

28 Signatories
20 Ratifiers

State	Date of Signature	Date of Ratification
Switzerland	24 Sep. 1996	1 Oct. 1999
Syrian Arab Republic		
Tajikistan	7 Oct. 1996	10 Jun. 1998
Thailand	12 Nov. 1996	
The former Yugoslav Republic of Macedonia	29 Oct. 1998	14 Mar. 2000
Timor-Leste	26 Sep. 2008	
Togo	2 Oct. 1996	2 Jul. 2004
Tonga		
Trinidad and Tobago	8 Oct. 2009	26 May 2010
Tunisia	16 Oct. 1996	23 Sep. 2004
Turkey	24 Sep. 1996	16 Feb. 2000
Turkmenistan	24 Sep. 1996	20 Feb. 1998
Tuvalu		
Uganda	7 Nov. 1996	14 Mar. 2001
Ukraine	27 Sep. 1996	23 Feb. 2001
United Arab Emirates	25 Sep. 1996	18 Sep. 2000
United Kingdom	24 Sep. 1996	6 Apr. 1998
United Republic of Tanzania	30 Sep. 2004	30 Sep. 2004
United States of America	24 Sep. 1996	
Uruguay	24 Sep. 1996	21 Sep. 2001
Uzbekistan	3 Oct. 1996	29 May 1997
Vanuatu	24 Sep. 1996	16 Sep. 2005
Venezuela (Bolivarian Republic of)	3 Oct. 1996	13 May 2002
Viet Nam	24 Sep. 1996	10 Mar. 2006
Yemen	30 Sep. 1996	
Zambia	3 Dec. 1996	23 Feb. 2006
Zimbabwe	13 Oct. 1999	

153 Ratified

182 Signed

13 Not signed

42 Not ratified