CTBTO
PREPARATORY COMMISSION

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

Annual Report 2012

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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

The year 2012, which heralded the 15th anniversary of our organization, was defined by notable progress for the Treaty and its verification regime.

The number of States Signatories rose over the course of the year to 183, with 157 of these States having ratified the Treaty. Indonesia and Guatemala joined the ratifying States. Also, Niue signed the Treaty. The ratification by Indonesia, an Annex 2 State, was a landmark on the road to ensuring durable long term security through international nuclear non-proliferation and disarmament regimes. This also sent a message to the eight remaining Annex 2 States to take the necessary steps towards early entry into force of the Treaty. Guatemala's ratification marked an important milestone in bringing the Latin America and the Caribbean region closer to full ratification of the Treaty. Niue's signature contributes to the momentum towards universalization among Pacific island States.

Preparations for the 2014 Integrated Field Exercise (IFE) were vigorously pursued. The exercise aims to boost significantly our operational capabilities for on-site inspections (OSIs) anywhere and at any time. The CTBTO Preparatory Commission selected Jordan as the host country for the exercise. We held two extensive build-up exercises, involving launch, pre-inspection and post-inspection activities. Selected equipment was tested in small scale field experiments. In addition, major training courses and tabletop exercises were held for over one hundred national experts and staff of the organization. These undertakings can serve as an investment in future inspectors and inspection assistants of the CTBTO.

We had a thorough evaluation of the first and second build-up exercises in order to learn lessons for further improvements before we conduct the third build-up exercise, additional training courses and, most importantly, the IFE, as well as for further development of the OSI regime as a whole.

Our International Monitoring System (IMS) achieved a new record. The number of certified IMS stations and radionuclide laboratories increased to 274. This accounts for 81% of the total network. Also, the number of certified noble gas monitoring systems rose to 12 (30% of the systems planned).

The data availability at certified facilities of the system increased to 90%. We also managed to enhance our noble gas monitoring coverage. These achievements,

combined with our technological updates at IMS stations, will improve our network resilience and better our understanding of future events recorded by the network. Several major IMS recapitalization projects were undertaken in 2012. The multimillion dollar project for the repair of IMS facilities in the Juan Fernández Islands (Chile) was advanced further.

In 2012, the increase in volumes of data and high quality data products continued. The data and analysis were shared constantly with close to 1400 authorized users in 123 States Signatories. The integration of noble gas and infrasound monitoring systems into International Data Centre operations was further consolidated. We also expanded our capacity building programmes by offering various training opportunities for National Data Centre staff and station operators.

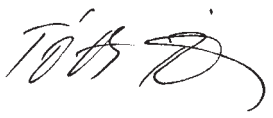
As part of the Capacity Development Initiative, we offered several courses throughout the year to educate the next generation of Treaty experts and connect with dozens of universities from around the world. In this regard, we took advantage of advanced and interactive e-learning tools to reach more than one thousand scientists, professionals, diplomats, academics, students, journalists and members of civil society in 2012 alone. In addition, the Commission has led the way among international organizations by establishing a unique presence on iTunes U, offering hundreds of hours of freely available academic material to thousands of users.

The implementation rate of the Programme and Budget of the organization in 2012 was 95.7%. The figure is indicative of many important factors, including high levels of efficiency, coordination and resource management.

On a related matter, the collection rate of the assessed contributions for 2012 shows a considerable increase compared with previous years. A collection rate of over 93% at a time of financial constraints experienced by many States Signatories indicates a belief in the mission and a trust in the performance of the organization. This will certainly strengthen our resolve to further the work of the Commission and seek new avenues of improvement.

I would like to take this opportunity to express my appreciation to the staff of the Commission for their dedication and tireless efforts in ensuring the effective functioning of the organization and serving its noble vision of a world free of nuclear weapons. Station and system operators, technicians, analysts and support personnel work day and night to run and maintain our system.

Finally, I am grateful to States Signatories for their unwavering and continuous support, which has enabled us to accomplish the many achievements detailed in this Annual Report. As the Commission takes on the remaining challenges leading to the completion of the Treaty's verification regime and to its entry into force, we rely on their support and strategic guidance.



Tibor Tóth
Executive Secretary
CTBTO Preparatory Commission
Vienna, February 2013

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.

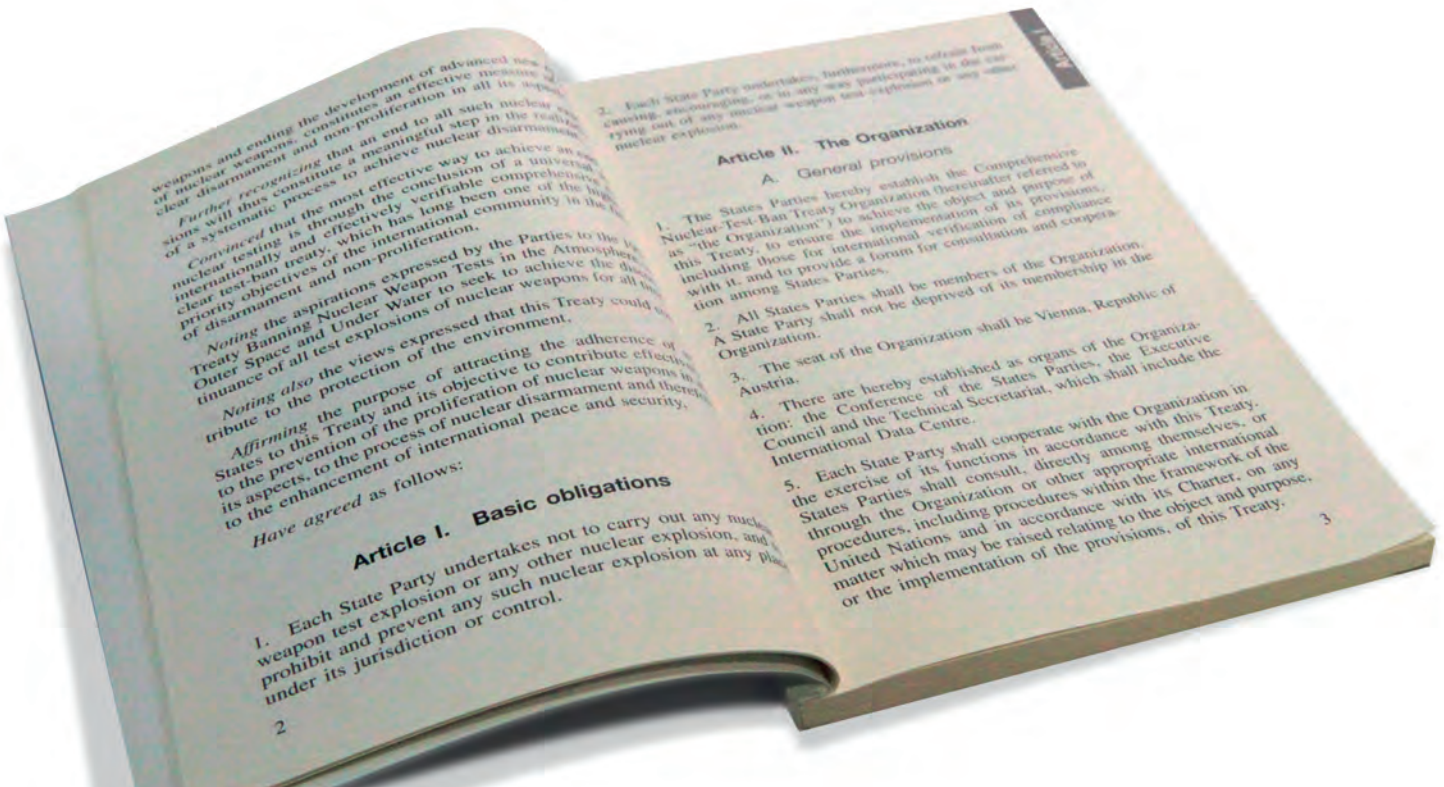
Under the terms and provisions of the Treaty, the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) is to be established in Vienna, Austria. The mandate of this international organization is to achieve the object and purpose of the Treaty, to ensure the implementation of its provisions, including 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.



Summary

This report presents the major achievements of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization in 2012.

The Commission continued to enjoy strong political support and registered notable progress in universalization of the Treaty. Many statesmen and -women and members of civil society repeatedly highlighted the significance of the Treaty, the international norm that it has established against nuclear testing and its contribution to regional and global security.

With ratifications by Indonesia and Guatemala, by the end of 2012 the Treaty boasted 157 ratifying States, thus approaching the historic milestone of 160. Niue also joined the ranks of States Signatories of the Treaty, increasing the number of such States to 183.

In 2012, joint efforts of the States hosting facilities of the International Monitoring System (IMS), local station operators, States Signatories and the Provisional Technical Secretariat (PTS) helped to further expand the coverage and data availability in all IMS technologies. Support and build-up of the IMS network continued with the testing and evaluation of data from new stations. Seven newly installed or upgraded stations and one radionuclide laboratory were introduced into the operations of the International Data Centre (IDC) as part of the certification process. Other stations awaiting certification were installed in the IDC test bed. The number of certified IMS stations and radionuclide laboratories reached 274, representing around 81% of the total foreseen by the Treaty. The number of certified IMS radionuclide noble gas monitoring systems increased to 12, which is 30% of the planned network.

> Delivering a medium- to long-term integrated technology forecast by means of the technology foresight initiative

These activities helped increase the overall data availability of the certified IMS stations, which has demonstrated a durable positive trend since 2009 towards the level required by the operational manuals. In an ever growing but also ageing IMS network, activities undertaken in recent years have thus not only mitigated the effects of obsolescence in the network but also reversed the decreasing trend in data availability experienced in the past.

The major project to repair IMS hydroacoustic station HA3 and infrasound station IS14 (Chile), which were destroyed by a tsunami in 2010, progressed further. A thorough bathymetric survey was conducted and the installation contract for HA3 was concluded in 2012. In light of the progress made, IS14 is expected to return to full operation in the first half of 2013.

Improvement in performance of the Global Communications Infrastructure (GCI) helped to keep overall adjusted availability consistently above 99.6%. The Commission also increased its GCI satellite capacity in five satellite regions to accommodate larger data volumes.

> Promoting operational capabilities in the area of on-site inspection

The PTS succeeded in further consolidating infrasound and noble gas monitoring into IDC operations. At the end of the year, 45 infrasound and 12 noble gas systems were in provisional operation. Moreover, some improvements in

reviewed noble gas data products were achieved by implementing a scheme that categorizes the sample spectra.

Efforts were also made to further enhance atmospheric transport modelling capabilities and to continue delivering high quality products to States Signatories. 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. 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.

The state of health system deployed in the IDC Operations Centre was developed further. In addition, a host of activities were focused on IDC hardware enhancements and software developments. The PTS also continued the work on developing more robust and flexible data and product request services.

Preparing for the next Integrated Field Exercise in 2014 in Jordan

The technology foresight exercise continued to focus 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 together with a 'taxonomy' that enables intuitive and in-depth understanding of identified developments. The technology foresight initiative was presented and discussed at a number of specialist meetings. A range of posters describing the approach and initial results were presented for discussion and an online conference was convened to review emerging technologies relevant to signal acquisition, data analysis and on-site inspection (OSI). At the end of 2012, a new software called Pivot was being customized to present over two hundred emerging and relevant technologies, processes, concepts and ideas. The software was planned to become operational by March 2013.

Expanding education and outreach activities through capacity building efforts and the Capacity Development Initiative as well as innovative public information campaigns

Promoting the operational capabilities of the organization in the area of OSI continued to be a major priority in 2012. The OSI action plan was further advanced in five main areas, namely policy planning and operations, operations support and logistics, techniques and equipment, training, and procedures and documentation.

Most importantly, considerable headway was made in preparation for the next Integrated Field Exercise (IFE) in 2014. The Commission selected Jordan as the host country for the exercise. Work on the preparation of a scientifically credible and comprehensive scenario began with the creation of a task force of external experts from States Signatories. Specific locations of interest in Jordan were identified and an agreement on the overarching background scenario was reached.

Further progress was also made in arranging for the long term provision of inspection equipment offered by States Signatories for the IFE.

With participation of around one hundred and fifty experts from States Signatories and staff of the Commission, two build-up exercises, involving procedures in the launch, pre-inspection and post-inspection phases of an inspection, were conducted. Major training courses were also held for over one hundred national experts and staff of the organization. Later, the build-up exercises were evaluated thoroughly in order to draw lessons for further improvements in the conduct of build-up exercises, training courses and, particularly, the IFE.

Streamlining activities and promoting synergies and efficiencies by fostering results based management, accountability and oversight

The Commission vigorously expanded its education and outreach activities through its capacity building efforts and the Capacity Development Initiative (CDI), as well as innovative public information campaigns.

Fourteen training events were held for station operators and eight training courses and workshops were conducted for staff of National Data Centres (NDCs): the first to ensure the smooth operation of the IMS and the second to build the capacity of NDCs to fulfil their obligations under the Treaty. More than four hundred station operators and NDC staff attended these events.

Four CDI courses reached over one thousand individuals from over one hundred countries in 2012 alone. Participants ranged from IMS station operators to NDC staff, diplomats, academics and members of civil society. Lecture courses addressed in depth the political, legal, technical and scientific challenges that face the Treaty, and were supplemented by a robust e-learning platform.

Using innovative approaches, the Commission further intensified its efforts in promoting the Treaty and its verification regime. Landmark events included the commemoration of the 15th anniversary of the organization in Vienna and the staged reading of the play "Reykjavik" during the week of the Ministerial Meeting in New York in September. During 2012, an increased level of public interest in the Treaty and the Commission was registered. Over 2700 articles and citations concerning the Treaty and its verification regime were counted. The presence of the Commission on social media channels was increased by 40%. With the help of United Nations TV, video material was distributed to broadcasters worldwide, while the video channel of the Commission attracted significantly more viewers.

The Commission continued to streamline its activities and to promote synergies and efficiencies by fostering results based management, accountability and oversight. This has resulted in a significant increase in the implementation rate of the organization. The development of an IPSAS-compliant Enterprise Resource Planning system also made significant progress, preparing the ground for its launch in 2013–2014.

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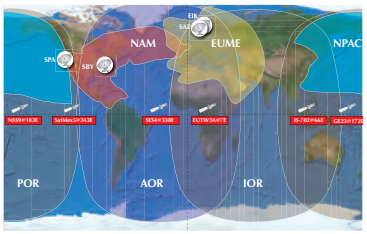

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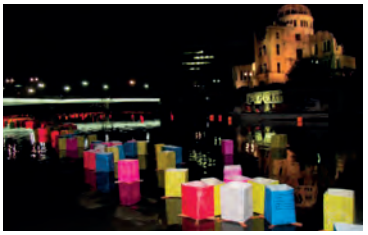

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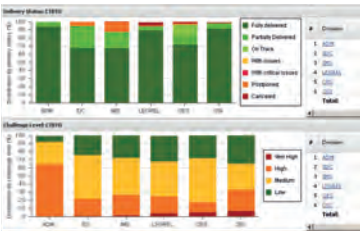

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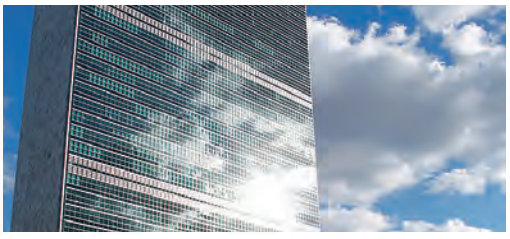

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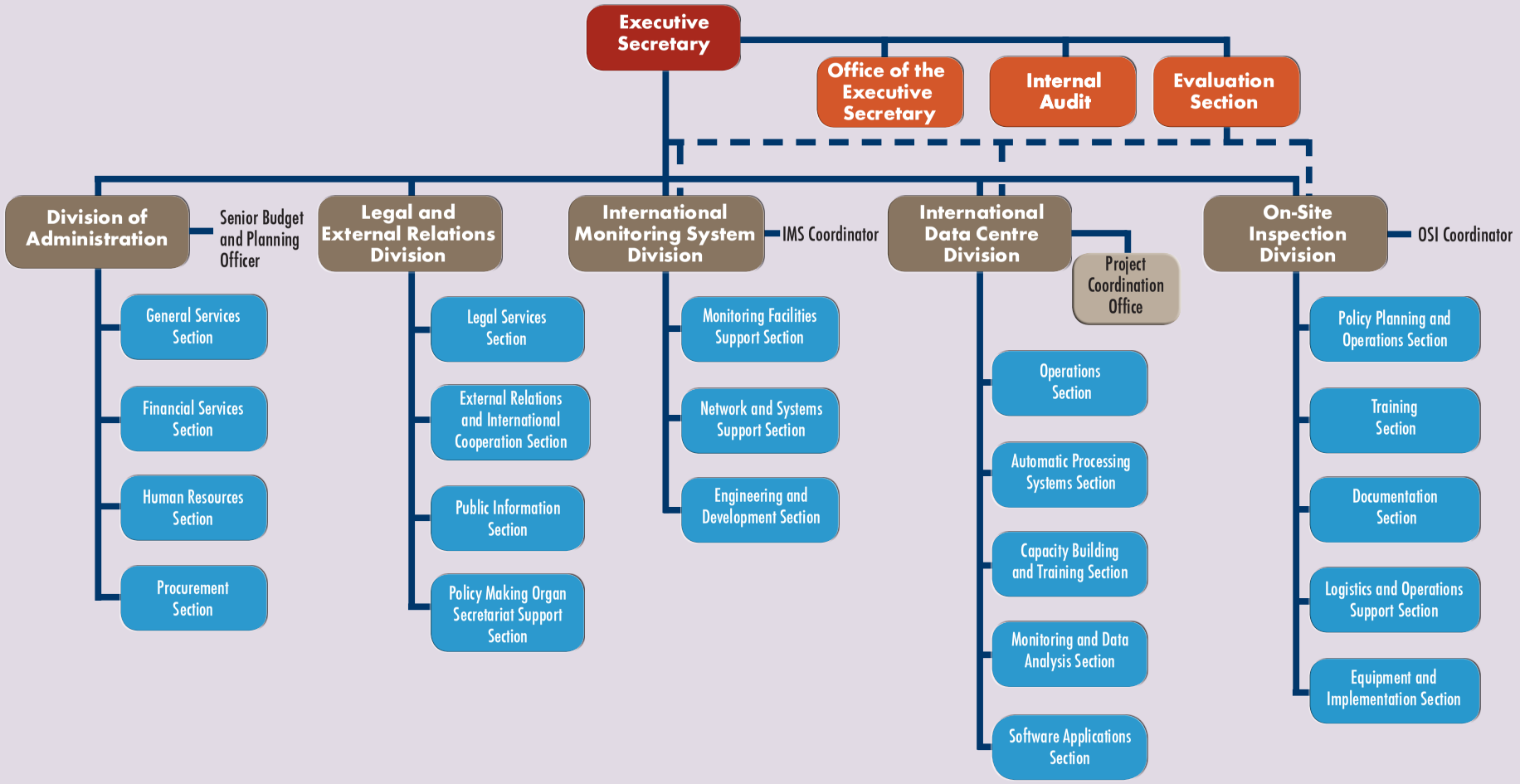


Abbreviations

ATM	atmospheric transport modelling
BUE	build-up exercise
CIF	Capital Investment Fund
ECS	Experts Communication System
ERP	Enterprise Resource Planning
ESMF	Equipment Storage and Maintenance Facility
EU	European Union
FIMS	field information management system
GCI	Global Communications Infrastructure
GIS	geographical information system
IAEA	International Atomic Energy Agency
IDC	International Data Centre
IFE	Integrated Field Exercise
IIMS	Integrated Information Management System
IISS	Integrated Inspection Support System
IMS	International Monitoring System
INGE	International Noble Gas Experiment
IPSAS	International Public Sector Accounting Standards
ISHTAR	Information System with Hyperlinks on Tasks Assigned by the Resolution Establishing the Preparatory Commission
IT	inspection team
ITF	inspection team functionality
KPI	key performance indicator
MPLS	multiprotocol label switching
MSIR	multispectral including infrared
NDC	National Data Centre
O&M	operation and maintenance
OPCW	Organisation for the Prohibition of Chemical Weapons
OSC	Operations Support Centre
OSI	on-site inspection
PCA	post-certification activity
PTS	Provisional Technical Secretariat
QMS	Quality Management System
REB	Reviewed Event Bulletin
RSTT	regional seismic travel time
SEL	Standard Event List
SOP	standard operating procedure
VPN	virtual private network
VSAT	very small aperture terminal
WFP	World Food Programme
WIN	work instruction
WHO	World Health Organization
WMO	World Meteorological Organization

International Monitoring System

Highlights in 2012

Increased data availability at certified IMS facilities as well as enhanced coverage of noble gas monitoring

Enhanced technology development of IMS stations

Major recapitalizations of IMS stations and support for the establishment of several new IMS facilities

Radionuclide station RN49, Spitsbergen, Norway, whose noble gas monitoring system was certified in 2012.

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.

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 facility of the IMS.

Establishing the International Monitoring System

The momentum to complete the IMS network was maintained in 2012. Progress was made in all four technologies (seismic, hydroacoustic, infrasound and radionuclide) with the installation, upgrade, certification and start-up of new facilities.

Three IMS stations were installed in 2012, bringing the total number installed by the end of the year to 281 (88% of the network foreseen by the Treaty). Station design in all technologies also continued to evolve, resulting in a higher detection capability of newly installed stations.

Four IMS facilities were certified as meeting all the stringent technical requirements of the Preparatory Commission. The total number of certified IMS stations and laboratories thus reached 274 (81% of the network foreseen by the Treaty) at the end of 2012. The increase in the number of certified stations has been a source of improvement for coverage and network resilience.

Several long-standing issues were resolved, enabling the initiation of the installation of several IMS stations, including the last station of the hydroacoustic monitoring network. Furthermore, political support was received from several countries hosting IMS facilities where the PTS had not been able to proceed in previous years. In October, upon thorough examination of technical justifications, agreement was received from the Commission to install three stations at sites alternative to the locations designated by the Treaty (one in the Russian Federation, one in South Africa and one in the United States of America). All these advances in 2012 contributed to bringing closer the prospect of a complete IMS network.

Upgrading work at primary seismic array station PS9, Yellowknife, Northwest Territories, Canada. *Left:* Erection of solar panels. *Right:* Installation of an equipment enclosure.

Table 1. Status of IMS Station Installations and Certifications (31 December 2012)

IMS Station Type	Installation Complete		Under Construction	Contract Under Negotiation	Not Started
	Certified	Not Certified			
Primary seismic	42	4	1	0	3
Auxiliary seismic	104	9	4	0	3
Hydroacoustic	10	1	0	0	0
Infrasound	45	0	4	0	11
Radionuclide	62	4	5	5	4
Total	**263**	**18**	**14**	**5**	**21**

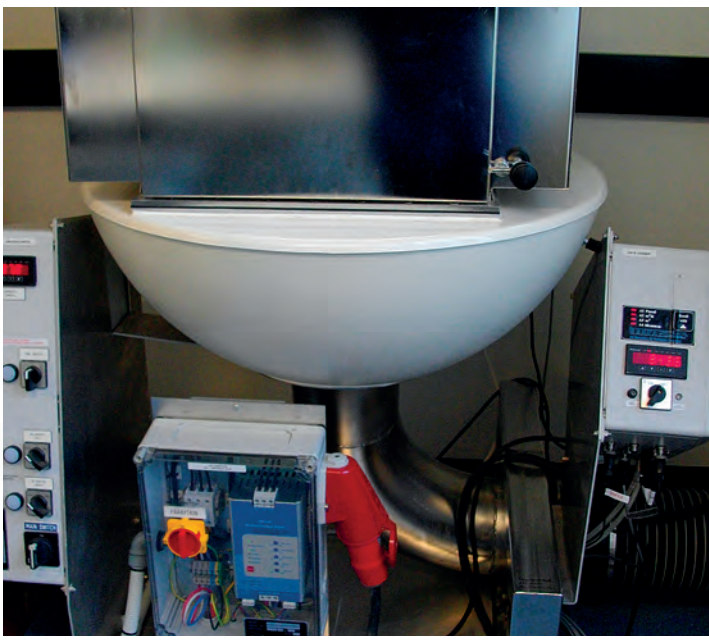
Table 2. Status of Noble Gas System Installations and Certifications (31 December 2012)

Total Number of Noble Gas Systems: 40	Installed: 31	Certified: 12

Table 3. Status of Radionuclide Laboratory Certifications (31 December 2012)

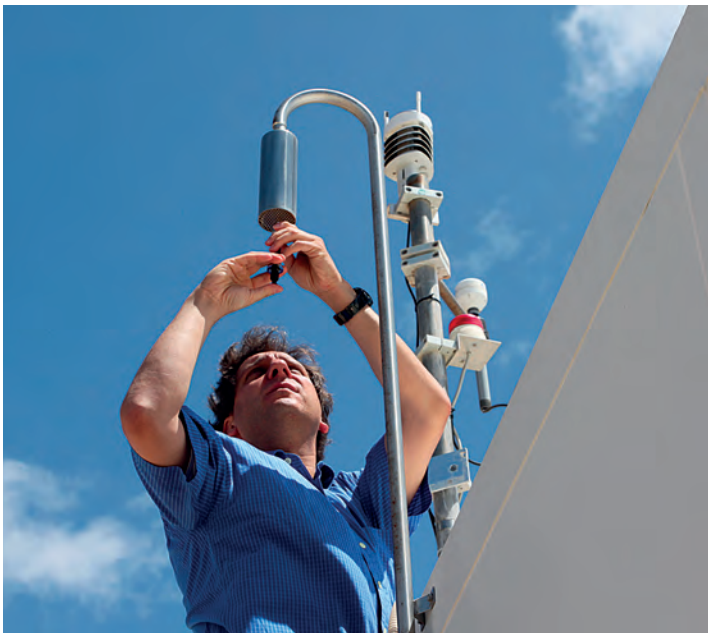
Total Number of Laboratories: 16	Certified: 11

With the certification of four noble gas systems, the upgrade of four further systems and the installation of an additional three systems, significant progress in 2012 was made in the noble gas monitoring programme. As demonstrated in October 2006 at the time of the 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. Noble gas monitoring also proved to be essential during the nuclear accident at Fukushima, Japan. Emphasis therefore continued to be placed on this technology. By the end of 2012, 31 noble gas systems (78% of the planned total) were installed at IMS radionuclide stations, of which 12 had been certified as meeting all the stringent technical requirements. The addition of these systems strengthens significantly the capacity of the IMS and continues the dynamic approach to the establishment of the verification system.



Radionuclide station RN7, Macquarie Island, Australia, which was certified in 2012. *Left:* Preparation of filter after removal from air sampler (*right*).

Auxiliary seismic station AS33, Montagne des Pères, French Guiana, which was certified in 2012.



Radionuclide station RN44, Guerrero Negro, Baja California, Mexico: performing a spike test of the noble gas monitoring system, which was certified in 2012.

Finally, the noble gas laboratory certification requirements and processes were presented to and approved by the Commission. This codification, which clarifies in particular the requirement concerning the minimum detectable activity for radioxenon analysis, contains both management and technical requirements for the analysis of noble gas samples from IMS radionuclide monitoring stations. With this approval by the Commission, the PTS intends to initiate in 2013 the certification for noble gas sample analysis of the radionuclide laboratories which support the network of IMS radionuclide stations.

These advances are not just about increases in data flow. They are about the effective application of monitoring technologies around the globe; they are about higher quality data processing 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 CTBTO Preparatory Commission needs to derive full benefit from the immunities to which it is entitled as an international organization under the Resolution establishing it, in similar terms to those stipulated in the Treaty for the CTBTO itself. 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, including exemption from taxes or duties. In practice, this may imply that a State hosting one or more IMS facilities 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).

Of the 89 States hosting IMS facilities, 43 have signed a facility agreement or arrangement with the Commission, and 35 of these agreements and arrangements are in force. At the end of 2012, the Commission was in negotiation with 20 of the 46 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 2012, the importance of establishing such facility agreements and arrangements and of their subsequent national implementation continued to be addressed by the Commission and its subsidiary organs. The lack of such legal mechanisms causes substantial costs and major delays in sustaining certified IMS facilities, adversely affecting the data availability of the verification system.

After Certification

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

PCA contracts are fixed-cost contracts between the Commission and some station operators. These contracts cover station operations and various preventive maintenance activities. The total PCA related expenditure in 2012 was US$17 365 000. This amount covers the 2012 applicable PCA related costs for 150 facilities and noble gas systems certified up to 31 December 2012, including the 11 certified radionuclide laboratories and 5 noble gas systems.

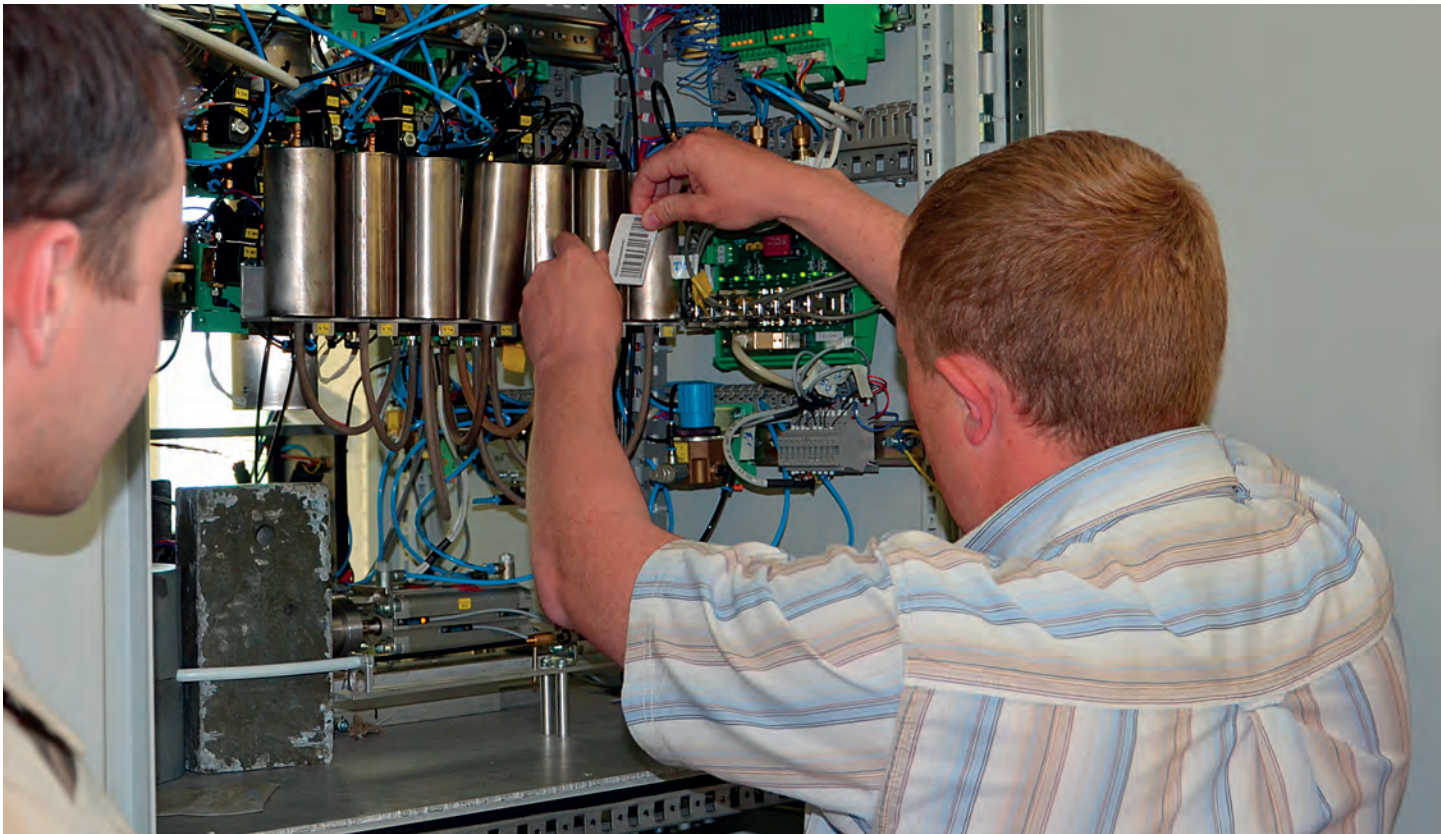
Station operators successfully adapted monthly reporting to the requirements of the revised versions of the draft IMS Operational Manuals released in 2011. Performance of PCAs is reported in the monthly reports and is reviewed by the PTS for compliance with operation and maintenance (O&M) plans. Standardized criteria for the review and evaluation of the performance of station operators were being developed.

The PTS continued to standardize the services provided under PCA contracts. Station operators of all newly certified stations and existing stations submitting new budget proposals were requested to develop O&M plans in accordance with a standard template. In 2012, O&M plans for 40 stations were submitted.

Sustaining Performance

Preparing a global monitoring system of 337 facilities supplemented by 40 noble gas systems involves much more than the building of stations. It requires taking a holistic approach to establishing and sustaining an intricate ‘system of systems’ that should be completed to meet the verification requirements of the Treaty while protecting the investment already made by the Commission. This can be achieved by testing, evaluating and sustaining what is in place, and then further improving on this.

Radionuclide station RN60, Petropavlovsk-Kamchatskiy, Russian Federation: removal of noble gas archive bottles.



The life cycle of the IMS station network proceeds from conceptual design and installation to operation and sustainment. Sustainment covers maintenance through necessary upgrades, replacement, repairs and continuous improvements to ensure the technological relevance of the monitoring capabilities. This process also involves management, coordination and support for the full life cycle of each facility component, performed as efficiently and effectively as possible. In addition, with IMS facilities reaching the end of their life cycle, there is the need to plan, manage and optimize the recapitalization of all components of each facility. Operation and support of facilities and their processes and activities thus continued in 2012. Work intensified in particular in enhancing the operability of the different functional areas involved (logistics, maintenance, engineering and the GCI).

Optimizing and enhancing performance also involve the continuous improvement of data quality, reliability and resilience. Efforts hence focused in 2012 on quality assurance and control, on facility calibration activities, which are essential for the reliable interpretation of detected signals, and on improvements of IMS technologies. These activities contribute to maintaining a credible and technologically relevant monitoring system.

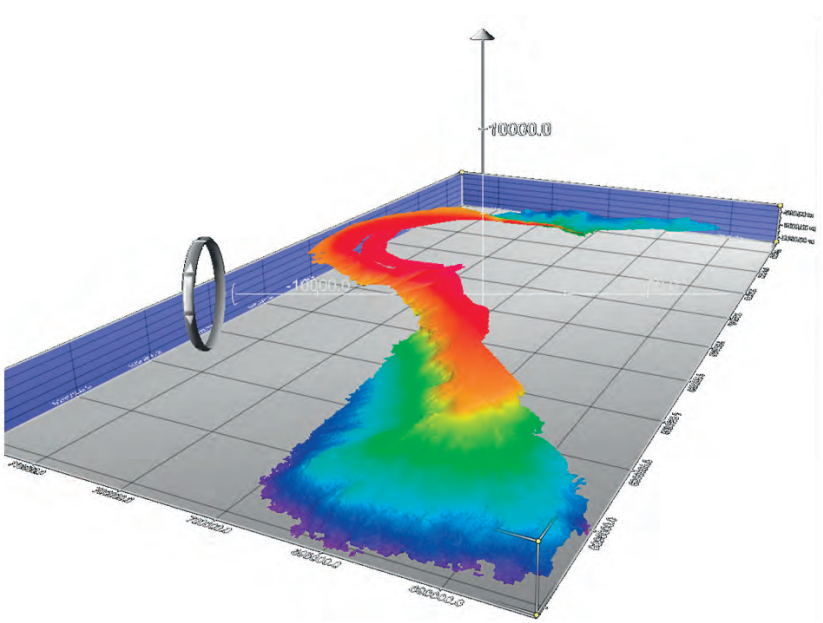
Logistics

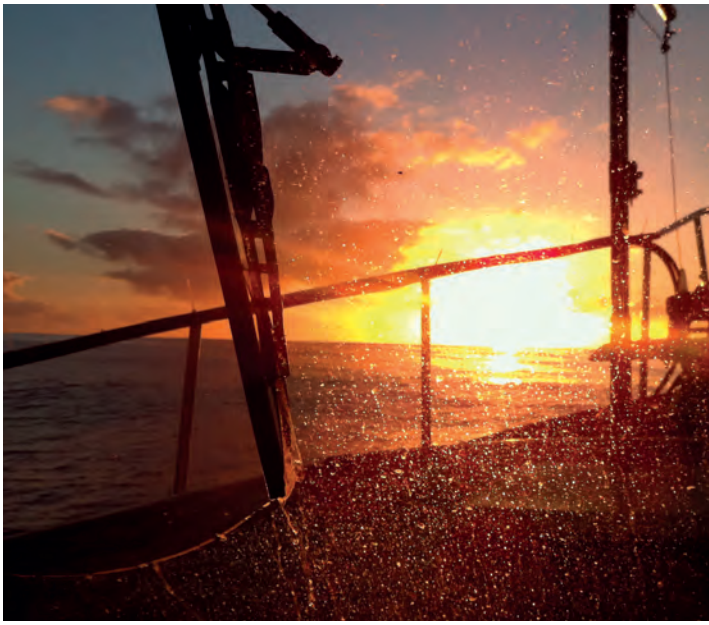
The support required to ensure the highest levels of data availability from such a global network of facilities calls for an all-encompassing logistics approach, which seeks continued optimization. In 2012, the Commission therefore continued its efforts and its allocation of resources in further exploiting information technology tools for logistics support analysis by continued modelling and by validating assumptions related to equipment and logistics criteria. Logistics support analysis is used to find the most efficient current and future support structure for the IMS.

Efforts also continued in 2012 to validate, review and improve the configuration management of IMS facilities. The aim of configuration management is to ensure a level of service compatible with that required by the Treaty and the draft IMS Operational Manuals by maintaining the status of complex assets in a cost effective manner. Knowing and tracking the status and associated life cycle sustainment information of the IMS network of stations and its major components are thus essential for effective planning. At the end of the year, baseline data had been established in the Database of the Technical Secretariat for 99% of the certified stations.

Work continued in 2012 to optimize the advance location and storage of IMS equipment and consumables at regional, country specific and station based depots and at the Vienna based storage facility. The PTS also continued to develop country specific shipment and customs clearance procedures for equipment transported to and from certified IMS facilities and to appeal for the support of host countries in this matter. In this regard,

Infrasound station IS47, Boshof, South Africa.





Bathymetric survey of hydroacoustic station HA3, performed near Robinson Crusoe Island (Juan Fernández Islands, Chile) in November 2012 as part of the work to re-establish the station. *Left:* Three dimensional view of the sea floor seen from the north triplet deployment site looking towards the south-east. The final merged data sets from the 2012 and 2009 surveys are displayed, showing the underwater landscape where the HA3 trunk cables and triplets are to be laid. Blue indicates deep water (down to approximately 2500 metres), orange indicates depths of less than 500 metres and red represents shallow water. *Right:* Sunset over the South Pacific Ocean seen from the survey boat during an east–west survey in deep water north of Robinson Crusoe Island at the start of the night shift.

country specific shipment procedures were streamlined in cooperation with several countries hosting IMS facilities to ensure the timely provision of equipment and consumables to the stations.

Maintenance

Maintenance support and technical assistance continued to be provided at IMS facilities around the globe. More than four hundred station problems were addressed, and 30 preventive and corrective maintenance visits were made to 42 certified facilities. In particular, the PTS progressed with the largest IMS station repair and reconstruction so far in terms of financial investment at the joint site of hydroacoustic station HA3 (which uses hydrophones) 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 funded through an extrabudgetary mechanism. A thorough bathymetric survey was conducted and the installation contract for HA3 was concluded in 2012. In light of the progress made, IS14 was expected to return to full operation in the first half of 2013.

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. Three maintenance support contracts covering all IMS technologies were established in 2012 with the aim to reduce PTS staff travel and expedite repairs at IMS facilities.

The PTS continued to optimize its station specific O&M information in 2012. Station specific operational manuals and other documentation which support the O&M relevant to each station were further developed. An overall approval process was established to include them under configuration management.

Emphasis also continued to be placed on developing the technical capabilities of station operators. As the entity closest to an IMS facility, the station operator is in the best position to prevent problems at stations and ensure a timely resolution when they occur. Technical training for station operators was held and station visits

Radionuclide station RN30, Port-aux-Français, Kerguelen (France), whose noble gas monitoring system was certified in 2012.

by PTS staff continued to include hands-on training for the local station operator, so that the PTS would not have to travel to a station twice to resolve the same problem. To complement the hands-on courses, the first training module in the form of a video recording was developed for an e-learning course.

The combination of technical training and enhanced coordination within the PTS to review PCA contracts, O&M plans and station summary reports has been rewarding. The abilities of station operators continued to improve in 2012, including their compliance with best practices in configuration management, which is essential for optimizing the sustainment and performance of the IMS network, and thus increasing its overall data availability.

Recapitalization

The final phase in the life cycle of equipment for IMS facilities involves its replacement (recapitalization) and disposal. The PTS continued to recapitalize IMS facility components as they reached the planned end of their operating lives. With the first certification of IMS stations in 2000 and hence an ageing IMS network, efforts intensified in 2012. In managing recapitalization, the PTS together with the station operators took into account life cycle data as well as station specific failure analysis and risk assessment. To optimize the obsolescence management of the IMS network and associated resources, priority continued to be given to the recapitalization of components with high failure rates and/or risks and where failure would cause significant downtime. At the same time, recapitalization of components that proved to be robust and reliable was delayed beyond their planned end of life, where suitable, in order to optimize available resources.

Several major recapitalization projects involved substantial planning and investment in 2012, in particular at primary seismic stations PS2 (Australia), PS9 (Canada), PS28 (Norway) and PS45 (Ukraine), at infrasound stations IS13 (Chile), IS47 (South Africa), IS50 and IS52 (United Kingdom) and IS56 (United States of America), and at radionuclide stations RN27, RN28, RN29 and RN30 (France). Several major recapitalization projects were also completed, such as at PS27 (Norway), at IS39 (Palau) and IS53 (USA), at hydroacoustic station HA7 (Portugal) and at RN66 (United Kingdom).

Engineering Solutions

The engineering and development programme for IMS facilities continued in 2012 by designing, validating and implementing solutions to

improve overall data availability and quality, cost effectiveness and performance. Systems engineering is implemented throughout the station life cycle. It relies on open systems design through standardization of interfaces and modularity. It demands improvement of systems and equipment reliability, maintainability, logistical supportability, operability and testability. It also requires enhancing trustworthiness of the IMS through calibration and data surety measures, and finally applying end-to-end systems engineering and optimizing station design with processing by the IDC. Measures taken in 2012 focused on improving data quality, reliability and resilience.

The continuous analysis of root causes and rates of station failure provided further valuable input for improving the technology of IMS facility components. The PTS hence continued to focus in 2012 on power, grounding and lightning protection solutions, and on cooling techniques for detectors at radionuclide stations. These initiatives contribute to improving the reliability and resilience of IMS facilities. In doing so, they also enhance the performance of the network and contribute to extending the useful life of stations.

Improvements were also made in the detection capabilities of stations through the introduction and validation of new technologies such as hybrid response broadband seismometers at seismic arrays, and through the testing of new solutions to reduce the 'memory effect' of beta–gamma detectors at noble gas stations.

Much emphasis was placed in 2012 on the data surety of IMS facilities. Physical security systems were upgraded at several stations, while the PTS state of health (SOH) software was enhanced to improve monitoring of facility data authentication. The SOH system is an essential tool to support trend analysis with a view to taking efficient preventive actions at facilities. Preparations also started to develop a Public Key Infrastructure module for station software to contribute to the PTS strategy of ensuring the authenticity of IMS data.

There was a continuous review, evaluation and improvement of formalized engineering processes. The PTS progressed with technical drawings as well as a standardized failure analysis system for IMS stations and the establishment of a technical risk register. This register constitutes a major technical basis for the planning of recapitalization and station improvement activities.

Recognizing that the involvement of station operators in technology development is essential

Installation of seismometer at auxiliary seismic station AS82, Kirov, Russian Federation, which was certified in 2012.

Revalidation testing at infrasound station IS56, Newport, Washington, United States of America.

Radionuclide laboratory RL9, Soreq Nuclear Research Centre, Yavne, Israel, which was certified in 2012. *Left:* IMS sample from a RASA noble gas monitoring system being rolled for compression into a cylindrical disc prior to spectral analysis and measurement. *Right:* Interior of laboratory showing detector system (at back of picture) and rack with detector electronics and computer.

for knowledge sharing, capacity development and long term sustainment of the stations, the engineering and development web site that was launched in 2011 continued to provide access to engineering documentation, projects and products.

Auxiliary Seismic Network

The long term operation and sustainment of auxiliary seismic stations continued to attract the attention of the Commission and its subsidiary bodies in 2012. In accordance with the Treaty, regular O&M costs of auxiliary seismic stations, including the cost of physical security, are the responsibility of the States hosting them. However, practice has shown over the years that this constitutes a significant challenge for IMS auxiliary seismic stations that are located in developing countries and do not belong to 'parent networks'.

Countries hosting auxiliary seismic stations which present design deficiencies or obsolescence problems thus continued to be 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 connection, through a Joint Action, the European Union (EU) continued to provide useful support for the sustainment of IMS auxiliary seismic stations that do not belong to parent networks and that are hosted by developing countries or countries in transition. This initiative includes actions to return stations to an operational state. Discussions were begun with other countries whose parent networks include several IMS auxiliary seismic stations to seek similar arrangements. In this regard, the USA provided a voluntary contribution for 2012 and 2013 to improve several auxiliary seismic stations belonging to US global parent networks and stations based in the USA. Overall, as a result of these voluntary sources of support and synergies, over twenty auxiliary seismic stations could be supported through these programmes in 2012.

The combined efforts of the host countries, the EU, the USA, the station operators and the PTS have been rewarding. As a result, the data availability of auxiliary seismic stations continued to rise steadily.

Quality Assurance

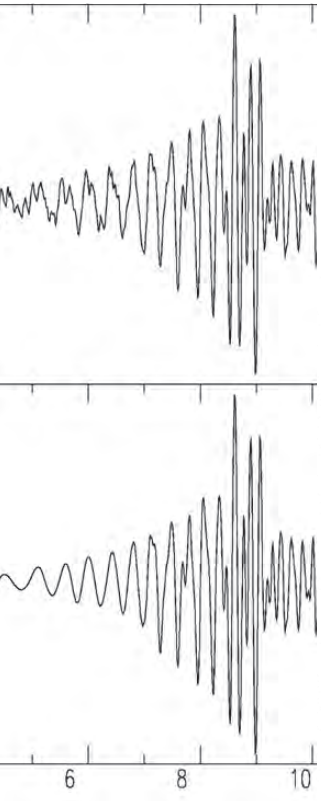
In addition to improving performance at stations, the PTS pays great attention to ensuring a reliable IMS network. Data quality therefore continued to be an important focus of attention in 2012. Calibration activities, in particular, continued. Calibration plays an essential role in the verification system as it determines and monitors, by measurement or comparison against a standard, parameters needed to properly interpret signals recorded by IMS facilities. A full-frequency calibration was performed at further primary seismic stations in 2012, bringing the total number of calibrated seismic stations to 113 at the end of the year. A calibration concept and in situ validation techniques were developed for infrasound stations with the support of the USA, while the voluntary contribution of the EU through its Joint Action IV facilitated the development of infrasound data quality control. Sensor orientation was also improved at four IMS stations, as was the calibration of noble gas systems.

Further progress was made with the inter-comparison of sample analyses between the IMS radionuclide laboratories. The aim of this activity is to check the quality of analytical results for integration in the quality assurance programme for laboratories. All of the 11 certified laboratories as well as the 5 non-certified laboratories participated in the 2011 inter-comparison exercise. For the first time, the exercise involved real IMS station samples, collected after the unexpected events at the Fukushima nuclear power plant. Samples containing nuclides released in the Fukushima accident were sent to the IMS radionuclide laboratories for the inter-comparison exercise. All participants except one correctly identified all major nuclides and overall a high consistency was observed, not only between the laboratory results but also between the laboratory and IDC results. As part of the continuous quality assurance programme, the regular annual inter-comparison of sample analyses by the IMS radionuclide laboratories (the 2012 Proficiency Test Exercise) was organized and the analysis of results was begun.

Continued Improvement in Data Availability

The activities referred to above contributed to increasing the overall data availability of the certified IMS stations in 2012, which has demonstrated a durable positive trend since 2009 towards the level required by the operational manuals. Over the last four years, in collaboration with the States hosting IMS facilities and local operators, a substantial increase in data availability has been achieved. In an ever growing but also ageing IMS network, activities undertaken in recent years have thus not only mitigated the effects of obsolescence in the network but also reversed the decreasing trend in data availability observed in the past.

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 as well as anthropogenic events 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 minutes 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.

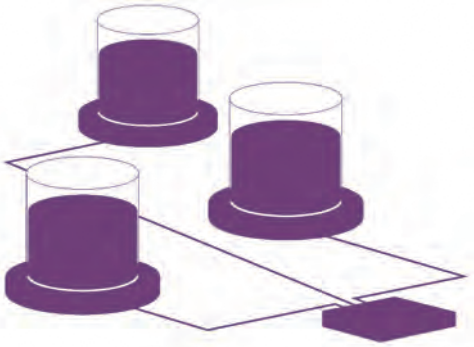
An IMS seismic station has typically three basic parts: a seismometer to measure the ground motion, a recording system which records the data digitally with an accurate time stamp, and a communication system interface.

In the primary and auxiliary seismic networks, there are two types of seismic station: three component (3-C) stations and array stations. The primary seismic network is mostly composed of arrays (30 out of 50 stations), whereas the auxiliary seismic network is mostly composed of 3-C stations (112 out of 120 stations).

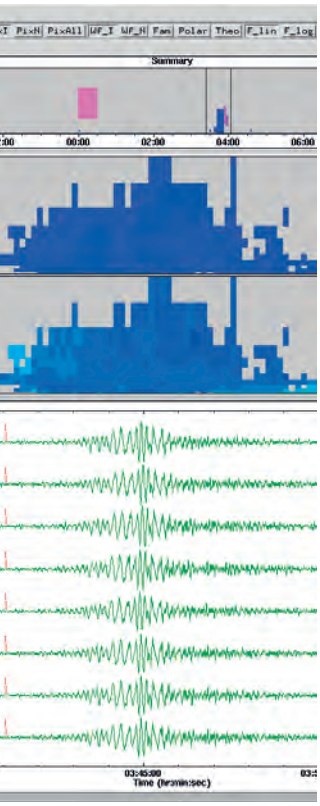
A 3-C seismic station records broadband ground motion in three orthogonal directions. An IMS seismic array station generally consists of multiple short period seismometers and 3-C broadband instruments.

Primary seismic stations send continuous data in near real time to the IDC. Auxiliary seismic stations provide data on request from the IDC.

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



60 stations in 34 countries around the world



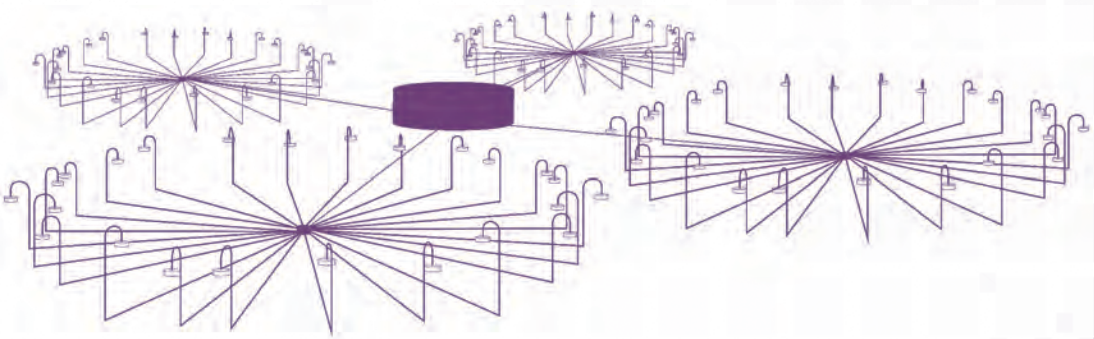
Infrasound Station

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.

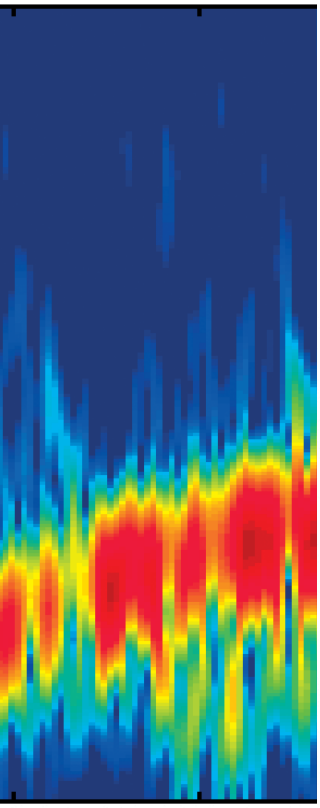
Infrasound waves cause minute changes in the atmospheric pressure which are measured by microbarometers. Infrasound has the ability to cover long distances with little dissipation, which is why infrasound monitoring is a useful technique for detecting and locating atmospheric nuclear explosions. In addition, 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, an ideal site for deploying an infrasound station is within a dense forest, where it is protected from prevailing winds, or at a location with the lowest possible background noise in order to improve signal detection.

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.



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



Hydroacoustic Station

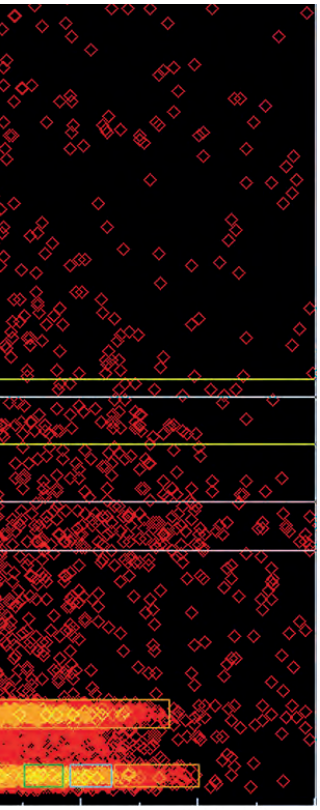
Nuclear explosions under water, in the atmosphere near the ocean surface or underground near oceanic coasts generate sound waves that can be detected by the hydroacoustic monitoring network.

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 most 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 must be designed to function 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 complex undertaking. It involves the hiring of ships, extensive underwater work and the use of specially designed materials and equipment.

80 stations and **16** laboratories in 41 countries around the world, with additional noble gas detection capabilities at 40 of the stations



Radionuclide Particulate Station

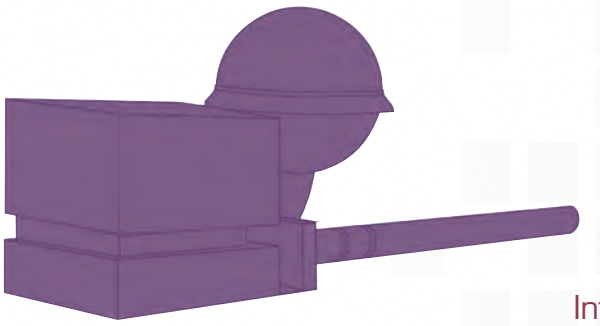
Radionuclide monitoring technology is complementary to the three waveform technologies employed in the CTBT verification regime. This is the only technology that is able to confirm whether an explosion detected and located by the waveform methods is indicative of a nuclear test. It provides the means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

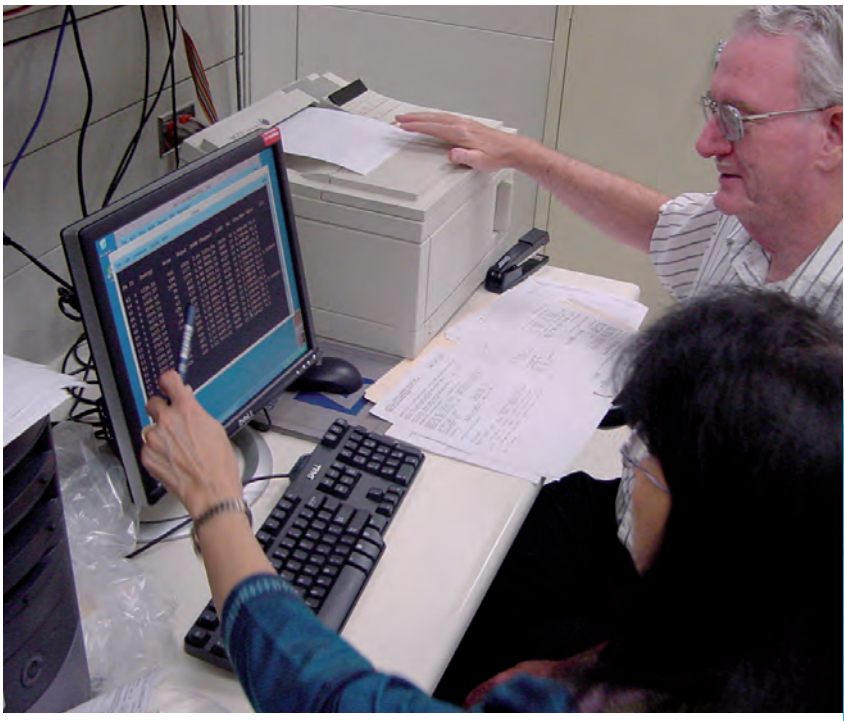
Radionuclide stations detect radionuclide particles in the air. Each station contains an air sampler, detection equipment, computers and a communication set-up. At the air sampler, air is forced through a filter, which retains most particles that reach it. The used filters are examined and the gamma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

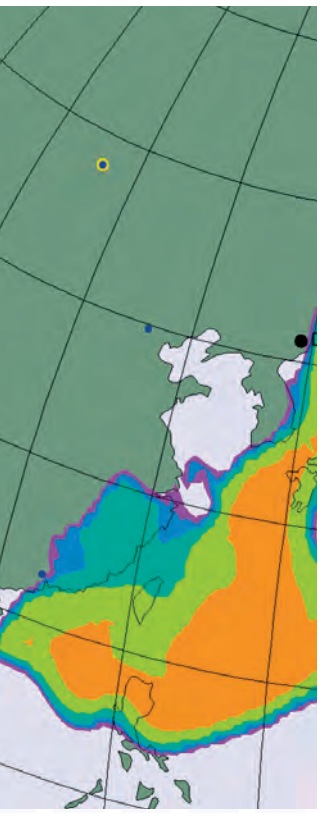
Noble Gas Detection System

By the time of entry into force of the Treaty, 40 of the 80 IMS radionuclide particulate stations are required by the Treaty 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' arises from 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 be produced only 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 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 Proficiency Test Exercises organized by the PTS.

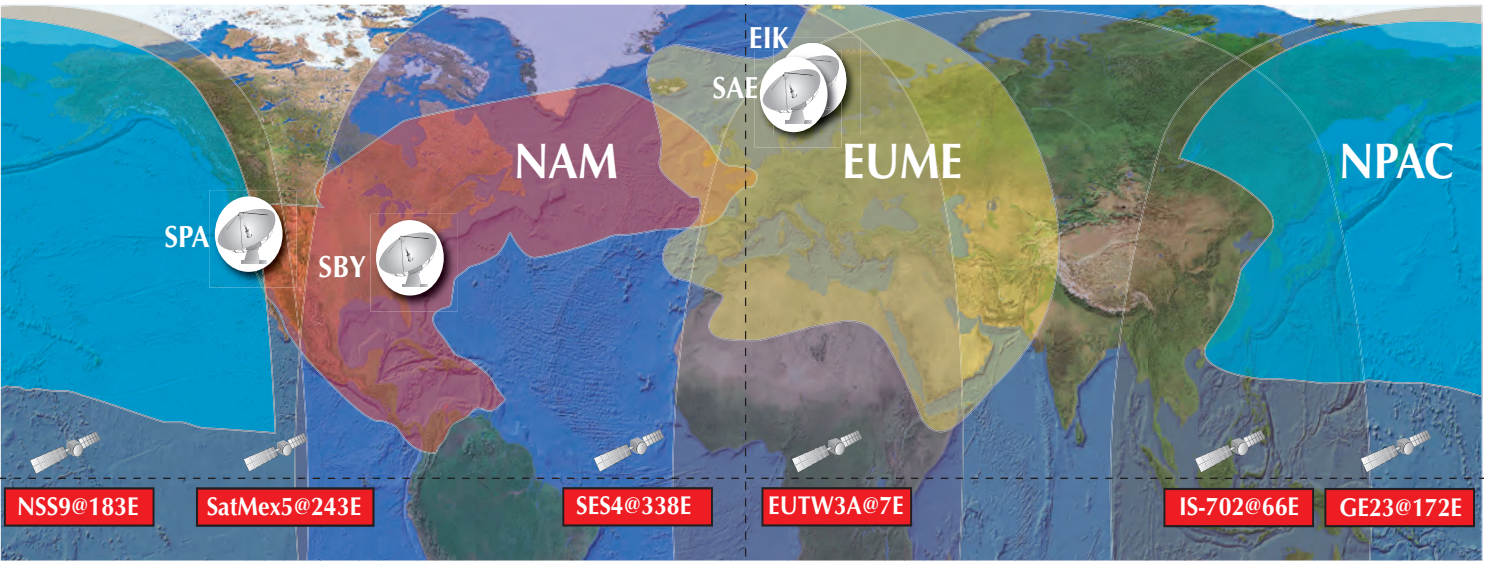
Global Communications

Highlights in 2012

Continued improvement in GCI availability, with overall adjusted availability consistently above 99.6%

Increase in GCI satellite capacity in five satellite regions to accommodate larger data volumes

Increase in aggregated Internet bandwidth of the PTS



Satellites and satellite hubs of the Global Communications Infrastructure.

The Global Communications Infrastructure (GCI) is designed to transport 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. Increasingly, the GCI is being used as a medium of communication for the Provisional Technical Secretariat and station operators to monitor and control IMS stations remotely.

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 99.5% availability for satellite communication links and 99.95% availability for terrestrial communication links, and to provide data within seconds from transmitter to receiver. The first generation GCI began provisional operation in mid-1999. In 2007, operation of the current, second generation GCI began under a new contractor.

Antenna at the Southbury Teleport (Connecticut, USA), one of the teleports providing services to the GCI.

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 very small aperture terminal (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 communication link in case of failure of a VSAT link. For National Data Centres (NDCs) with a viable Internet infrastructure, a VPN is the recommended medium for receiving data and products from the IDC.

At the end of 2012, the GCI included 215 VSAT stations, 32 stand-alone VPN links, 22 VSATs with 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 teleports (2 in Norway and 2 in the USA), 6 geostationary satellites, a network operations centre in Maryland, USA, and a service management desk in Vienna. All of these are managed by the GCI contractor. 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 satellite and terrestrial capacities were increased in the Pacific Ocean, North and Central America, and Europe and Middle East regions. In 2012, satellite capacity was upgraded in the Atlantic Ocean and Indian Ocean regions. The increases were triggered by higher data volumes from upgraded IMS stations and a larger number of active NDCs requesting IMS data and IDC products. The additional capacity improves the capability of the GCI VSATs to transport these data and products.

Internet backup was added to five VSAT sites to improve the reliability of communications. Two IMS station sites were converted from AC to DC power to remove their dependence on unstable commercial power sources. The overall long term impacts of these measures are expansion of the network capacity to carry data as well as further improvement of the data availability parameters.

The aggregated Internet bandwidth of the PTS was increased to 200 megabits per second in the second quarter. The current Internet service providers for the PTS are the companies COLT Telekom and KAPPER Network-Communications GmbH.

GCI Operations

GCI performance improved in comparison with the previous year. The overall adjusted availability, which measures the compliance of the GCI contractor against the operational target of 99.5%, was consistently above 99.6% throughout the year and reached a record one

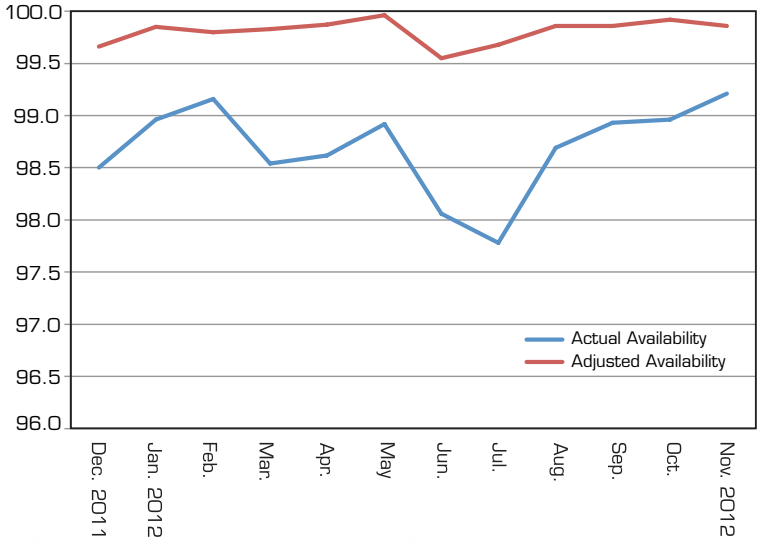
VSAT antenna at auxiliary seismic station AS82, Kirov, Russian Federation.

month high of 99.96%. Similarly, the actual availability, which is a measure of the raw uptime of each GCI link, was higher than in 2011. Over the year, the GCI transported on aggregate 28 gigabytes per day. Emphasis was placed on identifying and eliminating systemic sources of failures that caused repeated outages.

As GCI II entered its fifth year of operation, attention was given to enhancing the redundancy infrastructure at teleports. In addition, a process concerning quality management systems with the objective of achieving ISO 9000 certification in the future was continued.

Further improvements in incident management involving the GCI contractor and enhancements in network monitoring were made in 2012. Training for existing and new NDC operators, and the complement and geographical distribution of field service engineers were expanded. Moreover, the staffing of the network operations centre of the contractor was increased. As a result of these and other activities, the link availability of the GCI continued to show improvement.

In 2011, the PTS examined sites to find those where ageing equipment had deteriorated, necessitating investment and recapitalization.



GCI availability in 2012. The actual availability indicates the raw uptime of GCI links, whereas the adjusted availability is the uptime computed after excluding outage times outside the responsibility of the GCI contractor – examples are local power outages and downtimes due to station maintenance or construction work. Both parameters were higher in 2012 than in 2011, with the adjusted availability being above 99.6% for the entire year.

Replacement of such components continued in 2012 to extend the lifetime of GCI assets. This preventive maintenance programme will be sustained in the coming years.

GCI network security was strengthened by introducing two factor authentication in the form of VPN tokens that network administrators and some PTS staff members use to log into GCI routers.

GCI II is one of the primary telecommunications services to be used during an on-site inspection (OSI). The preparation for the Integrated Field Exercise (IFE) in 2014 included the purchase of a light VSAT terminal, which was successfully tested in 2012.

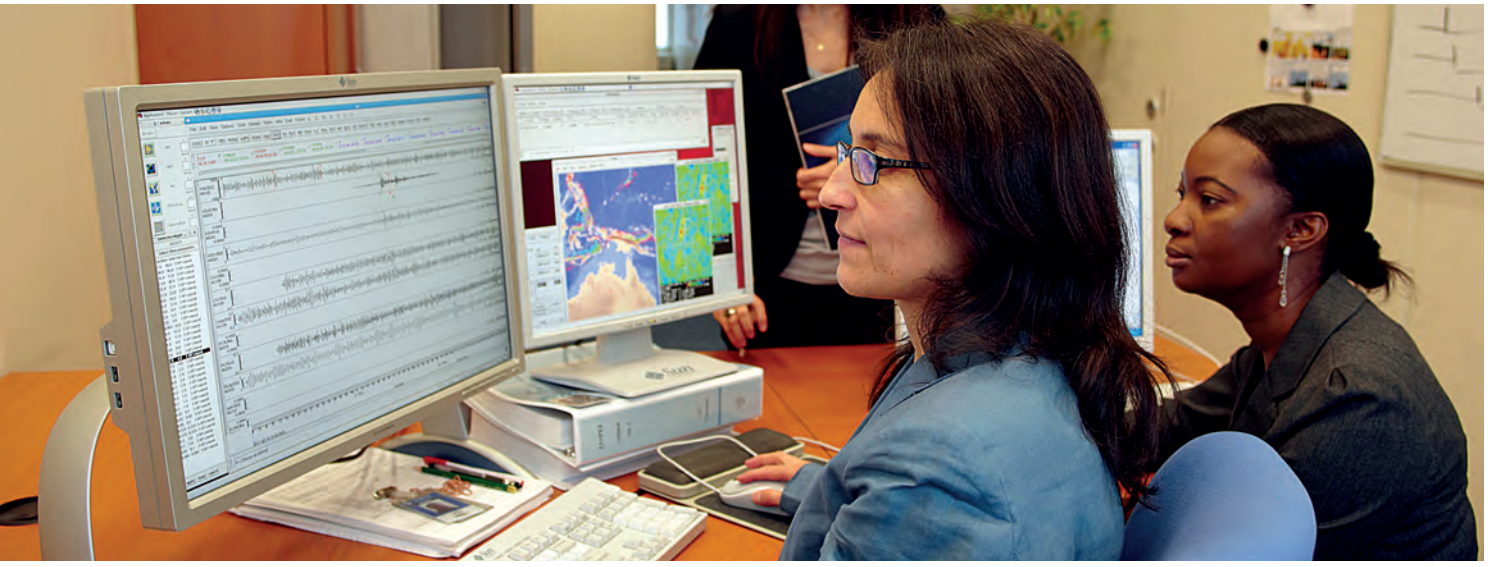
International Data Centre

Highlights in 2012

More robust and flexible data and product request services

Improvement in reviewed noble gas products by implementing a scheme that categorizes the sample spectra

Further progress in IDC capability



Data analysts at work in the International Data Centre.

The International Data Centre (IDC) is situated at the Headquarters of the CTBTO Preparatory Commission in the Vienna International Centre. Its function is to collect, process, analyse and report on data received from facilities of the International Monitoring System through the Global Communications Infrastructure, 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. In addition to handling the data and products, the IDC provides technical services and support to the States Signatories.

Full network redundancy has been created at the IDC to ensure high availability of its resources. A mass storage system provides archiving capacity for all verification data, currently covering more than 12 years. The software utilized in operating the IDC is mostly developed specifically for the CTBT verification regime.

Operations

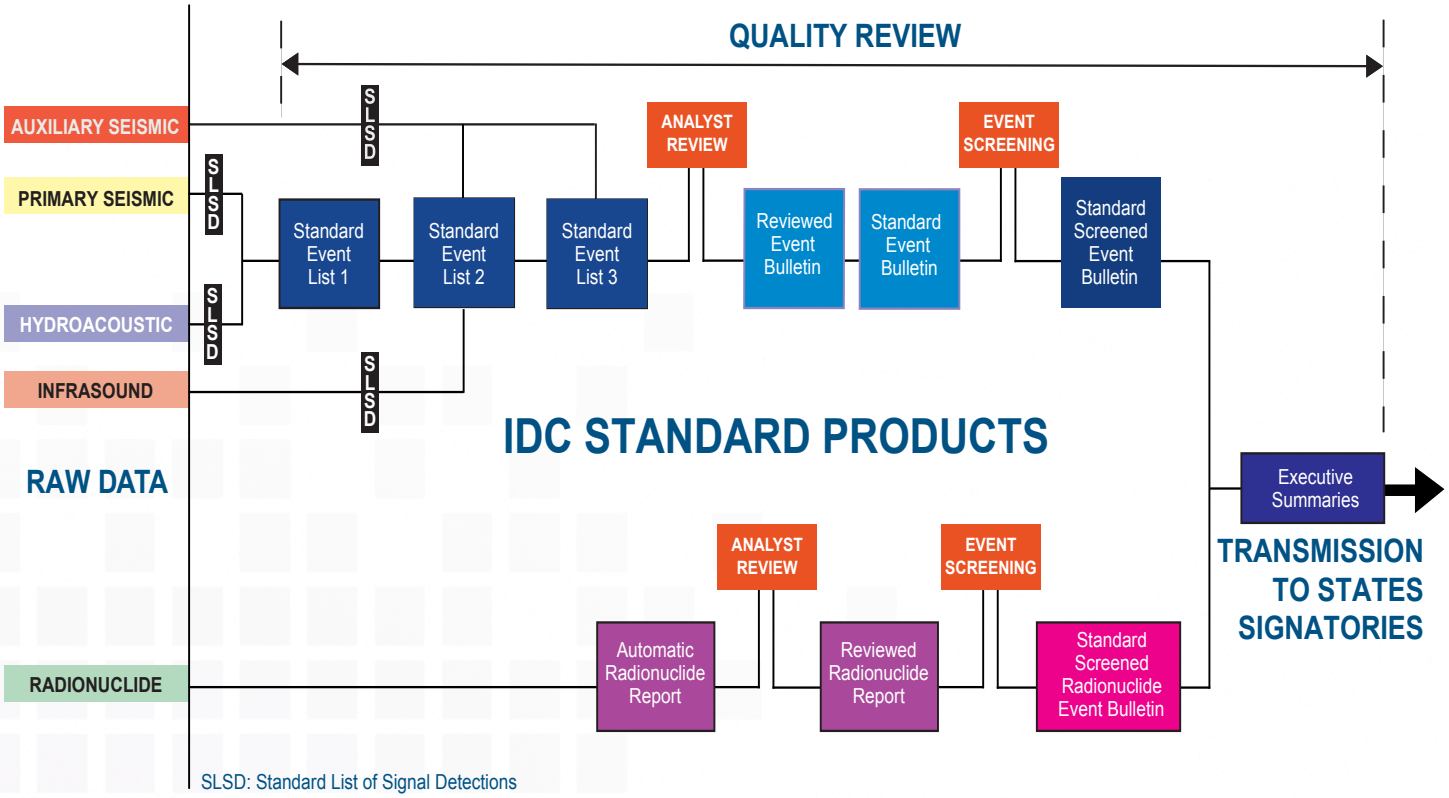
From Raw Data to Final Products

The data collected by the IMS under provisional operations are processed immediately when they reach the IDC. The first automated waveform 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 waveform 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 waveform data arriving late, are used to produce a more complete waveform event list, SEL2, four hours after recording the data. SEL2 is improved again after six hours have elapsed to incorporate any additional late-arriving waveform data, to produce the final automated waveform event list, SEL3.

Analysts subsequently review the waveform events recorded in SEL3 and correct the automated results as appropriate to generate the Reviewed Event Bulletin (REB). The REB for a given day contains all waveform events that meet specific quality 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, the REB will be released within 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 data undergo automatic processing to produce an Automatic Radionuclide Report (ARR) and then analyst review to generate a Reviewed Radionuclide Report (RRR) for each spectrum received. The information in the REB and RRR will eventually be fused, associating seismoacoustic events with radionuclide detections through atmospheric transport modelling (ATM).



SLSD: Standard List of Signal Detections

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. 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.

To corroborate the backtracking calculations, the Commission collaborates with the World Meteorological Organization (WMO) through a CTBTO–WMO response system. 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 WMO 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.

After the data products are generated, they must be distributed in a timely way to the States Signatories. The IDC provides subscription- and Web-based access to a variety of products ranging from near real time data streams to event bulletins and from gamma ray spectra to atmospheric dispersion models.

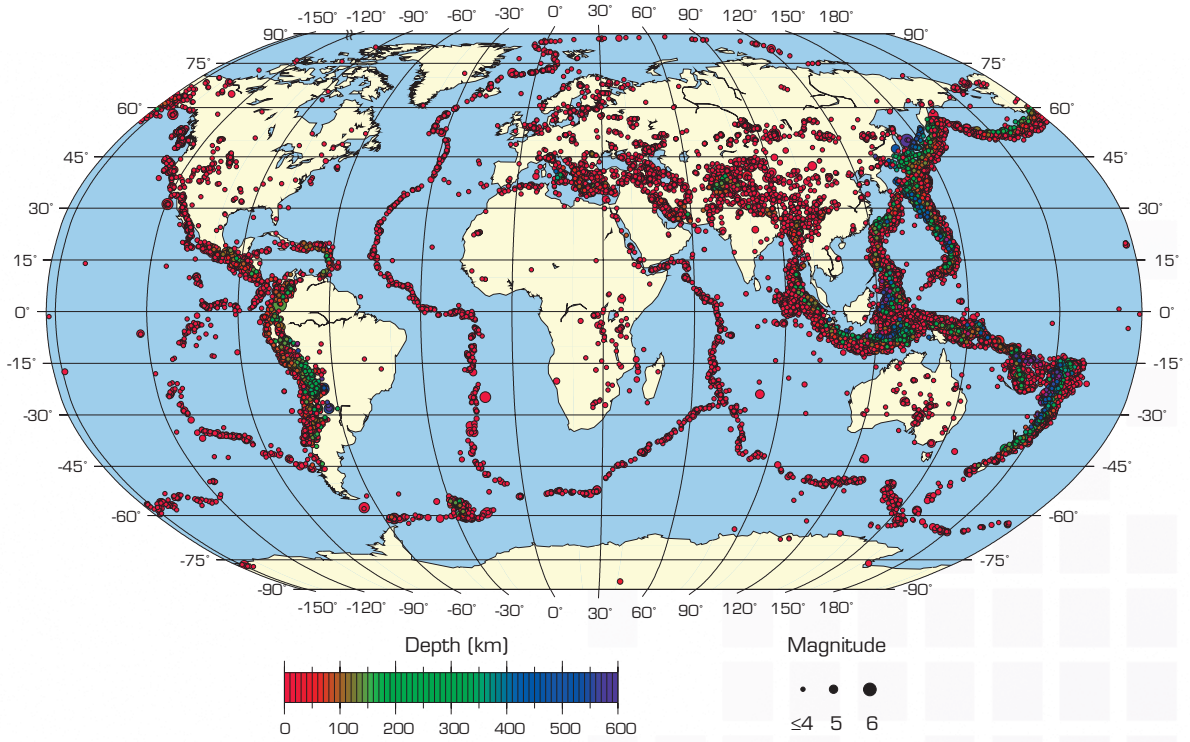
New Stations in Operations

In 2012, support and build-up of the IMS continued with the testing and evaluation of data from new stations. Seven newly installed or upgraded stations and one radionuclide laboratory were introduced into IDC operations as part of the certification process. Other stations awaiting certification were installed in the IDC test bed.

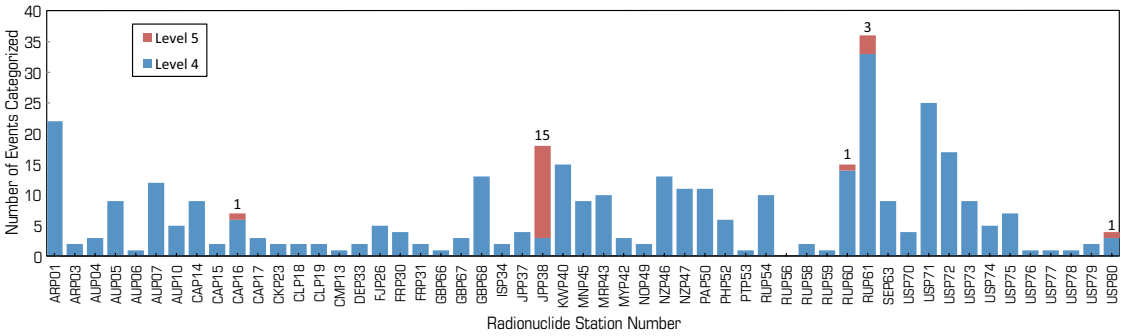
Services

An NDC is an organization with technical expertise in the CTBT verification technologies.

37 435 Events from the IDC 2012 Reviewed Event Bulletin



Level 4 and Level 5 Radionuclide Events Recorded During 2012 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.

Its functions may include receiving data and products from the IDC, processing IMS and other data, and providing technical advice to its national authority.

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

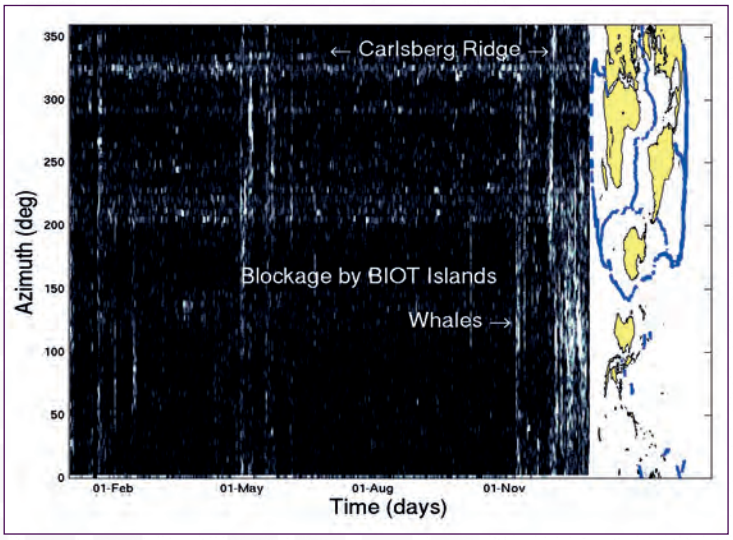
A total of 123 secure signatory accounts, one for each requesting State Signatory, have been established, and close to 1400 users from these States Signatories have been authorized to access IMS data and IDC products and receive technical support.

About nine hundred requests for support were received in 2012 from NDCs and authorized users, and 90% of them were addressed. The remaining 10% involve long term issues that will take time to resolve. Upgrades to the system for managing service requests from authorized users have been installed and tested to improve the service.

Build-Up and Enhancement

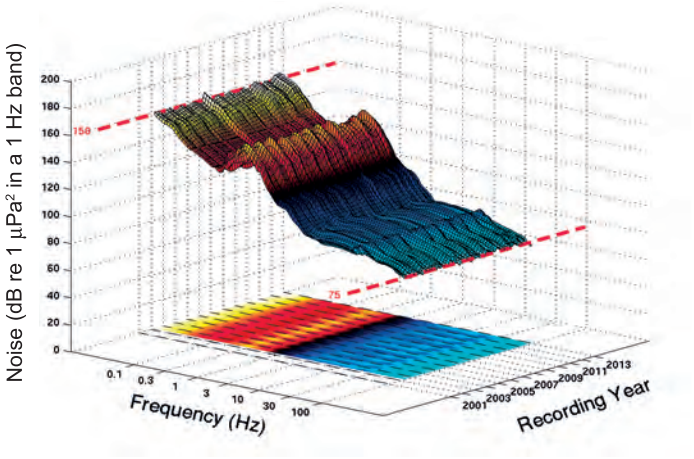
IDC Commissioning

Build-up and enhancement of the IDC further the goal of commissioning the IDC, GCI and IMS. To move from phase 5a to 5b of the IDC Progressive Commissioning Plan, two steps remain: the first is to produce a draft IDC validation and acceptance test plan, and the second is to ensure that formal security measures are in place to prevent external interference or compromise of IDC operations



A one year image of hydroacoustic signal detections by the northern hydrophone triplet of hydroacoustic station HA8 offshore of Diego Garcia in the Chagos Archipelago (British Indian Ocean Territory, BIOT) associates the signal propagation direction with possible source regions. The blue lines on the right hand map show the locations of ocean-spreading ridges (such as the Carlsberg Ridge in the Indian Ocean), which are associated with seismic activity. White indicates 10 or more signal arrivals each day. Of particular interest are the signals shown by the vertical striations. These have no obvious correlation with any source regions and, in fact, are known to be signals from whales. Because of their interest to bioacousticians, a project has begun that uses the virtual Data Exploitation Centre (vDEC), which provides a way for external researchers to collaborate with the PTS to work on topics of joint interest.

The hydroacoustic soundscape recorded by the western hydrophone triplet of hydroacoustic station HA1 offshore of Cape Leeuwin, Western Australia. The figure shows the monthly averaged signal level since 2001. The average noise distribution at the station, which is characteristic of the local area, is used in everyday processing of monitoring data from the station to observe whether the hydrophones are performing as expected. The noise data can also be used in calculations to predict detection probability at the station. The chart shows the same noise data plotted twice: once as an isometric surface and once as a shaded image. The peaks on the red–orange ridge on the isometric surface are caused by winter storms. The alternating blue bands on the shaded image are caused by ice breaking and whales. For this reason, the hydrophone data have been made available via the virtual Data Exploitation Centre (vDEC) for external researchers. The two red lines show the noise level, averaged over all years, at the highest and lowest frequencies studied. There seems to be no indication at Cape Leeuwin of a rise in ocean noise with time due to human activity.



and products and of other PTS facilities. A draft validation and acceptance test plan has been placed on a secure web site known as the Experts Communication System (ECS) for comment and the necessary security measures are being implemented.

Security Enhancements

Security is being addressed on a number of levels, from email and Internet to data authentication. Email and Internet security was enhanced through installation of new infrastructures and portals to curb spam and viruses in the PTS. To ensure the authenticity of IMS data and IDC products, highly secure hardware was installed in the computer centre to manage the private keys that are used by the IDC certificate authority. States Signatories may also authenticate data and products by connecting to dedicated certificate repositories which store all certificates generated by the certificate authority. The associated public keys are also retrievable from the certificate stores, which in turn have a robust infrastructure.

Hardware Enhancements

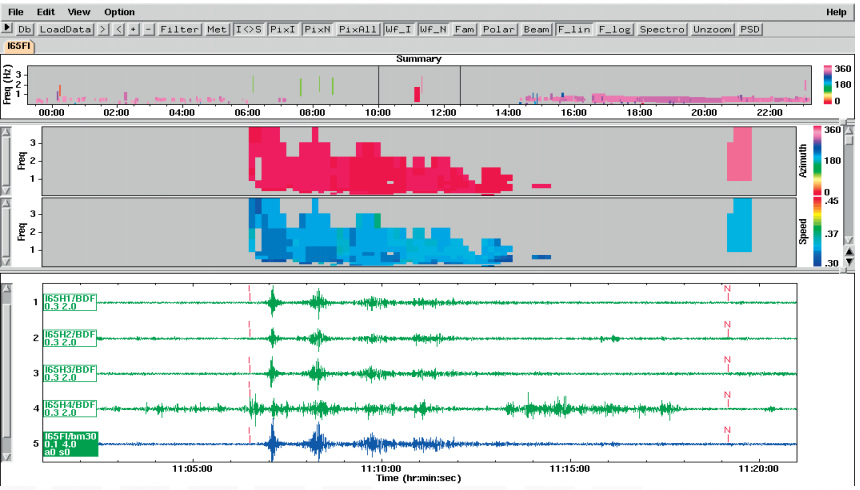
Four servers were added to host acquisition of meteorological field data and WMO ATM computations. For the next stage of expansion, the PTS has acquired supplementary hardware for the servers and the storage array network. This project is jointly funded with Japan.

The progressive expansion of the hardware in the computer centre poses challenges to its power supply systems, cooling capabilities and other design parameters. To meet these challenges, the floor load capacity was doubled and the uninterruptible power systems were upgraded to make the power supply more robust and reliable. A power and cooling audit was carried out to reveal any potential bottlenecks in the systems. Some legacy servers were retired and others were consolidated, making the service that they provide more robust.

Software Enhancements

Data availability and performance for auxiliary seismic stations were significantly enhanced with the implementation of the GCI data repository. The repository, logically external to the IDC, receives and stores data from IMS waveform stations and handles IDC requests for auxiliary seismic data. Along with improving the timely availability of the data, the repository helps fulfil the requirement that auxiliary seismic data "shall be immediately available through on-line computer connections" (Part I, paragraph 8, of the Protocol to the Treaty), reduces data traffic on the GCI and improves resource utilization.

The new IDC message system was officially released to external users in November 2012. The system offers new noble gas products as well as a Web based delivery mechanism for data and products that is faster and more secure than the email based delivery used so far. The new message system is integrated with the



'single sign-on' platform and offers enhanced maintainability and robustness.

A categorization scheme for the IMS radionuclide particulate stations has been in place for years. A similar scheme for radionuclide noble gas stations was installed in 2012 and experience is being gained with this new scheme. The new scheme sorts noble gas spectra into three categories: A (no radioxenon detected), B (radioxenon typical for the sampling location detected) and C (radioxenon atypical for the sampling location detected). It is distinguishable from the scheme for particulate spectra, which uses numerical categories 1 to 5.

Activities continued to validate the new regional seismic travel time (RSTT) model provided by the USA as part of a contribution in kind. The validation performed so far included comparing the RSTT and source specific station correction values for some stations, computing travel time correction grid files of most seismic stations in North Eurasia and North America based on the RSTT model, and comparing the measured travel time of some near ground truth events with the travel time computed using the RSTT model.

The PTS continued its efforts to apply state of the art machine learning and artificial intelligence techniques to its automatic and interactive processing software for waveform data. A first version of the NET-VISA software was installed in the IDC development local area network (LAN). Waveform analysts reviewed a day of events produced by the new software and provided positive and valuable feedback. In-depth tests were conducted using the locally installed version of NET-VISA. The tests involved comparing the results and performance of NET-VISA and

A PTS portable infrasound array was deployed between August 2011 and June 2012 in the Päijänne Tavastia region of Finland, at the site of primary seismic station PS17, to monitor infrasound activity in the Scandinavian region. Infrasound waves generated by the destruction of obsolete ammunition at the Hukkakero military range, about 850 kilometres to the north, were recorded by the PTS array. This work was done in collaboration with the Finnish NDC at the University of Helsinki. The screenshot displays the IDC processing results with the IDC interactive review software (Geotool-PMCC) for signals recorded from a Hukkakero explosion. The waveforms are visible in the bottom panel. Wave parameters estimated with IDC station processing software (DFX-PMCC) are shown in the top panels.

the existing Global Association software, and evaluating and improving the computational complexity of the NET-VISA algorithm.

International Noble Gas Experiment

Additional noble gas systems were transferred into IDC operations during 2012. At the end of the year, a total of 31 noble gas systems were in provisional operation at IMS radionuclide stations. Data from these stations and from one national facility (Canada) are sent to the IDC and processed in the testing environment.

Today the xenon background is measured as part of the International Noble Gas Experiment (INGE) at 32 locations, but is still not understood in all cases. Medical isotope production facilities are the biggest contributor to the radioxenon background. As more medical isotope production plants are expected to start operating, this will lead to an increased number of non-CTBT-relevant detections. Also, the noble gas composition of the emissions from these plants can be similar to emissions from nuclear explosions. A good understanding of the noble gas background is thus crucial for identification of signals from nuclear explosions. Therefore the EU has funded an initiative to improve knowledge of the global xenon background.

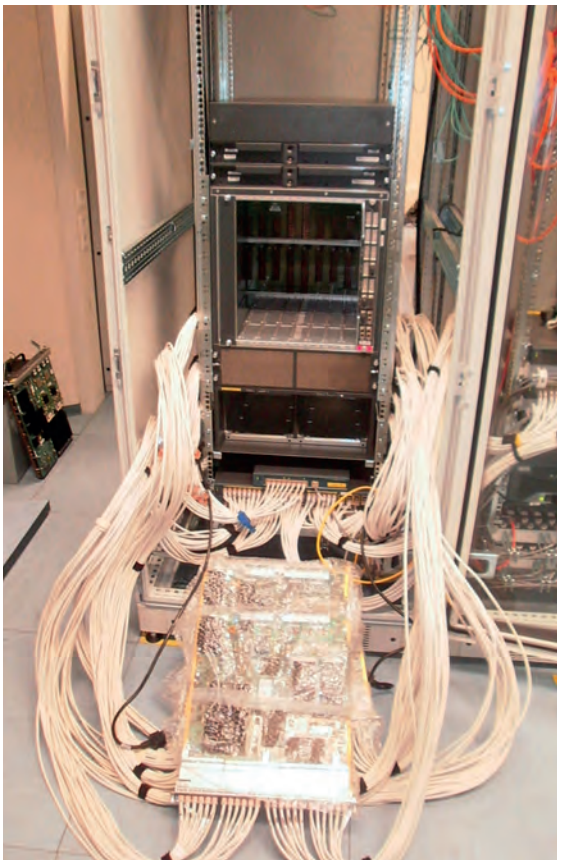
The initiative funded by the EU (Joint Action III), which started in December 2008, continued in 2012 to further improve knowledge of the global xenon background. The objectives of this project are to supplement knowledge on the global radioxenon background over longer and thus more representative periods at selected sites by performing measurements for at least six months, to detect local sources, if present, and to provide empirical data for validating network performance, for testing xenon equipment and logistics, for data analysis and for training local experts.

For this purpose three systems were deployed temporarily at selected locations. These mobile systems, two owned by the PTS and one by the USA, are designed to be deployable anywhere in the world within a few days. Measurement campaigns were conducted in 2012, in cooperation with regional hosting institutions and with the Pacific Northwest National Laboratory in Richland, Washington, USA, for periods from 6 to 12 months in Kuwait City, Jakarta and the Mutsu area of Japan. Locations were selected on the basis of the noble gas background information available, the influence from medical isotope production facilities and negotiations with hosting countries, among other things. The location in Jakarta is in the immediate vicinity of a medical isotope production facility for which emission data are available, thus providing the unique opportunity to correlate emission measurements with sampling data. Through these measurements, insight into seasonal variations and general background levels could be gained in areas which are poorly covered by the current IMS stations.

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 the 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 2012, the technology foresight exercise continued to focus 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 together with a ‘taxonomy’ that enables intuitive and in-depth understanding of identified developments. The technology foresight initiative was presented and discussed at a number of specialist meetings. A range



Two core switches direct virtually all network traffic on the PTS Intranet, ensuring that everything arrives correctly and securely at the proper destination. The switches were replaced in 2012 to modernize the equipment as well as to increase the capacity to accommodate future growth. The picture shows a switch chassis prior to insertion of the switchboards.

of posters describing the approach and initial results were presented for discussion and an online conference was convened to review emerging technologies relevant to signal acquisition, data analysis and on-site inspection. At the end of 2012, a new software called Pivot was being customized to present over two hundred emerging and relevant technologies, processes, concepts and ideas. The software was planned to become operational by March 2013.

Engaging with the Scientific Community

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, "International Scientific Studies" (ISS09) in 2009 and "Science and Technology 2011" (S&T2011) have provided good opportunities for the global scientific community and the Commission to interact constructively. The next conference in the series, S&T2013, was being planned for June 2013 and will be held at the Hofburg in Vienna.

The conference is expected to attract approximately four hundred oral and poster presentations by scientists worldwide, including some from non-signatory States. The presentations will be organized around three themes: the earth as a complex system; understanding the nuclear explosion source; and advances in sensors, networks and processing.

A comprehensive public information strategy has been put in place for S&T2013. A dedicated web site area was created for registration, abstract submission and materials related to the conference. The conference was being publicized through brochures, posters, booths at scientific conferences, direct emails and advertisements in scientific journals.

Civic Activities

Provision of Data for Tsunami Early Warning

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 2012, an agreement was finalized with the Korea Meteorological Administration of the Republic

of Korea. This brought to 11 the number of such agreements or arrangements that the Commission has entered into: with Australia, France, Indonesia, Japan, Malaysia, the Philippines, the Republic of Korea, Thailand, Turkey and the USA (Alaska and Hawaii). Additional agreements or arrangements were being developed with Greece and Spain.

Participation in the Inter-Agency Committee on Radiological and Nuclear Emergencies

The Commission was invited by the International Atomic Energy Agency (IAEA) to attend meetings of the Inter-Agency Committee on Radiological and Nuclear Emergencies (IACRNE) as an observer following the Fukushima accident. The IACRNE, which is coordinated by the IAEA, gathers representatives of the European Commission, the European Police Office, the Food and Agriculture Organization of the United Nations, the IAEA, the International Civil Aviation Organization, the International Maritime Organization, the United Nations Scientific Committee on the Effects of Atomic Radiation, the International Criminal Police Organization, the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development, the Pan American Health Organization, the United Nations Environment Programme, the United Nations Office for the Co-ordination of Humanitarian Affairs, the United Nations Office for Outer Space Affairs, the World Health Organization (WHO) and WMO. Joint work through the IACRNE was found beneficial for all parties, and in 2012 the Commission was accepted as a participating member.

Conducting On-Site Inspections

Highlights in 2012

Further progress in preparation for the 2014 Integrated Field Exercise (IFE), including the conduct of two build-up exercises

Continuation of the second training cycle for surrogate inspectors and conduct of a number of other OSI training events

Conduct of four field operational tests related to OSI techniques and technologies

Setting up the base of operations at Bruckneudorf, Austria, during the second build-up exercise, devoted to the pre-inspection and post-inspection phases, September 2012.

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's entry 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 require adequately trained personnel, appropriate logistics and approved equipment to sustain a team of up to 40 inspectors in the field for a maximum of 130 days while enforcing the highest standards of health and safety and confidentiality.

Surrogate inspectors practising decontamination procedures during the health and safety training course, May 2012.

Progress in Implementation of the Action Plan

The aim of the action plan, which was approved by the Commission in November 2009 and adjusted in February 2011, 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 (as well as its adjustment) outlines a total of 38 sub-projects in five main areas of development. These areas are policy planning and operations, operations support and logistics, techniques and equipment, training, and procedures and documentation.

Twenty-one sub-projects were being implemented during 2012. By the end of the year, 26 of the original 38 sub-projects were completed, 1 less than planned. Financial and human resource constraints, as in previous years, presented a major challenge to the implementation of the action plan.

2014 Integrated Field Exercise

In 2011, the PTS notified the States Signatories that it was seeking a host country for the IFE in 2014. Three countries responded positively: Hungary, Jordan and Ukraine. In 2012, the results of site visits and other discussions were conveyed to the Permanent Missions and to the Thirty-Eighth Session of Working Group B.

The Commission at its Thirty-Eighth Session selected Jordan as the host country on the basis of the Working Group B recommendation.

Accordingly, in-depth planning and preparation activities were initiated jointly with the host country. As part of the process, the respective legal framework documents covering the responsibilities of each party during the exercise preparation and conduct were agreed on and signed in November 2012. Public information and media related preparations for the IFE were started by developing a media concept, a logo and a dedicated web page.

Work on the preparation of a scientifically credible and comprehensive scenario began in March 2012 with the creation of a task force of external experts from States Signatories. Steps taken throughout the year culminated in a visit to Jordan in December to define the inspection area and specific locations of interest and to agree on the overarching background scenario.

Further progress was made in arranging for the long term provision of inspection equipment offered by States Signatories for the IFE. Ten States Signatories, Canada, China, the Czech

Republic, Finland, France, Hungary, Italy, Japan, the United Kingdom and the USA, provided offers of equipment and consultations were held with the respective States Signatories on the selection of required equipment.

As part of the IFE preparations, two build-up exercises (BUEs) were successfully conducted. BUE I, covering the launch phase of an OSI, was carried out from 16 to 20 April at the Equipment Storage and Maintenance Facility (ESMF) of the PTS in Guntramsdorf, near Vienna. The exercise involved a total of 70 representatives from States Signatories and various PTS Divisions, who performed core inspection team (IT) related functions. Various aspects were exercised, including activation of the Operations Support Centre (OSC), verification of the validity of the OSI request by senior management, preparation of the initial inspection plan and the inspection mandate, including an equipment list, call-up of prospective IT members, and equipment preparation, packing and certification. Major improvements in a number of areas were noted by the external evaluation team when compared with the 2008 IFE in Kazakhstan. The exercise validated the basic BUE concept as well as confirming the functionality of the ESMF.

The second BUE, covering the pre-inspection and post-inspection phases of an OSI (BUE II/IV), was carried out from 8 to 14 September. The exercise was conducted at the ESMF and at the Austrian Armed Forces training ground in Bruckneudorf, 45 kilometres south-east of Vienna. Forty-one national experts and 63 staff from various PTS Divisions participated in the exercise. Key activities tested during the exercise included procedures and processes related to the point of entry (e.g. negotiations between the IT and the inspected State Party and checking of equipment), setting up a base of operations and establishing operational readiness, as well as conducting crucial elements of the post-inspection procedures. Major improvements in a number of areas since the 2008 IFE were noted. The exercise provided evidence of the availability of an increasingly competent cadre of trained surrogate inspectors, both from the States Signatories and from the PTS.

Top: The Executive Secretary of the CTBTO Preparatory Commission, Tibor Tóth, signing an inspection mandate in the role of Director-General of the CTBTO, in the presence of Oleg Rozhkov, Director of the OSI Division, during the first build-up exercise, devoted to the launch phase of an OSI, April 2012.
Bottom: Development of an initial inspection plan during the first build-up exercise.

Planning for BUE III has begun and the exercise specifications have been drafted. The exercise is to focus on the inspection phase and will take place from 26 May to 7 June 2013 at a military training ground near Veszprém, Hungary, that was visited in October 2012.

Policy Planning and Operations

The inspection team functionality (ITF) project was successfully concluded in 2012. An information based search logic and methodology

for IT activities were developed and tested during the first two BUEs as well as during an expert meeting held at the ESMF in March. The ITF concepts were tested during BUE I for the development of the initial inspection plan and yielded satisfactory results. A document covering the IT search logic and the methodology for its application, the structure and agenda of IT internal meetings and reporting, and the IT structure and distribution of roles and responsibilities was drafted for testing during BUE III and for review prior to the IFE.

As a follow-up of the project on IT communications, an expert group meeting took place from 29 May to 1 June at the Austrian Armed Forces training area in the Seetaler Alpen. Thirteen national and six PTS experts participated in the meeting. A new portable VSAT was fully integrated into the GCI network. A successful test was conducted to follow the link to the PTS network via the different satellite hubs. Additionally, in-depth testing of various means of IT communication was performed under the challenging conditions of a mountainous region. Furthermore, the concept of operations for OSI communications, including the relevant draft standard operating procedure (SOP), was tested and validated.

With respect to work on the field information management system (FIMS), an expert group meeting on the geographical information system (GIS), funded by the EU under Joint Action IV, was conducted from 8 to 12 October in Guntramsdorf. A total of 22 experts from States Signatories, United Nations based organizations and the PTS participated in the activity. The meeting focused on evaluating the draft SOP recently developed as well as the new custom designed GIS, which is at the heart of FIMS. A number of valuable

Top: Role playing at the second build-up exercise, devoted to the pre-inspection and post-inspection phases, September 2012: negotiations between the inspection team and representatives of the inspected State Party at the point of entry of the inspection team on the territory of the inspected State Party.
Middle: Checking of equipment at the point of entry during the second build-up exercise, carried out at the Equipment Storage and Maintenance Facility of the PTS in Guntramsdorf, near Vienna.
Bottom: The base of operations established at Bruckneudorf, Austria, during the second build-up exercise.

recommendations were made and have been implemented. As a result, an improved SOP as well as an optimized GIS will be available and tested during BUE III and the IFE.

An expert meeting on multispectral including infrared (MSIR) imaging, funded by the EU under Joint Action IV, took place from 3 to 5 October at the Vienna International Centre. Ten invited experts from eight States Signatories along with PTS staff participated. The meeting was held as a follow-up of the 2011 MSIR expert meeting and focused on progress achieved by the PTS with support from States Signatories in the development of technical specifications for the MSIR equipment, results from field tests, drafting of relevant documentation and parts of the draft OSI Operational Manual, and further actions to prepare for the IFE.

Testing and development of the Integrated Information Management System (IIMS) continued in 2012. Suggested changes were made to its functional structure and the specific procedures in order to allow an integration of the IIMS with the ITF and FIMS projects. This should contribute significantly not only to the daily planning and management of IT activities but also to the clear fine-tuning of IT search logic. Integration of the IIMS with the other OSI technologies was also initiated. Work instructions (WINs) for setting up the IIMS were drafted and used during BUE II/IV. Some aspects of the IIMS were tested in field conditions for the first time as an exercise element for BUE II/IV. Development of the concept for chain of custody for management of OSI samples was carried out using the IIMS as a central information management platform.

In preparation for BUE I, an expert meeting on the OSC was held on 10 and 11 January with the participation of 3 external experts and 13 PTS staff. The meeting focused on the set-up and organization of the OSC and procedures applied there with the aim of identifying best practices. The outcome of the meeting was used to develop, inter alia, OSC related SOPs that were then applied during BUE I.

Operations Support and Logistics

The PTS continued the implementation of the Integrated Inspection Support System (IISS). The IISS concept covers nine major areas of operations support and logistics for the preparation, launch, conduct and recovery of an OSI. Activities in 2012 focused on completion and testing of the system engineering and synergies of the ESMF, establishment and testing of the infrastructure of the provisional OSC, development of equipment modules to be used with the Intermodal Rapid Deployment System, the health and safety concept, completion of the OSI databank and further improvement of the base of operations.

The ESMF has proven its capability to function as a multipurpose facility for supporting specific training events and exercises as well as for storage, maintenance and calibration of all OSI equipment. Lessons identified during BUE I and BUE II/IV were applied to further refine the ESMF infrastructure and processes. Special emphasis was given to the development of deployment kits and equipment modules. During 2012, all equipment was repacked and sorted into system modules to enable rapid and flexible deployment.

The PTS completed the development of the OSI databank project as an important pillar of operations support. The first version of the databank was being tested and data entry was due to commence at the beginning of 2013.

The layout and infrastructure requirements for the base of operations were further refined in preparation for BUE II/IV using a systematic approach and standardization. The developed infrastructure and procedures proved to be efficient during BUE II/IV, showing significant improvement since the 2008 IFE. Overall, the current equipment and structure enable rapid and effective deployment anywhere in the world. Capability shortfalls revealed during testing, which were related to power generation systems and the handling of material in the field, have been addressed and new equipment is to be delivered. Air conditioning systems and further

modernization of the decontamination module have been planned for 2013.

In 2012, the PTS completed the review and update of the OSI health and safety regime and provided the chapter on health and safety for the draft OSI Operational Manual. Subsequently, it initiated the procurement of items to ensure the safe conduct of OSI activities, including personal protective equipment to be used by inspectors in the field. In addition to updating the health and safety manual, the PTS prepared a draft SOP related to security issues for an OSI.

Techniques and Equipment

During 2012, the PTS focused on the development of techniques and equipment for noble gas detection and radionuclide mapping as well as the further development of MSIR technologies. In addition, more progress was made in implementation of a project funded through EU Joint Action IV for a noble gas system. As part of Joint Action V, an additional project for development of a modular MSIR system was planned.

Another MSIR field test took place in Hungary in May to assess, for OSI purposes, the operational readiness of airborne MSIR sensors. The test addressed the detection of areas where the surface material has been shaken by the detonation of charges and the impact of such detonations on vegetation, as well as changes to hydrological characteristics. The area surveyed was an order of magnitude greater than that in the previous test and key improvements were made in data processing and in the delivery time of data products. These developments, together with the simulation of the integration of MSIR imagery with the IIMS, will help effective deployment of MSIR technologies during BUE III as well as the IFE.

Top: Inflatable VSAT antenna tested during the second build-up exercise, devoted to the pre-inspection and post-inspection phases, September 2012. *Middle:* PTS equipment being used to auger a borehole for a subsoil noble gas sampling point during a field test, Slovakia, October 2012. *Bottom:* Mounting of gamma survey equipment (provided as a contribution in kind by Italy) aboard a helicopter in preparation for a field test of airborne MSIR technology, Hungary, November 2012.

A field test of portable gamma radiation scanning equipment was conducted in Belarus in September in order to evaluate its technical performance in operational conditions at the Polesye State Radiation and Ecological Reserve, an exclusion zone created in the aftermath of the Chernobyl accident. The test was combined with O&M training for PTS staff. The tested systems comprised a handheld portable configuration with a standard detector as well as vehicle-borne and airborne configurations with larger detectors. The technical performance of the systems in the field was entirely satisfactory. The software developed and used for data collection and evaluation was very informative and easy to use. This field test activity was extremely productive and generated many lessons learned from the perspectives of in-field operation and inspector efficiency in an elevated radiation field, as well as identifying further developments required for the equipment.

A field test held at the Turecký Vrch military base in Slovakia in October allowed field operation of newly acquired 'direct push'/augering equipment for environmental sampling of noble gases in soil. Several subsurface sampling stations were created and installed with equipment for subsoil gas sampling. The configurations tested demonstrated no atmospheric gas infiltration during the pumping on each hole, which lasted up to 24 hours. Concurrently, a second team gained experience in collecting environmental samples that would probably entrain dust contaminated with radionuclides in a real OSI situation. Activities involved three types of air sampler and one high volume water sampler. Experience was also gained with the logistics of transporting large and heavy pieces of equipment into an operational setting.

As direct preparation for BUE III, a field test was held in Hungary in November to test the installation and operation of three airborne sensors on board a commercial helicopter. The field test, which involved equipment offered as a contribution in kind by Italy, demonstrated the functionality of these sensors (a caesium vapour magnetometer, a gamma spectrometer and a complex camera system adapted to flight path documentation and visual observation purposes) and established the airworthiness of specific components fabricated as part of the unique sensor installation.

Testing of a smart sampler developed for OSI purposes (as a contribution in kind by the USA) during a field test of noble gas subsoil sampling techniques, Slovakia, October 2012.

Within the framework of meetings related to noble gas detection, international experts discussed, together with PTS staff, technical details of radionuclide particulate and noble gas sampling for OSI purposes. The meeting identified objectives and needs for development and field testing, and included valuable in-depth technical discussions of equipment and sampling strategy. In a second meeting, the chain of custody was addressed.

An equipment certification SOP was compiled and approved at the beginning of the year. This contributes to the smooth flow of OSI preparation because it covers the whole OSI process, from receiving equipment and performing initial checks, through laboratory and field tests, to readiness for certification. The concept of equipment certification was successfully tested in both BUE I and BUE II/IV and the experience was reported at OSI Workshop-20.

Within the framework of adapting the active seismic survey method for OSI purposes, considerable progress was achieved by one of the contracted geophysical institutions. The breakthrough concept is that the secondary target of any underground nuclear explosion,

the irreversibly fractured zone surrounding an actual cavity, is much more revealing from an OSI standpoint than the primary target, namely the void created by the explosion. This new concept of active seismic detection is based on the petrophysical situation surrounding a detonation point, characterized by a decrease in seismic velocity and high wave attenuation. Although current active seismic methods are very effective, they are also the most labour-intensive inspection activities of an OSI. However, this new approach will reveal traceable changes in rock properties by merely deploying a scaled-down 3D seismic survey. Additionally, the operational benefit of this strategy is that Seismic Aftershock Monitoring System equipment already available and approved can be used for an OSI-relevant active seismic survey.

Surrogate inspectors (*top*) being issued with radios at the base of operations prior to a training mission, and (*bottom*) being briefed on monitoring and decontamination procedures after completing a field survey for radioactive material, at the health and safety training course, May 2012.

Training

In parallel with the continuation of training of surrogate inspectors nominated for the second training cycle, the PTS focused on training potential participants in the BUEs.

The year started with an introductory training course for staff from Permanent Missions. This course was attended by 17 participants from 12 States Signatories.

Training for BUE I was provided in seven days dispersed between January and April. It addressed the training needs for various types of expertise required for the functioning of the OSC. Approximately eighty trainees undertook this training by attending one or more of the training segments.

From 14 to 18 May, a health and safety training course took place both in Vienna and at the Austrian Armed Forces NBC Defence School in Korneuburg, near Vienna. This event was ambitious in terms of its scope, the training methods and the large number of participants: in total, 74 experts attended, of whom 64 were from 41 States Signatories and 10 from the PTS. Trainers were drawn from the PTS and external cost-free experts from the USA. Through a combination of lectures, hands-on experience and field activities involving radioactive sources, the participants gained an understanding of the possible hazards of radioactive fields and contamination and the measures which can be taken to mitigate them. This was a very successful event from which several lessons were identified that can contribute to future health and safety courses.

From 18 to 22 June, a tabletop exercise combined with hands-on training in logistics and administration was organized for 22 participants from 14 States Signatories. Most trainees were from both training cycles and had a logistics background. The same training techniques were used as in the health and safety training course, namely lectures, hands-on activities and practical activities using OSI equipment at the ESMF. Following the practical activities, participants took part in the tabletop exercise, which included several simulations and role playing that explored the logistical and administrative procedures of an OSI.

A BUE training course was conducted from 6 to 10 August. It addressed learning needs for three types of participant in BUE II/IV: inspectors, representatives of the inspected State Party and OSC staff. It involved approximately sixty people. The organization of the training was complex as it had to accommodate a challenging scope and the technical and non-technical, procedural and strategic aspects, as well as a variety of training methods (from hands-on training to classroom simulations).

From 5 to 9 November, a tailor-made leadership training course was held for 36 trainees from the first and second OSI training cycles. The course addressed leadership, negotiations and management skills relevant for the ITF and search logic. Most of the training methodology was based on simulations, a tabletop exercise and role playing involving the understanding of other cultures, leadership, public speaking and negotiations.

Steady progress was made with the upgrading and updating of the database for OSI Rapid Inspector Selection (OSIRIS). At the end of the year, data on trainees taken from a comprehensive survey were being prepared for use in the 2013 training and BUE III. An important practical step was taken during BUE I, when a call-up of trainees was performed to assess the degree of completeness of the database.

The e-training simulation system was being upgraded and new equipment for a radioactivity contamination simulation system was being purchased. This will enable trainees to simulate the detection of radioactive sources during field exercises.

The status of inspectors and inspection assistants was discussed at meetings of the Working Groups in 2012. As a result, some progress was made in terms of more detailed definitions of availability criteria as well as improvement of the call-up process.

The year 2012 was one of the most active and productive for OSI training, with about five hundred participants being trained to perform various functions and being prepared for participation in and/or support of activities to test OSI readiness.

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. This included a further update of the Model Text for the manual, issued in June 2012. It is expected that in 2013 a consolidated Model Text will be available for use at the IFE in 2014.

OSI Workshop-20 was held at the Vienna International Centre from 29 October to 2 November. A total of 83 experts from all six geographical regions participated, comprising 40 external experts from 19 States Signatories and 43 experts from the PTS. The workshop included two sessions during which participants were debriefed on BUE I and BUE II/IV. The third session focused on the preparations for BUE III and the lead-up to the IFE.

The workshop covered all aspects of the BUEs already conducted, including roles and activities of the different players at the OSC located in the ESMF, activities at the point of entry/exit, set-up of the base of operations, communications, IT reporting and interaction of the inspected State Party with the IT. It also focused on inspection techniques, equipment

Participants at OSI Workshop-20, Vienna, October–November 2012.

and procedures for BUE III, and identified areas for improvement in preparation for BUE III and the IFE.

A number of OSI documents related to the Quality Management System (QMS) of the PTS were drafted and approved in preparation for the BUEs and training activities. Fourteen SOPs, twelve WINs and three manuals were drafted or revised in 2012. These included two WINs that provided guidance on drafting QMS related OSI documents and the templates to be used by document drafters and process owners.

The first phase of the conversion of the OSI document management system to an 'e-library' was completed and a prototype e-library platform was made available for testing and review. The next and final phase of the project has been initiated. This will help the e-library move to a production environment and interface with other systems in the PTS.

With respect to the consolidation of OSI scientific literature, work on the integration of compiled material into the e-library concluded with the first compilation of technical literature for each of the techniques covered by the Treaty. It is expected that this compilation will support the work of PTS staff in obtaining relevant information for the development of training modules, technical specifications of required equipment, concepts of operations for the different techniques and logistical support needed to employ these techniques.

Capacity Building

Highlights in 2012

Integration and testing of software for processing radionuclide data

Improved training for NDC staff and station operators through further development and use of e-learning modules as prerequisites for courses

Installation of capacity building systems at 18 NDCs to enhance their capability to participate fully in the verification regime

Participants of the International Hydroacoustics Workshop, Yokohama, Japan, November 2012.

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 (OSI), 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 capacity building programme is funded through the Regular Budget of the Commission as well as through voluntary contributions from the European Union and Monaco and a contribution in kind from the United States of America.

Participants in a training course on NDC capacity building at the Headquarters of the Commission, Vienna, May 2012.

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 EU, consists of various phases:

- Development of country profiles for all States Signatories
- Organization of regional NDC development workshops
- Two week training courses for NDC technical staff
- One month NDC training courses
- NDC visits by one or more technical experts
- Provision of basic NDC computer equipment and software.

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 surrogate 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 from the State, 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 2012: in Minsk, Belarus (39 participants), in Tokyo, Japan (43 participants), for NDCs in eastern Asia, and in Chiang Mai, Thailand (25 participants), for NDCs in countries belonging to the Association of Southeast Asian Nations (ASEAN). Their purpose was to promote understanding of the Treaty and the work of the Commission and to enhance national capabilities of States Signatories in the implementation of the Treaty. They also provided a forum to promote both the exchange of experience and

expertise in the establishment, operation and management of an NDC, and 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 from representatives of NDCs in different stages of development. They also provided opportunities for the PTS to collect additional information to update the country profiles.

Further to the NDC development workshops, two training courses on "NDC Capacity Building: Access and Analysis of IMS Waveform Data and IDC Products" were held: in Mexico City (28 participants) for Latin America and the Caribbean, and in Vienna (25 participants) for all regions. During the courses, participants were trained in accessing IMS data and IDC products, downloading and installing the 'NDC in a box' software and analysing data.

NDC Technical Visits

Following an advanced training course, one or more technical experts visit recipient countries 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 the visits. Sixteen such visits were made in 2012.

NDC Support

As part of the capacity building strategy of the Commission, sets of equipment that provide an adequate technical infrastructure

Top: Participants of a training course in NDC capacity building at the Headquarters of the Commission, Vienna, May 2012.
Middle: Television interview with Lassina Zerbo, Director of the IDC Division of the PTS, and Alexandr Shamko, Deputy Minister for Emergency Situations of Belarus, on the occasion of the handover of a capacity building system to the NDC in Minsk, September 2012.
Bottom: Visit to radionuclide station RN38 (Takasaki) during the NDC development workshop, Tokyo, October–November 2012.

Participants of the NDC development workshop, Tokyo, October–November 2012.

for NDCs were purchased by means of the Regular Budget and Joint Actions III and IV of the EU. The equipment was delivered and installed at 18 NDCs and further deliveries were planned for early 2013. 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 national needs.

Software to process and analyse IMS data is made available to all authorized users. The tool for analysing seismic data (Geotool) was enhanced in 2012 and the tool for post-processing of atmospheric transport results (WEB-GRAPE) was improved. Radionuclide software has been prepared for the NDC in a box software package for the first time and has been made available for beta testing. This is identical to the software used at the IDC to process and analyse all radionuclide samples, particulate as well as noble gas.

NDCs receive technical support upon request. This covers data access, special data handling, software issues and questions related to data analysis. The IDC provided special support related to the 2012 NDC Preparedness Exercise, an exercise that is conducted by NDCs for NDCs. A similar exercise was conducted in connection with the NDC workshop for eastern Asia. Activities were started to combine capacity development with the RSTT project.

A diverse range of training events for station operators was provided in 2012. A total of 97 station managers and station operators benefited from 14 courses, largely on the use and maintenance of equipment, but also covering procedures related to reporting and communication with the PTS.

On the basis of assessments of needs and as an additional building block to augment the verification capabilities of States Signatories, the Commission hosted two NDC analyst courses of one month each (15 participants). The objectives of the courses were to further strengthen the capacity of the States Signatories to participate in the verification regime and to enhance their use of PTS data and products for civil and scientific applications. The courses were well received, as indicated by the high numbers of applicants from all regions.

The e-learning system, which was put into preliminary operation at the end of 2009, increased in use throughout 2012. The development of e-learning modules continued and with the available funds it was possible to expand the number of courses by eight modules.

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.

Workshops on Monitoring Technologies

The PTS organized jointly with the Korea Institute of Geoscience and Mineral Resources the annual Infrasound Technology Workshop in Daejeon, Republic of Korea, from 8 to 12 October. The objective was to create an international forum for presenting and discussing recent advances in infrasound research and operational capabilities of global and regional networks. The topics covered during the workshop included infrasound instrumentation, modelling, data processing,

Participants of the 2012 INGE Workshop, Mito, Ibaraki, Japan, November 2012.

network detection capabilities, analysis of infrasound sources and infrasound station performance. In addition, two sessions were held with international infrasound experts on meteorological stations at IMS infrasound stations and on IMS infrasound array geometry. A total of 72 scientists from 20 countries, together with the international staff of the PTS, participated in the various sessions.

The 2012 International Noble Gas Experiment (INGE) Workshop was held from 5 to 9 November at Mito, Ibaraki, Japan. It was hosted by the Japan Atomic Energy Agency with support from the Commission and the EU. The workshop was well attended, with 98 experts from the international noble gas scientific community participating. Important aspects of the noble gas monitoring technology were discussed, including advances in science and technology, analysis and calibration, studies on noble gas background and ATM applications, OSI and quality assurance/quality control in laboratory analysis. About forty recommendations for further work on the various topics emerged from the discussions. Among these, the value of data fusion, the reduction of emissions of radioxenon isotopes into the environment and advances in OSI related applications were underscored.

The 2012 International Hydroacoustics Workshop took place in Yokohama, Japan, from 12 to 15 November. It was jointly organized by the Japan Agency for Marine–Earth Science and Technology and the PTS. A total of 40 participants from 12 countries took part in this event. The workshop raised awareness of existing, new and emerging hydroacoustic technologies, discussed installation challenges of cabling systems and enabled participants to explore areas of future cooperation.

Improving Performance and Efficiency

Highlights in 2012

Enhancement of the PTS performance reporting tool and refinement of key performance indicators (KPIs) for waveform and radionuclide monitoring

Further development and consolidation of the QMS, with an emphasis on implementing the Quality Policy

Feedback from users of data, products and services

Participants of the 2012 NDC Evaluation Workshop, Asunción, Paraguay, October.

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.

Developing the Quality Management System

The main purpose of the QMS is to ensure continuous provision of high quality products and services. The QMS is a 'living system' that can be adjusted, in keeping with the emphasis placed by the organization on customer needs and continual improvement.

In the ongoing work to consolidate QMS procedures, efforts focused on developing and testing the procedure for coding and controlling QMS related documents as well as the QMS document preparation workflow. Forms, manuals, quality plans, records, reports, specifications, SOPs and WINs prepared by the PTS will all be organized within this document management system.

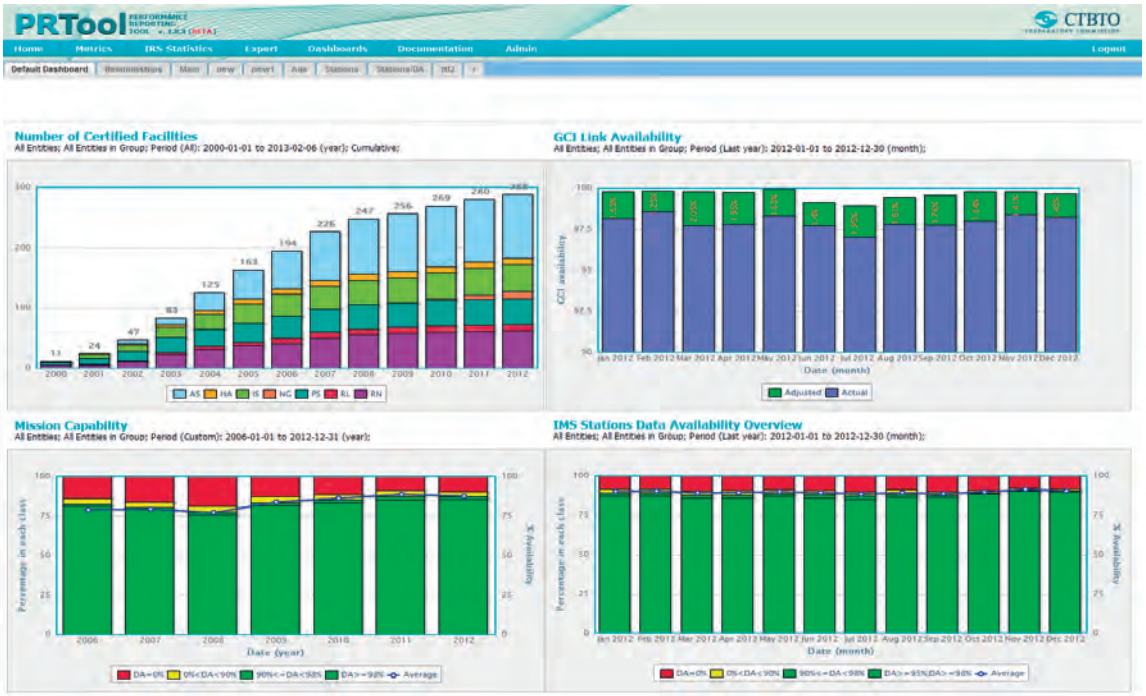
As part of the QMS, a PTS manual on verification related process maps was compiled with the involvement of process owners. The maps illustrate those processes within the scope of the Quality Manual that contribute directly to the quality and availability of data products and PTS outputs. The purpose of the manual is to show the main process decision points and the KPIs and other metrics that facilitate the measurement, evaluation and continual improvement of the development, testing and provisional operation of the verification system.

Recognizing that every staff member of the PTS is responsible for ensuring that the work reflects the highest standards of quality as reflected in the QMS, efforts were made to implement one of the statements in the PTS Quality Policy, namely to instil a quality culture and maintain staff awareness of the QMS. Courses on how quality is managed at the PTS were made available on the PTS e-learning platform, covering both key principles and process specific QMS requirements.

In line with a recommendation made by the 2010 Quality Management Workshop, an extended version of the glossary of verification related terms was compiled.

Performance Reporting Tool

One of the functions of the QMS is to identify and put into effect KPIs for



Example of a customized dashboard of the performance reporting tool (PRTool). *Top left:* Yearly evolution of the number of certified facilities since 2000. *Top right:* Monthly GCI link availability during 2012. *Bottom left:* Yearly evolution of mission capability for the period 2006–2012. *Bottom right:* Monthly overview of data availability for all IMS stations in 2012.

Evaluation team at the first build-up exercise, devoted to the launch phase of an OSI, held at the ESMF, Guntramsdorf, Austria, April 2012.

evaluating PTS processes and products, thus facilitating management review and continual improvement. KPIs are parameters used to quantify the performance of the processes of an organization. They are primarily employed to assess the progress in reaching objectives and to supply quantitative information for prescribing a course of action. The aim of the QMS is to support the objective of consistently meeting verification system requirements, and it encompasses all contributing PTS processes and work products.

The capabilities of the performance reporting tool (PRTool) were expanded to strengthen its potential for helping to assess improvement of processes and products on the basis of the values of the related KPIs, and to permit browsing and filtering of information by date or by geographical region or for an individual country or IMS station. In other words, this approach enables the assessment of performance at many different levels. PRTool is therefore setting ambitious standards of transparency and accountability. It allows States Signatories to monitor the PTS programme implementation with the possibility of going back to any given year and making a judgement on the value gained for the resources invested. This interactive tool can be used to generate more than one thousand standard graphical presentations.

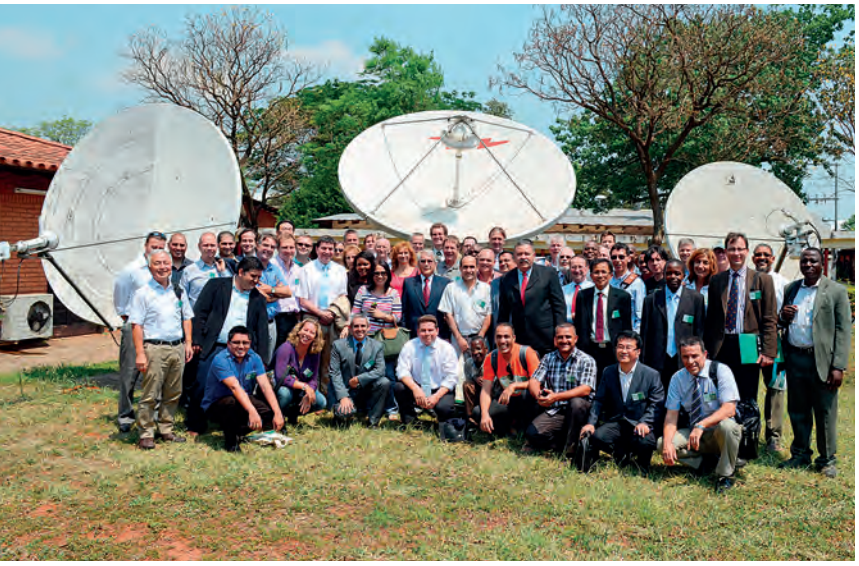
Evaluating On-Site Inspection Activities

The evaluation of OSI activities during the year was focused on the preparations for the 2014 IFE and specifically on the first two BUEs, conducted in April and September and devoted to the launch phase and the pre-inspection and post-inspection phases of an OSI. Preparations for the evaluation of BUE III, scheduled for May–June 2013, were also started.

The concept and method for the evaluation of the next IFE and its preceding activities over the period 2012–2014 are set out in a rolling draft blueprint. The blueprint is being developed and periodically refined on the basis of experience gained during its implementation at each BUE. A specially designed evaluation framework together with an appropriate toolset was also developed and used by the external evaluation team to evaluate each exercise.

The evaluation concept blueprint sets out two different approaches in order to reflect the two distinct purposes of the BUEs and the IFE. Since the former are viewed as ‘dress rehearsals’ for the IFE, in which progress can be assessed and capability built, the evaluation of the BUEs is taking a ‘formative’ approach in order to help shape the operational capability being exercised. In BUEs I and II/IV, the evaluation provided formative rapid feedback while the OSI activities were being exercised and at the end of each day’s activities, as well as in an internal report. It is intended that the feedback given will help build operational capability as a result of the lessons learned being incorporated into subsequent exercise planning and suitable adjustments being made in advance of the IFE.

Unlike the BUEs, the IFE is regarded as a test vehicle for benchmarking operational capability and determining the current level of OSI preparedness. The evaluation of the IFE will therefore take a ‘summative’, hands-off approach whereby the external evaluation team, instead of providing rapid feedback, merely makes an assessment and



Scenes from the 2012 NDC Evaluation Workshop, Asunción, Paraguay, October. *Bottom:* On the podium at the official opening (*from left to right*): Constantino Nicolas Guefos Kapsalis (Dean of the Faculty of Exact and Natural Sciences of the National University of Asunción), Petr Firbas (Chief of the Evaluation Section of the PTS), Antonio Rivas Palacios (Deputy Minister of Foreign Affairs of Paraguay), Pedro Gerardo González (Rector of the National University of Asunción) and Martin Kalinowski (Chief of the Capacity Building and Training Section of the PTS).

sums up the capability demonstrated during the exercise. Planning for the evaluation of the IFE was advancing on schedule and an approach to making an overall assessment of the level of operational preparedness for the IFE was formally introduced to stakeholders during OSI Workshop-20.

Feedback from National Data Centres

The 2012 NDC Evaluation Workshop, which took place from 1 to 5 October, was jointly organized by the Government of Paraguay and the PTS and was hosted by the National University of Asunción (Faculty of Exact and Natural Sciences). Sixty-five participants representing 31 States Signatories, NDCs and the PTS attended the workshop.

The objective of the workshop was to provide a forum for NDC experts to share their experiences in fulfilling their verification responsibilities and to provide feedback on all aspects of the data, products, services and support provided by the PTS. The workshop focused on the results of the 2012 NDC Preparedness Exercise and plans for subsequent exercises, as well as on data, products, services and support, and their importance to the NDC mission. The NDC Preparedness Exercise was organized by a control team with expertise in several technologies. This allowed the exercise and all other activities at the workshop to be aligned with OSI activities.

In its Quality Policy, the PTS underlines its focus on customers. The 2012 NDC Evaluation Workshop reviewed the status of implementation of the recommendations of previous workshops. The PTS described the overall status and proposed the closure of the recommendations that were considered fully addressed. The proposal was welcomed by the participants.

The themes covered by NDC experts at the workshop included their approaches to accessing IMS data and IDC products, and the sharing of waveform and radionuclide data between NDCs. Discussions involved a wide variety of topics related to data acquisition and analysis. The importance of communicating clearly to the NDCs any changes in parameters was emphasized. The discussions also covered aspects such as a better understanding of the degree to which

PTS data and products are used by the NDCs and the importance of providing feedback to the PTS through the established channels.

The NDCs expressed their views on issues such as differences between the IDC and NDC bulletins, shifts and mismatches in event locations, missing events and sources of discrepancies in bulletin comparisons. They also reported on the civil uses of scientific data and pointed out the importance of training and software. Group discussions addressed topics with a view to supporting NDCs in achieving their goals. The topics included hands-on training requirements, a newly established online NDC Forum, issues related to capacity building and support between NDCs.

NDC feedback to the PTS on services covered a broad range of aspects, including use of IDC products, performance reporting, documentation and access. During discussions it was pointed out that the IDC regularly organizes hands-on training for NDC representatives. Regional workshops and promoting collaboration between NDCs were also encouraged. It was highlighted that IMS data are completely accessible to all States Signatories, including for scientific purposes and research through the virtual Data Exploitation Centre (vDEC). NDCs highly appreciated the efforts made by the IDC. PRTool and its use by NDCs were also discussed at the workshop.

Policy Making

Highlights in 2012

Election by the Commission of a new Executive Secretary

Continuation of the new method of work of Working Group B, which enabled it to carry out its work more efficiently and in a more focused manner

Launching of the 'virtual paper approach' and further advances in establishing the Information System with Hyperlinks on Tasks Assigned by the Resolution Establishing the Preparatory Commission (ISHTAR)

The Secretariat and Task Leaders of Working Group B at the Thirty-Ninth Session.

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 2012

In 2012, the Thirty-Eighth and Thirty-Ninth Sessions of the Preparatory Commission were held on 14 June and 22–23 October respectively. The Thirty-Eighth Session was chaired by Ambassador Alfredo Alejandro Labbé Villa, Permanent Representative of Chile, and the Thirty-Ninth Session was chaired by Ambassador Ana Teresa Dengo, Permanent Representative of Costa Rica.

Working Group A was chaired by Ambassador Jargalsaikhan Enkhsaikhan (Mongolia) and held its Forty-First Session from 23 to 24 May and its Forty-Second Session on 26 September. Working Group B was chaired by Mr Hein Haak (Netherlands) and held its Thirty-Eighth Session from 6 to 24 February and its Thirty-Ninth Session from 13 to 31 August. Joint meetings of Working Groups A and B were held on 20 February and 27 August. The Advisory Group, chaired by Mr Michael Weston (United Kingdom), held the first and second parts of its Thirty-Eighth Session from 16 to 19 April and from 30 April to 4 May and its Thirty-Ninth Session from 3 to 7 September.

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.

In 2012, three experts supported in 2010 and 2011 left the project and three new experts were selected, so that the total number of experts supported continued to be 10 (one each from Algeria, Brazil, Burkina Faso, the Dominican Republic, Jordan, Kenya, Madagascar, Paraguay, South Africa and Vanuatu). Experts from three least developed countries were therefore supported under the project.

Experts took part in the Thirty-Eighth and Thirty-Ninth Sessions of Working Group B, including formal meetings, meetings of the expert groups and meetings of their respective geographical groups, and in the NDC Evaluation Workshop in Asunción, Paraguay, in October. In addition, the experts benefited from technical discussions with the PTS on key verification related issues. The experts from Brazil, Kenya and Madagascar continued to carry out their functions as Task Leaders in Working Group B for Testing and Provisional Operation, Issues Related to NDCs and Technology Refreshment respectively.

The project was financed in 2012 by voluntary contributions from Austria, China, Finland, Hungary, Indonesia, Luxembourg, Malaysia, Morocco, 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 (OFID). New voluntary contributions were received in 2012 from China, Finland, Norway and OFID.

On the basis of an implementation report prepared by the PTS, at its October session the Commission expressed its appreciation to the donor countries for their contributions and to the PTS for its reports on, and management of, the project. It also decided to continue the project for a further three years (2013–2015), according to the current management guidelines and selection criteria and subject to availability of sufficient voluntary contributions.

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, thus facilitating the decision making process. From

organizing conference facilities and arranging interpretation for the meetings and translation of papers 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.

In 2012, the PTS provided substantive and organizational support to the process for election of the next Executive Secretary of the Preparatory Commission. At its Thirty-Ninth Session, the Commission elected Mr Lassina Zerbo as the next Executive Secretary for a renewable term of four years. Mr Zerbo will begin his term of office on 1 August 2013.

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 2013.

Information System on Progress in Fulfilling the Mandate of the Treaty

ISHTAR was launched in September 2012 and the database made available to all users of the ECS. Using hyperlinks to the official documentation of the Commission as its basis, the aim of the ISHTAR project continues to be the monitoring of 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 provide up to date information to the Commission on the tasks that remain to be completed in terms of preparations for the establishment of the CTBTO at entry into force and the first session of the Conference of the States Parties.

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 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 2012, the PTS continued to distribute on DVDs all documents of and presentations to the Commission and its subsidiary bodies at their sessions. The Executive Secretary also announced in August 2012 that, as part of a new 'virtual paper approach', through which the PTS is seeking to limit its output of printed documentation, official documents of the Commission, its subsidiary bodies and the PTS would no longer be distributed in hard copy to all States Signatories as of 1 January 2013.

Outreach

Highlights in 2012

Deposit of instruments of ratification of the Treaty by Guatemala and Indonesia, and signature by Niue

Considerable expansion of education and outreach activities through the Capacity Development Initiative (CDI)

Innovative outreach and public information activities, in particular through upgrading of the public web site and use of social media

Lanterns floating along the Motoyasu River in Hiroshima to commemorate those killed by the atomic bomb in 1945. The Executive Secretary of the CTBTO Preparatory Commission visited Hiroshima and Nagasaki in August 2012 to attend events marking the 67th anniversary of the bombing of the two cities.

The Provisional Technical Secretariat of the CTBTO Preparatory Commission pursues outreach activities to promote universalization and entry into force of the Treaty. The Commission aims to enhance understanding of the Treaty and its verification regime, the functions of the Commission and the civil and scientific applications of CTBT verification technologies. Outreach entails interaction with the international community, including States, international organizations and non-State actors, such as academic institutions and the media. The interaction involves promoting signature and ratification of the Treaty by States, promoting understanding of the objectives, principles and benefits of the Treaty by government representatives and the general public, and fostering international cooperation in the exchange of verification related technologies.

Ban Ki-moon, United Nations Secretary-General, accompanied by Tibor Tóth, Executive Secretary of the CTBTO Preparatory Commission, entering the Vienna International Centre at the start of the celebration of the 15th anniversary of the organization, 17 February 2012.

Political support for the Treaty and the work of the Commission continued to be strong. The Treaty has been recognized by the international community as an effective instrument of collective security and an important pillar of the nuclear non-proliferation and disarmament regime, as demonstrated by the support by 184 States for the Resolution on the Comprehensive Nuclear-Test-Ban Treaty (A/RES/67/76) in the United Nations General Assembly. A growing number of States, decision makers and representatives of civil society were spearheading the campaign for ratification of the Treaty by the States that have not yet done so, including the remaining Annex 2 States. States and regional organizations also continued to support the work of the Commission with voluntary contributions. Through these efforts, the international community has reinforced the understanding that the Treaty plays a critical role in today's security environment.

The Treaty in 2012

The Treaty gathered momentum towards entry into force and universalization during 2012 as a result of several developments, such as the deposit, on 6 February, of the instrument of ratification by Indonesia at the United Nations Headquarters in New York. The developments illustrate the political determination of the international community in favour of the Treaty. By ratifying, Indonesia highlighted the importance of the CTBT for global and regional security to the States that have not yet signed or ratified, especially those listed in Annex 2 to the Treaty, whose ratification is required for it to enter into force.

Towards Entry into Force and Universality of the Treaty

The Treaty moved closer to universalization in 2012 with ratifications by Guatemala as well as Indonesia, and signature by Niue. In October, the Commission was informed that the Parliament of Iraq had ratified the Treaty.

As of 31 December 2012, the Treaty had been signed by 183 States and ratified by 157 States, including 36 of the 44 States listed in Annex 2 to the Treaty.

Consultations were conducted with nearly all States that had not yet ratified or signed the Treaty, including all but one Annex 2 State. A large number of ratifying States, the United Nations and other international and regional organizations, as well as institutions such as the Inter-Parliamentary Union (IPU) that work closely with the Commission to promote additional signatures and ratifications, were also consulted.

Interacting with the International Community

In 2012, the PTS continued efforts to facilitate implementation of decisions of the Commission on establishing the verification regime and promoting participation in its work. The PTS also maintained a dialogue with States through bilateral visits in capitals and interactions with Permanent Missions in Berlin, Geneva, New York and Vienna. The major focus of such interactions was on States hosting IMS facilities and States that have not yet signed or ratified the Treaty, in particular those listed in Annex 2.

The PTS took advantage of various global, 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 PTS attended meetings of the African Commission on Nuclear Energy, the African Union, the IAEA, the IPU, the Organisation for the Prohibition of Chemical Weapons (OPCW), the Organization for Security and Co-operation in Europe (OSCE) and the United Nations General Assembly.

The Executive Secretary of the Preparatory Commission visited Canada, Egypt, Hungary, Ireland, Italy, Japan, Mexico, the Netherlands, Switzerland, the United Arab Emirates, the United Kingdom and the USA to participate in high level events, and with a view to strengthening their interaction with the Commission and highlighting the significance of entry into force of the Treaty.

Capacity Development Initiative

The Commission continued to expand its CDI activities in 2012. The CDI is a key education and outreach activity that aims to build the necessary capacity in States Signatories to confront effectively the political, legal, technical and scientific challenges that face the Treaty and its verification regime.

On 11–12 June, the Commission held a seminar entitled "Engaging the Experts, Training the Trainers: A Seminar of CTBT Education in the 21st Century". The seminar, the first of an annual series, aimed at providing methodological guidance for academics and researchers involved in CTBT related fields. It also served as a forum for dialogue between academics and representatives of international organizations on non-proliferation and disarmament education. Participants from over thirty academic institutions and five international organizations attended the seminar, representing a wide range of backgrounds and disciplines encompassing both policy oriented and technical fields.

Participants in the Intensive Policy Course, held in Vienna in July 2012, during the simulation of a meeting of the Executive Council of the CTBTO to discuss a request for an OSI.

Participants of the Intensive Policy Course, July 2012.

The Commission held an Intensive Policy Course from 16 to 20 July, entitled "Multilateral Verification, Collective Security: The Contribution of the CTBT". The course was attended by more than eighty participants in Vienna, with several hundred more following the course on the Internet. The course featured an unprecedented simulation of a future Executive Council deliberation over a request for an OSI. Around two hundred and fifty participants completed the necessary criteria and received a certificate of successful completion.

From 10 to 14 September, a special course was organized for a visiting group of United Nations Disarmament Fellows. The group consisted of 25 young diplomats from 25 countries, including several of the outstanding Annex 2 States. The course provided an overview of the CTBT and its verification system and included tours of the rooftop radionuclide station located at the Vienna International Centre and the Operations

Speakers at the Advanced Science Course, Vienna, November 2012: *Top:* Wendy Watson-Wright, Executive Secretary of the Intergovernmental Oceanographic Commission of UNESCO and Assistant Director-General of UNESCO, gave a keynote presentation on tsunami warning systems. *Bottom:* Eileen Radde, Project Assistant at the Vienna University of Technology, and Lyndon Bevington, Senior Safety Officer at the IAEA, led a panel discussion on lessons learned from the Fukushima nuclear accident.

Top: Robert Werzi, Head of the Maintenance Unit in the Monitoring Facilities Support Section of the PTS, shows the radionuclide monitoring station on the rooftop of the Vienna International Centre to participants of the Advanced Science Course in July 2012. The station is used for training and calibration purposes and is not part of the IMS network.
Middle: Introduction by Tibor Tóth, Executive Secretary of the CTBTO Preparatory Commission, of *Global Risks 2012* published by the World Economic Forum (WEF), with invited guests from the WEF (*from left to right*) – Lee Howell, Managing Director, Risk Response Network, and Florian Ramseger, Manager, Quantitative Research – during the high level one day event of the Advanced Science Course, 16 November 2012.
Bottom: Participants in the high level one day event.

Centre of the IDC. The fellows also visited an OSI base of operations in Bruckneudorf, south-east of Vienna, which was set up as part of an exercise in preparation for the IFE in 2014.

From 12 to 23 November, the Commission held an Advanced Science Course entitled "Around the Globe and Around the Clock: The Science and Technology of the CTBT". The course was designed to enhance understanding of the CTBT verification technologies for individuals with a background or interest in nuclear, geophysical or computer sciences as well as electronics, telecommunications or engineering. The course was attended by 70 participants in Vienna, with many more participating online. The course included an observation of IDC analysis, tours of the rooftop radionuclide station and the Operations Centre, and a tour of the ESMF at Guntramsdorf, near Vienna. A high level one day event, entitled "Science for Peace: Applying Technical Expertise to Emerging Security Challenges", was also held and included presentations

by some of the world's leading scientists and policy experts in CTBT related fields.

The Commission has achieved success in promoting online CTBT education and training materials with its iTunes U page. There are currently 12 different collections and two full courses on the page. Since the Commission established a presence on iTunes U in April 2012, the page has amassed over one thousand subscribers.

United Nations

The Executive Secretary took part in the opening of the general debate of the sixty-seventh regular session of the United Nations General Assembly in New York, where he met with the foreign ministers of the Comoros, the Holy See, Iraq and Sweden, as well as other high level officials, including the US Acting Under Secretary for Arms Control and International Security. Throughout 2012, the Executive Secretary had several meetings with the United Nations Secretary-General. PTS representatives also participated in a number of conferences sponsored by the United Nations with the aim of strengthening cooperation with academics and practitioners in the field of disarmament and non-proliferation.

The Executive Secretary delivered his report to the plenary of the United Nations General Assembly under the agenda item entitled "Cooperation between the United Nations and the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization" (A/RES/67/9). On 3 December, the Resolution on the Comprehensive Nuclear-Test-Ban Treaty was supported by an overwhelming number of 184 States.

Over one hundred States Signatories associated themselves with the Joint Ministerial Statement on 27 September during the Ministerial Meeting in New York, which was hosted by the foreign ministers of Australia, Canada, Finland, Japan, Mexico, the Netherlands and Sweden.

Regional Organizations

The Executive Secretary attended an event organized by the Agency for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (OPANAL) in Mexico City to commemorate the 45th anniversary of the opening for signature of the Treaty of Tlatelolco on 14 February.

The Executive Secretary undertook a mission to Egypt to attend the Ministerial Meeting of the Coordinating Bureau of the Non-Aligned Movement, which was held in Sharm El Sheikh from 9 to 10 May.

From 6 to 8 December, the Executive Secretary attended the 19th OSCE Ministerial Council Meeting in Dublin. On the margins, bilateral meetings were held with the foreign ministers and high level representatives of Austria, Denmark, Finland, the Holy See, Ireland, Kazakhstan, Luxembourg, Norway and Turkey as well as with the Deputy Secretary General for Political Affairs of the External Action Service of the European Union.

Other Conferences and Seminars

The Executive Secretary delivered a welcoming address and participated in a panel discussion on nuclear disarmament during the second annual conference on "UN Agencies Connecting with Academics and the Civil Society". The conference was held from 11 to 13 January at the Vienna International Centre and organized by the Academic Council on the United Nations System.

On 6 February, the Executive Secretary attended a ceremony at the United Nations Headquarters in New York at which Indonesia deposited its instrument of ratification of the Treaty.

The Executive Secretary attended a Wilton Park conference, entitled "Nuclear energy one year after Fukushima: challenges and responses", at Wilton Park, United Kingdom, from 27 to 28 February.

The Executive Secretary delivered a keynote speech during the Fifth Annual Transatlantic Security Symposium, which was hosted by the University of Illinois at Urbana–Champaign, USA, and held from 28 to 30 March.

On 24 April, the Executive Secretary was a keynote speaker at a seminar entitled "Towards a CBN Security Culture: Developing a Holistic Approach", which was hosted in Vienna by the Permanent Mission of Hungary.

The Executive Secretary addressed the first session of the Preparatory Committee for the 2015 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, which was held in Vienna from 30 April to 11 May. Over two hundred participants, including delegates and members of civil society, took advantage of the tours and lectures offered by the Commission in different languages.

On 3 May, the Executive Secretary delivered keynote remarks at a reception organized by the International Network of Emerging Nuclear Specialists on the margins of the session of the Preparatory Committee.

The Executive Secretary spoke at the "Scientific/Technical Experts' Briefing on Nuclear Weapons Practices and Policies", which was organized by the Global Security Institute and held in Vienna on 7 May.

On 8 May, the Executive Secretary participated in a panel discussion on "Nuclear Nonproliferation and Disarmament: Ideas for Russia", which was organized by the Russian Center for Policy Studies (PIR Center) in Vienna and held at the premises of the Vienna Center for Disarmament and Non-Proliferation.

On 14 June, the Executive Secretary delivered a keynote dinner speech at the Annual NATO Conference on WMD Arms Control, Disarmament and Non-Proliferation, which was hosted by the Hungarian Ministry of Foreign Affairs in Budapest.

The Executive Secretary was a keynote speaker at the Wilton Park conference on "Verification in the 21st Century – technological, political and institutional challenges and opportunities", which was held at the Wilton Park premises from 17 to 20 June.

From 5 to 12 August, the Executive Secretary attended the 67th Peace Ceremony in Nagasaki and Hiroshima, held bilateral meetings with the city mayors, visited the peace museums of both cities and spoke at their universities. In addition, he conducted an official visit to Tokyo and met with high level officials there. These activities and the International Day against Nuclear Tests on 29 August together helped to create a broad media coverage, including mentions in many Japanese and international news outlets.

The Executive Secretary visited The Hague on 3 September to take part in the celebration by the OPCW of the 15th anniversary of the entry into force of the Chemical Weapons Convention and to speak at the Third Summer Programme on Disarmament and Non-Proliferation of Weapons of Mass Destruction in a Changing World, which was held at the T.M.C. Asser Institute.

The Executive Secretary travelled to New York in September to attend the United Nations General Assembly and the sixth Ministerial Meeting on promoting the entry into force of the CTBT.

From 3 to 4 October, the Executive Secretary participated in a workshop entitled "Fifty Years after the Cuban Missile Crisis: Science in Support of Nuclear Arms Control and Security", which was hosted by the Center for International Strategy, Technology and Policy at the Georgia Institute of Technology in cooperation with the American Association for the Advancement of Science.

The Executive Secretary participated in the 127th Assembly of the IPU, which was held in Quebec City, Canada, from 21 to 26 October. There, he conducted bilateral meetings with representatives from Canada, Iraq, Ireland, Myanmar, Sri Lanka, Thailand and Yemen.

The Executive Secretary attended the fifth annual Summit on the Global Agenda. The event was hosted by the World Economic Forum in partnership with the United Arab Emirates and held in Dubai from 12 to 14 November.

The Executive Secretary participated in the Fukushima Ministerial Conference on Nuclear Safety, which took place in Koriyama City, Japan, from 15 to 17 December.

Bilateral Visits

The Executive Secretary conducted high level meetings in Geneva with Kassym-Jomart Tokayev, Director-General of the United Nations Office at Geneva, Keiji Fukuda, Assistant Director-General of WHO, and representatives of the World Economic Forum from 3 to 4 July.

The Executive Secretary delivered the School of Cosmic Physics 2012 Statutory Public Lecture in Trinity College Dublin, Ireland, on 17 September, which was entitled "Global Science for the Benefit of Security and Humankind". During his visit to Dublin, the Executive Secretary also held a bilateral meeting with Joe Costello T.D., Minister of State at the Department of Foreign Affairs and Trade.

Information Visits

The PTS organized three information visits to its offices in Vienna for representatives from selected States Signatories. The main objectives of these visits were to enhance the States' understanding of the Treaty and raise awareness of the activities of the PTS. Delegations were briefed on the political aspects of the CTBT, including entry into force and universalization, the work of the Commission, the verification regime, including operation of the IMS and IDC, and technical support given to States Signatories, as well as the preparatory work for OSIs. Other presentation topics included membership benefits, capacity building and capacity development opportunities, and technical and legal support programmes offered by the PTS.

An information visit to the PTS for a representative from the Congo was conducted from 23 to 24 April. The representative met with the Executive Secretary and was given an overview of the work of the PTS and the CTBT verification technologies.

On 17 July, a high level delegation from China conducted an information visit. PTS staff provided presentations on capacity building. The delegation also attended the Intensive Policy Course.

From 14 to 16 November, the PTS organized an information visit for a group of representatives from Angola, Thailand and Yemen. Participants also had the opportunity to attend the Advanced Science Course.

Promoting the Treaty and the Commission

The PTS traditionally 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.

During 2012, the PTS engaged in the final stages of planning a high level regional conference in the South-East Asia, the Pacific and the Far East region. The objectives of this event will include promoting entry into force and ratifications in the region, as well as 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 will also explore means to promote the application of IMS data and IDC 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.

Fifteenth Anniversary

On 17 February, the Commission held a special event to commemorate the 15th anniversary of the organization. Speakers included the United Nations Secretary-General, Ban Ki-moon, the Swedish Foreign Minister, Carl Bildt, the Austrian State Secretary for European and International Affairs, Wolfgang Waldner, and the Executive Secretary.


CTBTO
PREPARATORY COMMISSION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PUTTING AN END
TO NUCLEAR TEST EXPLOSIONS


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15 YEARS
COMPREHENSIVE
NUCLEAR-TEST-BAN TREATY
ORGANIZATION
MITIGATING NATURAL DISASTERS AND
ENCOURAGING SCIENTIFIC ADVANCEMENT

The Secretary-General paid tribute to the victims of over two thousand nuclear tests conducted worldwide:

"Nuclear tests poison the environment – and they also poison the political climate. They breed mistrust, isolation and fear. So today I issue a challenge to all leaders of all countries that have not endorsed the CTBT: Visit the site of a nuclear test. Speak to the population exposed to the fallout. Then take action to prevent this from ever happening again."

The event received wide coverage in the international print and broadcast media.

A comprehensive exhibition on the Treaty and its verification regime was on display in the Rotunda of the Vienna International Centre throughout the month of February and was viewed by thousands of visitors. A special anniversary issue of the magazine *CTBTO Spectrum* was produced, as well as a commemorative video entitled *A Grand Design Becomes Reality,* featuring staff recollections of the 15 year journey of the organization. The Executive Secretary and the Director of the IDC Division spoke at a side event promoting the entry into force of the Treaty, which was organized by the US Arms Control Association in cooperation with the Vienna Center for Disarmament and Non-Proliferation.

Public Information

Proactive and strategically planned public information activities continue to be an integral part of the outreach efforts of the Commission in verification related fields as well as in the political arena. Landmark events in 2012 included the commemoration of the 15th anniversary with the United Nations Secretary-General in February and the staged reading of the play "Reykjavik" during the week of the Ministerial Meeting in New York in September, both of which were flanked by tailor-made public information campaigns.

The public web site and social media channels of the Commission received on average around 150 000 visits monthly. The web site was updated with 31 highlight articles and 10 press releases. Twelve electronic newsletters were issued. The Commission considerably expanded its presence on YouTube, Facebook, Twitter and Flickr. The Commission 'tweets' reached over one million users in five cases, as a result of re-tweeting by the United Nations, with the Hiroshima commemoration having the highest number.

The revamped version of the public web site, which was launched in May, takes into account the increased importance of social media and audiovisual information

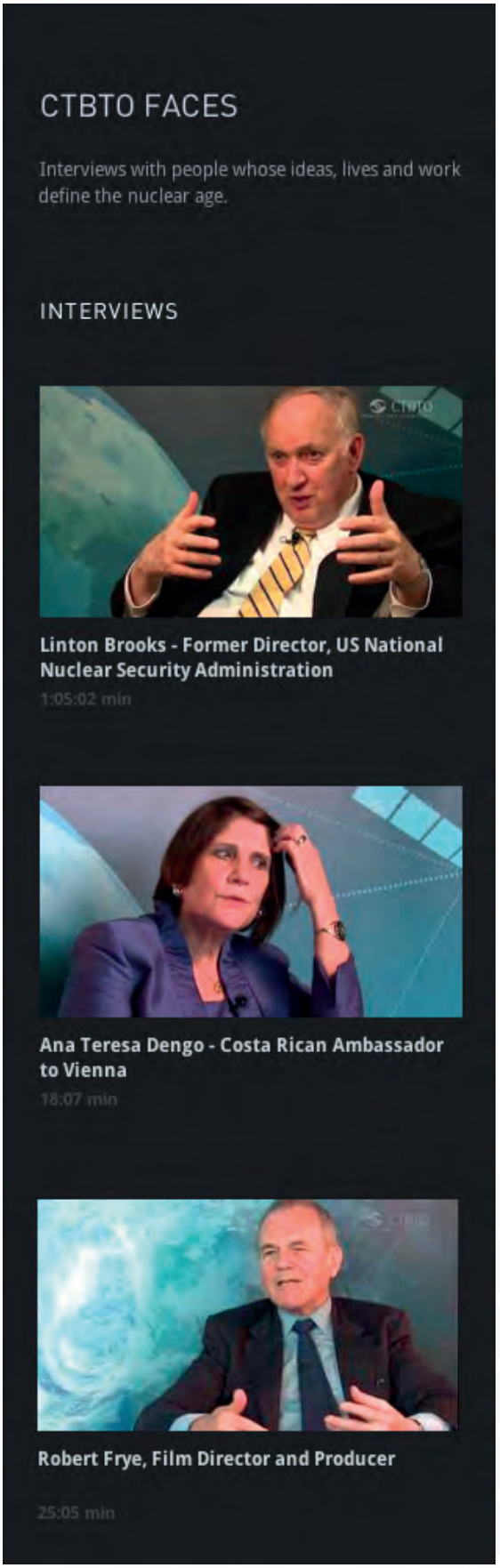
by embedding relevant functions. It is also compatible with mobile computing devices.

On the YouTube channel, the videos attracted more than 85 000 visits, a fourfold increase over 2011. Social media guidelines were launched, encouraging the staff of the Commission to promote the activities of the organization in a more coherent manner. The "CTBTO Faces" series was launched, comprising in-depth interviews with people whose ideas, lives and work define the nuclear age. With 21 interviews to date, the series has quickly become a reference library of opinions on nuclear non-proliferation, disarmament and verification issues. Two videos featuring OSI BUEs were produced.

The biannual publication *CTBTO Spectrum* included contributions from the Prime Minister of the Cook Islands and the foreign ministers of Chile, Finland, Indonesia, the Netherlands, Turkey and the United Kingdom as well as a former foreign minister of Japan and the heads of WHO and the Intergovernmental Oceanographic Commission of UNESCO. The new *CTBTO Spectrum* app for the iPad includes current and previous issues, together with interactive slide shows and Treaty signature and ratification maps. Brochures on the verification regime and on civil and scientific uses of the verification technologies for Africa and the Latin America and the Caribbean region were issued in official languages of the United Nations. A brochure on the ASEAN States was issued in Thai.

Promotion and outreach work for the S&T2013 conference commenced and included targeted outreach work at scientific conferences as well as the creation of a dedicated web site area, a brochure, a poster and a postcard.

Around fifty thousand visitors to the Vienna International Centre toured the permanent CTBTO exhibition, to which three new display walls were added. Permanent displays at the United Nations in New York and Geneva reached even more visitors. Over one thousand visitors to the Vienna International Centre received individual presentations. A service agreement was concluded with the United Nations Information Service in Vienna to



facilitate cooperation in promotion and outreach with regard to guided tours and lectures.

Global Media Coverage

Global media coverage of the Treaty and its verification regime remained high, with over 2700 articles and citations in online media alone.

In February, the 15th anniversary event organized by the Commission, at which the United Nations Secretary-General made a statement, received global media coverage, including in the remaining Annex 2 States.

Media coverage relating to the Treaty remained high in the USA, with numerous opinion pieces appearing, especially around the times of the publication of the report of the National Research Council in March and the presidential election in November. In October, the *Chicago Tribune* published an op-ed by the Executive Secretary, entitled "A nuclear world: 50 years after Cuban missile crisis; the world waits to move back the hands on doomsday clock", reaching over half a million readers through hard copy alone. Similarly, in Asia there was a notable increase of interest throughout the year.

A CTBT related capacity building workshop for journalists and civil society was conducted in January in Cairo. An increase in media coverage in the region was observed in connection with the International Day against Nuclear Tests in August. Also, analysts pointed out the importance of adherence to the Treaty as a catalyst for progress towards a Middle East free of weapons of mass destruction.

Television feature stories about IMS stations PS9 and IS18 and two news packages, produced by the Commission, were distributed via United Nations TV and broadcast in several languages by stations globally. An interview with Mikhail Gorbachev produced by the Commission for the staging of "Reykjavik" was picked up and distributed worldwide.

National Implementation Measures

In 2012, the PTS continued to promote the exchange of information between States Signatories on the subject of national implementation measures. Following a format similar to that of the 2011 pilot workshop, a legislation workshop was run during the Intensive Policy Course. The workshop was held so that participants could exchange their experiences in the adoption of national implementation measures for the CTBT. To facilitate this exchange and the identification of elements for inclusion in implementing legislation, participants completed in advance a legislation questionnaire and discussed it during the meeting. Bilateral meetings with States Signatories were also held during 2012 to discuss draft legislation submitted to the PTS with a request for legal assistance. Presentations on implementing CTBT legislation were routinely delivered during the year at workshops, seminars and other events.

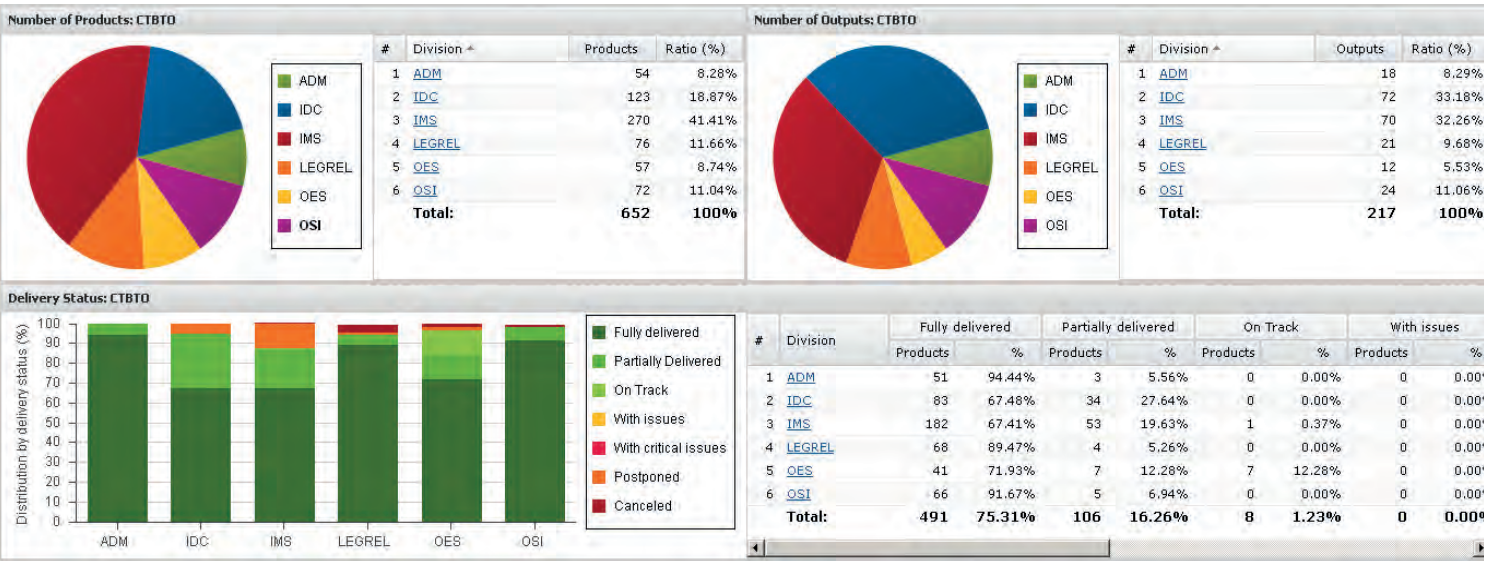
Management

Highlights in 2012

Increase in collection rates of the assessed contributions and in the number of States that paid their 2012 assessed contributions in full

Further increase in numbers of female staff in the Professional category and in senior management positions

Further progress in implementation of an Enterprise Resource Planning (ERP) system compliant with International Public Sector Accounting Standards (IPSAS)



Number of Products: CTBTO

#	Division	Products	Ratio (%)
1	ADM	54	8.28%
2	IDC	123	18.87%
3	IMS	270	41.41%
4	LEGREL	76	11.66%
5	OES	57	8.74%
6	OSI	72	11.04%
	Total:	**652**	**100%**

Number of Outputs: CTBTO

#	Division	Outputs	Ratio (%)
1	ADM	18	8.29%
2	IDC	72	33.18%
3	IMS	70	32.26%
4	LEGREL	21	9.68%
5	OES	12	5.53%
6	OSI	24	11.06%
	Total:	**217**	**100%**

Delivery Status: CTBTO

#	Division	Fully delivered		Partially delivered		On Track		With issues	
		Products	%	Products	%	Products	%	Products	%
1	ADM	51	94.44%	3	5.56%	0	0.00%	0	0.00
2	IDC	83	67.48%	34	27.64%	0	0.00%	0	0.00
3	IMS	182	67.41%	53	19.63%	1	0.37%	0	0.00
4	LEGREL	68	89.47%	4	5.26%	0	0.00%	0	0.00
5	OES	41	71.93%	7	12.28%	7	12.28%	0	0.00
6	OSI	66	91.67%	5	6.94%	0	0.00%	0	0.00
	Total:	**491**	**75.31%**	**106**	**16.26%**	**8**	**1.23%**	**0**	**0.00**

Screenshot of data compiled in the Programme and Product Management System.

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

Internal Audit is an independent and objective internal oversight mechanism. It helps the organization accomplish its objectives through a systematic approach to assessing and improving the effectiveness of risk management, control and governance processes.

In order to promote the independence and objectivity of the function, Internal Audit reports directly to the Executive Secretary and has direct access to the Chairpersons of the Advisory Group and Working Group A. The Chief of Internal Audit independently also submits an annual activity report for consideration by the Commission and its subsidiary bodies. In addition to the approved work plan, the Chief of Internal Audit may institute special audits or investigations warranted by particular circumstances.

In 2012, six audits were undertaken. These resulted in identification of areas for improving efficiency, effectiveness and internal controls, and of compliance with rules and procedures.

In line with the International Standards for the Professional Practice of Internal Auditing, Internal Audit also performs management support activities, such as risk management, resource and product planning, and maximizing synergies.

Networking with internal audit services of United Nations organizations is conducted regularly to exchange good practices and lessons learned. Internal Audit is also the focal point of the Commission for activities related to the Joint Inspection Unit of the United Nations.

Finance

2012 Programme and Budget

The 2012 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 2012 amounted to $44 556 400 and €59 765 200. At the budget exchange rate of 0.796 euro to 1 US dollar, the total US dollar equivalent of the 2012 Budget was $119 639 700, representing a nominal growth of 1.9% but almost constant in real terms (a decrease of $109 300 or 0.1%).

On the basis of the actual average exchange rate in 2012 of 0.7758 euro to 1 US dollar, the final total US dollar equivalent of the 2012 Budget was $120 541 499 (Table 4). Of the total Budget, 78.8% originally was allocated to verification related activities, including an allocation of $18 521 619 to the Capital Investment Fund (CIF), established for the build-up of the IMS.

Table 4. Distribution of 2012 Budget

Area of Activity	U$$ (millions)[a]
International Monitoring System	38.6
International Data Centre	44.4
On-Site Inspection	10.6
Evaluation and Audit	2.1
Policy Making Organ Support	4.8
Administration, Coordination and Support	15.8
Legal and External Relations	4.2
Total	**120.5**

[a] An average exchange rate of 0.7758 euro to 1 US dollar was used to convert the euro component of the 2012 Budget.

Assessed Contributions

As of 31 December 2012, the collection rates of the assessed contributions for 2012 amounted to 92.7% of the US dollar portion and 93.3% of the euro portion. In comparison, the 2011 collection rates as of 31 December 2011 were 97.0% and 82.1% respectively. The combined collection rate for the US dollar and euro portions in 2012 was 93.0%, compared with 88.8% in 2011.

The number of States that had paid their 2012 assessed contributions in full as of 31 December

2012 was 100, higher than 91 in 2011. Regarding 2011 assessed contributions, the collection rate as of 31 December 2012 amounted to 98.8%.

Expenditure

The expenditure for the Programme and Budget in 2012 amounted to $142 302 329, of which $44 717 785 was from the CIF. For the General Fund, the unused budget amounted to $4 435 338. For the CIF, approximately 69.8% of the allotment was executed by the end of 2012.

Procurement

In 2012, the PTS obligated approximately $81.5 million through 838 procurement actions for high value purchases and $1.4 million through 949 contractual instruments for small value purchases. At the end of the year, there were 63 open requisitions for future obligation in the procurement pipeline with a total value of approximately $5.9 million: $4.1 million for the CIF and $1.8 million for the General Fund.

As of 31 December 2012, 132 IMS stations, 10 radionuclide laboratories and the testing of 28 noble gas systems were under contract for testing and evaluation or for PCAs.

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 2012, the PTS had 264 staff members from 79 countries, compared with 252 staff members from 77 countries at the end of 2011. The chart below 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 2012, there were 56 women in Professional positions, corresponding to 31.82% of the Professional staff. For the first time in the history of the PTS, there was an increase of 100% (to 40%) in female representation at the Director level (D1) in 2012. In comparison with 2011, there were increases of 14.29%, 6.25% and 57.14% in the numbers of female staff members at the P5, P4 and P2 levels respectively. The representation of women decreased by 5.26% at the P3 level.

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 2012 which were tailored for the benefit of the PTS in carrying out its work programmes and to enhance job performance and career development.

In general, throughout 2012 the PTS continued to focus on smart planning, to streamline

Staff Members in the Professional Category by Geographical Region as of 31 December 2012
(Percentages as of 31 December 2011 are shown in brackets.)

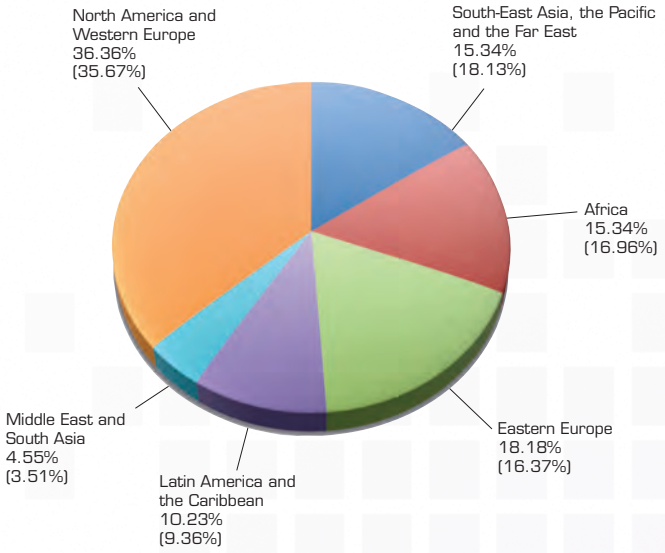


Table 5. Regular Staff Members by Field of Work (31 December 2012)

Field of Work	Professional	General Service	Total
Evaluation Section	4	1	5
International Monitoring System Division	37	22	59
International Data Centre Division	68	14	82
On-Site Inspection Division	20	6	26
Total, verification related	***129 (73.30%)***	***43 (48.86%)***	***172 (65.15%)***
Office of the Executive Secretary	3	3	6
Internal Audit	3	0	3
Division of Administration	22	26	48
Legal and External Relations Division	19	16	35
Total, non-verification-related	***47 (26.70%)***	***45 (51.14%)***	***92 (34.85%)***
Total	**176**	**88**	**264**

its activities and to increase synergies and efficiencies. It also accorded priority to results based management.

Implementation of an IPSAS-Compliant Enterprise Resource Planning System

The implementation of an IPSAS-compliant ERP system continued in line with the approach approved by the Commission at its Thirty-Fifth Session in November 2010. To this end, the Commission successfully concluded a memorandum of understanding in February 2012 and a service support agreement in July with the World Food Programme (WFP).

Following the signing of the agreement, the Commission was given access to a cloned version of the WFP Information Network and Global System (WINGS II). A series of workshops were held with WFP experts and PTS process owners to familiarize the Commission staff with the functionalities of the system. Throughout the year, the ERP team strived to ensure that deliverables were provided within the envisaged budget and schedule.

The project entered the business blueprint phase. Deliverables included high level gap analyses, detailed gap analyses and a comparison of processes at the PTS and WFP with the objective of preparing future PTS processes. The work also involved reviews of IPSAS in order to prepare accounting policies and opening balances compliant with IPSAS.

After a thorough review of the Financial Regulations and Rules of the Commission in relation to the requirements of IPSAS-compliant ERP, a set of changes to the Financial Regulations and Rules was presented to and adopted by the Commission at its Thirty-Ninth Session in October.

The PTS also presented to the Commission and Working Group A some areas of possible change to the Staff Regulations and Rules.

The road map, project plan and implementation strategy for the human resources functionality were finalized and a preliminary training plan was designed. These were supplemented by a data cleansing and migration strategy and preparation of a draft blueprint for finance, procurement and travel processes.

Sixth Ministerial Meeting on Promoting the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty

In the years between the Article XIV conferences that are held to facilitate the entry into force of the Treaty, foreign ministers of CTBT States Signatories are invited to meet on the margins of the United Nations General Assembly in New York in September. The aim of these meetings is to sustain and generate further political momentum as well as public support for entry into force. To that end, the ministers adopt and sign a Joint Ministerial Statement that is open for adherence by other countries. The initiative for these meetings was taken by Japan in cooperation with Australia and the Netherlands, which organized the first "Friends of the CTBT" Foreign Ministers' Meeting on the margins of the General Assembly in New York in 2002. They have since continued to be held biennially.

United Nations Headquarters, New York, venue of the sixth Ministerial Meeting in September 2012.

Conditions for Entry into Force

The entry into force of the CTBT is conditioned on its ratification by all 44 States listed in its Annex 2. The Annex 2 States are States that formally participated in the final stage of the negotiation of the Treaty in the Conference on Disarmament in 1996 and possessed nuclear power reactors or nuclear research reactors at that time. As of 31 December 2012, 36 of these 44 States had ratified the Treaty. Of the Annex 2 States that had still to ratify the Treaty, three had not yet signed it.

New York, 2012

On 27 September 2012, the sixth Ministerial Meeting on the entry into force of the CTBT was held at the United Nations Headquarters in New York. Jointly hosted by the foreign ministers of Australia, Canada, Finland, Japan, Mexico, the Netherlands and Sweden, the event served to demonstrate the reinvigorated political determination of the international community to achieve the Treaty's entry into force and its universality.

The United Nations Secretary-General, Ban Ki-moon, echoed the sentiments of the meeting, telling States that have not yet signed or ratified that "you are failing to live up to your responsibility as a member of the international community". The Joint Ministerial Statement was supported by the 101 States Signatories in attendance on 27 September, highlighting the scale of international support behind the Treaty.

As a side event, the PTS organized, in close cooperation with the theatre community,

On the podium at the sixth Ministerial Meeting (*from left to right*): Uri Rosenthal (Minister of Foreign Affairs of the Netherlands), Carl Bildt (Minister for Foreign Affairs of Sweden), Koichiro Gemba (Minister for Foreign Affairs of Japan), Ban Ki-moon (United Nations Secretary-General), John Baird (Minister of Foreign Affairs of Canada), Erkki Tuomioja (Minister for Foreign Affairs of Finland) and Tibor Tóth (Executive Secretary of the CTBTO Preparatory Commission). *Middle*: Tibor Tóth, Executive Secretary of the CTBTO Preparatory Commission, speaking at the sixth Ministerial Meeting. *Bottom:* Delegates at the sixth Ministerial Meeting.

a staged reading of the play "Reykjavik" by the Pulitzer Prize winning author, Richard Rhodes, based on the famous meeting in 1986 of Soviet General Secretary Mikhail Gorbachev and US President Ronald Reagan. The reading was followed by a panel discussion with the participation of Max Kampelman, Roald Sagdeev and Morton Halperin, as well as the playwright himself. The event was attended by a diverse and influential audience of around two hundred people and accompanied by a multifaceted public information campaign reaching tens of thousands more. The initiative was financed through voluntary contributions from the Governments of Australia, Japan, Kazakhstan, Mexico and Sweden, as well as the Ploughshares Fund.

Around one hundred identified news sources reported on the Ministerial Meeting and on the play; the latter featured also in the *New York Times*.

Panel discussion following the staged reading of "Reykjavik". *From left to right:* Philip Taubman (panel moderator, standing), Max Kampelman, Richard Rhodes (the author of the play), Roald Sagdeev and Morton Halperin.

Signature and Ratification

STATES WHOSE RATIFICATION IS REQUIRED FOR THE TREATY TO ENTER INTO FORCE (31 DECEMBER 2012)

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	6 Feb. 2012
Iran (Islamic Republic of)	24 Sep. 1996	

State	Date of Signature	Date of Ratification
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

36 Ratified **41** Signed **3** Not signed **8** Not ratified

STATUS OF SIGNATURE AND RATIFICATION OF THE TREATY (31 DECEMBER 2012)

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	
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

State	Date of Signature	Date of Ratification
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	14 Jun. 2011
Greece	24 Sep. 1996	21 Apr. 1999
Grenada	10 Oct. 1996	19 Aug. 1998
Guatemala	20 Sep. 1999	12 Jan. 2012
Guinea	3 Oct. 1996	20 Sep. 2011
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	6 Feb. 2012
Iran (Islamic Republic of)	24 Sep. 1996	
Iraq	19 Aug. 2008	
Ireland	24 Sep. 1996	15 Jul. 1999
Israel	25 Sep. 1996	

157 Ratified **183** Signed **13** Not signed **39** Not ratified

State	Date of Signature	Date of Ratification
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
Libya	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
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

State	Date of Signature	Date of Ratification
Nigeria	8 Sep. 2000	27 Sep. 2001
Niue	9 Apr. 2012	
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
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
South Sudan[a]		
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	

State	Date of Signature	Date of Ratification
Sweden	24 Sep. 1996	2 Dec. 1998
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	

[a]Annex 1 to the Treaty provides the list of States at the time of its conclusion. South Sudan has since been recognized by the United Nations as an independent State.

STATUS OF SIGNATURE AND RATIFICATION OF THE TREATY BY GEOGRAPHICAL REGION (31 DECEMBER 2012)

Africa (54 States)

51 Signatories
40 Ratifiers

Middle East and South Asia (26 States)

21 Signatories
15 Ratifiers

Eastern Europe (23 States)

23 Signatories
23 Ratifiers

North America and Western Europe (28 States)

28 Signatories
27 Ratifiers

Latin America and the Caribbean (33 States)

31 Signatories
31 Ratifiers

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

29 Signatories
21 Ratifiers