CTBTO
PREPARATORY COMMISSION

ANNUAL REPORT 2017

United for the Cause

THE TREATY

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) is an international treaty that outlaws all nuclear explosions. By totally banning nuclear testing, the Treaty seeks to constrain the qualitative improvement of nuclear weapons and to end the development of new types of nuclear weapons. 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. The Treaty will enter into force 180 days after it has been ratified by all 44 States listed in its Annex 2.

When the Treaty enters into force, the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) will 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.

THE 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.

The Commission, which is located at the Vienna International Centre, has two main activities. The first is to make all necessary preparations to ensure that the Treaty verification regime can be brought into operation at entry into force. The second is the promotion of signature and ratification of the Treaty in order to achieve entry into force.

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

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United for the Cause

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Austria

Throughout the document, countries are referred to by the names that were in official use in the period for which the text was compiled.

The boundaries and presentation of material on maps contained in this document do not imply the expression of any opinion on the part of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization concerning the legal status of any country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries.

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The maps on pages 11–13 and page 15 show 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

Our activities in 2017 were guided by several important objectives. These involved strengthening the momentum in support of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) and its entry into force, increasing high level engagement with States and promoting the engagement of youth and women in the outreach activities of the organization. Activities also included enhancing the capabilities of our verification system through sustainment and build-up of the International Monitoring System (IMS). Furthering the development of a robust on-site inspection regime was another priority area.

The Treaty and the work of the organization continued to be in the international spotlight. Many world leaders, State officials and civil society representatives acknowledged the significance of the CTBT for international peace and security. They also called on the remaining Annex 2 States, whose ratifications are required for entry into force, to join the ranks of ratifiers. This call became especially urgent in the aftermath of the sixth nuclear test by the Democratic People's Republic of Korea on 3 September 2017 and during the Article XIV Ministerial Meeting held on 20 September 2017.

Taking place on the margins of the United Nations General Assembly in New York, the tenth Article XIV conference offered an opportunity for States to renew their commitment to the CTBT as a core element of the nuclear disarmament and non-proliferation regime.

Mr Didier Reynders, Deputy Prime Minister and Minister of Foreign Affairs of Belgium, and Mr Ibrahim Al-Eshaiker Al-Jaafari, Minister of Foreign Affairs of Iraq, presided over the conference. Many States participated in the conference at the level of deputy prime minister, minister and other senior officials. The United Nations Secretary-General, Mr António Guterres, and the President of the United Nations General Assembly, Mr Miroslav Lajčák, addressed the opening session. The High Representative of the European Union for Foreign Affairs and Security Policy, Ms Federica Mogherini, also delivered a statement on behalf of the European Union.

Some members of the Group of Eminent Persons attended the conference. Mr Kevin Rudd, former Prime Minister of Australia, and Ms Amina Mohamed, Cabinet Secretary for Foreign Affairs and International Trade of Kenya, presented a statement on behalf of the group.

The 72nd session of the United Nations General Assembly as well as the high level United Nations Security Council meeting on 21 September 2017 were other occasions for States to pledge their support for the Treaty and its verification regime.

In 2017, I met with a number of Heads of State and Government, foreign ministers and other high ranking State officials, including from Angola, Australia, Austria, Belarus, Belgium, Burkina Faso, China, Cuba, Ecuador, Finland, France, Germany, the Islamic Republic of Iran, Japan, Kazakhstan, Lebanon, Namibia, Nepal, the Netherlands, the Republic of Korea, Romania, the Russian Federation, Senegal, Slovakia, Slovenia, South Sudan, Sweden, Thailand, Tunisia, the United States of America and Uruguay, and the High Representative of the European Union for Foreign Affairs and Security Policy.

On 3 September 2017, our verification system detected an unusual seismic event in the Democratic People's Republic of Korea. This was followed by an announcement by the Democratic People's Republic of Korea that it had conducted yet another nuclear test.

We held technical briefings on 3 and 4 September 2017 and shared the data and products of our verification regime. The IMS and the International Data Centre (IDC) performed in a holistic manner, proving their robust capabilities in detecting nuclear tests.

The international community was unequivocal in its response to the announced nuclear test. It strongly condemned the test and expressed grave concern over the serious implications of such an act for international peace and security. Steadfast support was expressed for entry into force of the Treaty. The timely and effective performance of the verification regime of the Treaty was appreciated, and requests were made for further advancement and completion of the verification regime.

The sixth CTBT: Science and Technology conference took place on 26-30 June 2017 in Vienna. Around one thousand scientists, experts, researchers, technologists and diplomats from over 110 countries attended the conference and engaged in an exchange of knowledge and ideas across CTBT related scientific disciplines. With some 650 abstracts, 400 posters and more than 100 oral presentations, it was the largest of our series of Science and Technology conferences. The conference also served as a platform to review the status of the verification regime and to reflect on how to ensure its continued scientific and technical viability.

In recognition of our collective achievements, I was bestowed with two awards in 2017: a presidential medal on the occasion of the 25th anniversary of the Republic of Kazakhstan and special honorary citizenship of the City of Hiroshima. I share these distinctions with the States Signatories and the staff of the organization and thank them for their unwavering support.

The variety and coverage of the capacity development programme of the organization continued to expand. Many experts, mainly from developing countries, benefitted from our educational programmes, workshops and training courses on efficient use of the data and products of the verification system.

I am pleased to note the progress accomplished in the development of the verification regime. Several important new IMS stations were installed or certified. The last remaining hydroacoustic station (HA4, Crozet Islands, France) was certified, marking a major milestone on the way to completion of the verification system. Four stations in China, consisting of two primary seismic stations and two radionuclide stations, were certified. We also proceeded with the installation and certification of an infrasound station and the certification of a radionuclide station in the Galápagos Islands (Ecuador); the installation and certification of a radionuclide station in the Russian Federation; the certification of two laboratories for noble gas analysis capability; and the installation of two infrasound stations, in China and in Thailand.

By the end of the year, the total number of certified IMS facilities reached 294, improving both the coverage and the resilience of the network. This figure represents 87% of the network foreseen by the Treaty.

The contract for the third generation of the Global Communications Infrastructure (GCI III), which is one of the largest projects of the organization, was concluded and its migration phase started.

OSI related activities during 2017 covered implementation of the OSI action plan for 2016-2019 and the OSI exercise plan for 2016-2020, drawn from the review and evaluation process of the 2014 Integrated Field Exercise. The groundwork for the construction of the permanent Equipment Storage and Maintenance Facility was also completed.

Throughout the year, we sought to enhance synergy and further organizational development. In this respect, additional steps were taken to apply best practices and streamline the existing processes and procedures. We also improved our human resources management to ensure that our human resources structure is more flexible and closely aligned with the strategic and programmatic needs of the organization.

I invite you to review the following report that provides detailed information on the main activities of the Commission throughout 2017. I am grateful for the continuous support of States Signatories, which has helped us to serve our mandate and contribute to the international campaign in nuclear non-proliferation and disarmament.

Lassina Zerbo
Executive Secretary
CTBTO Preparatory Commission
Vienna, April 2018

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ABBREVIATIONS

3-C	three component
ARISE	Atmospheric dynamics Research InfraStructure in Europe
ARR	Automatic Radionuclide Report
ATM	atmospheric transport modelling
BIPM	International Bureau of Weights and Measures
BOO	base of operations
BUE	build-up exercise
CCAUV	Consultative Committee for Acoustics, Ultrasound and Vibration
CTBT	Comprehensive Nuclear-Test-Ban Treaty
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organization
ECS	Experts Communication System
ESMF	Equipment Storage and Maintenance Facility
EU	European Union
FTF	field team functionality
GCI	Global Communications Infrastructure
GIMO	Geospatial Information Management for OSI
IAEA	International Atomic Energy Agency
IDC	International Data Centre
IFE	Integrated Field Exercise
IMS	International Monitoring System
ITF	inspection team functionality
MPLS	multiprotocol label switching
MSIR	multispectral including infrared
NPE	NDC Preparedness Exercise
NDC	National Data Centre
NEO	near-earth object
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
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
PRTool	performance reporting tool
PTE	proficiency test exercise
PTS	Provisional Technical Secretariat
QA/QC	quality assurance and quality control
QMPM	Quality Management and Performance Monitoring (Section)
QMS	Quality Management System
REB	Reviewed Event Bulletin
RRR	Reviewed Radionuclide Report
SAMS	seismic aftershock monitoring system
SAUNA	Swedish Automatic Unit for Noble Gas Acquisition
SEL	Standard Event List
SHI	seismic, hydroacoustic and infrasound
SnT2017	CTBT: Science and Technology 2017 conference
SOP	standard operating procedure
SSI	standard station interface
UNE	underground nuclear explosion
UNIDO	United Nations Industrial Development Organization
UNODC	United Nations Office on Drugs and Crime
VIC	Vienna International Centre
VPN	virtual private network
VSAT	very small aperture terminal
WGA	Working Group A
WGB	Working Group B
WMO	World Meteorological Organization
WIN	work instruction

THE INTERNATIONAL MONITORING SYSTEM

HIGHLIGHTS IN 2017

Significant progress in the build-up of the IMS with 87% of its facilities certified

Completion of the hydroacoustic network and certification of several IMS stations, including four stations in China and two in Ecuador

Sustainment of the IMS network to ensure a high level of data availability

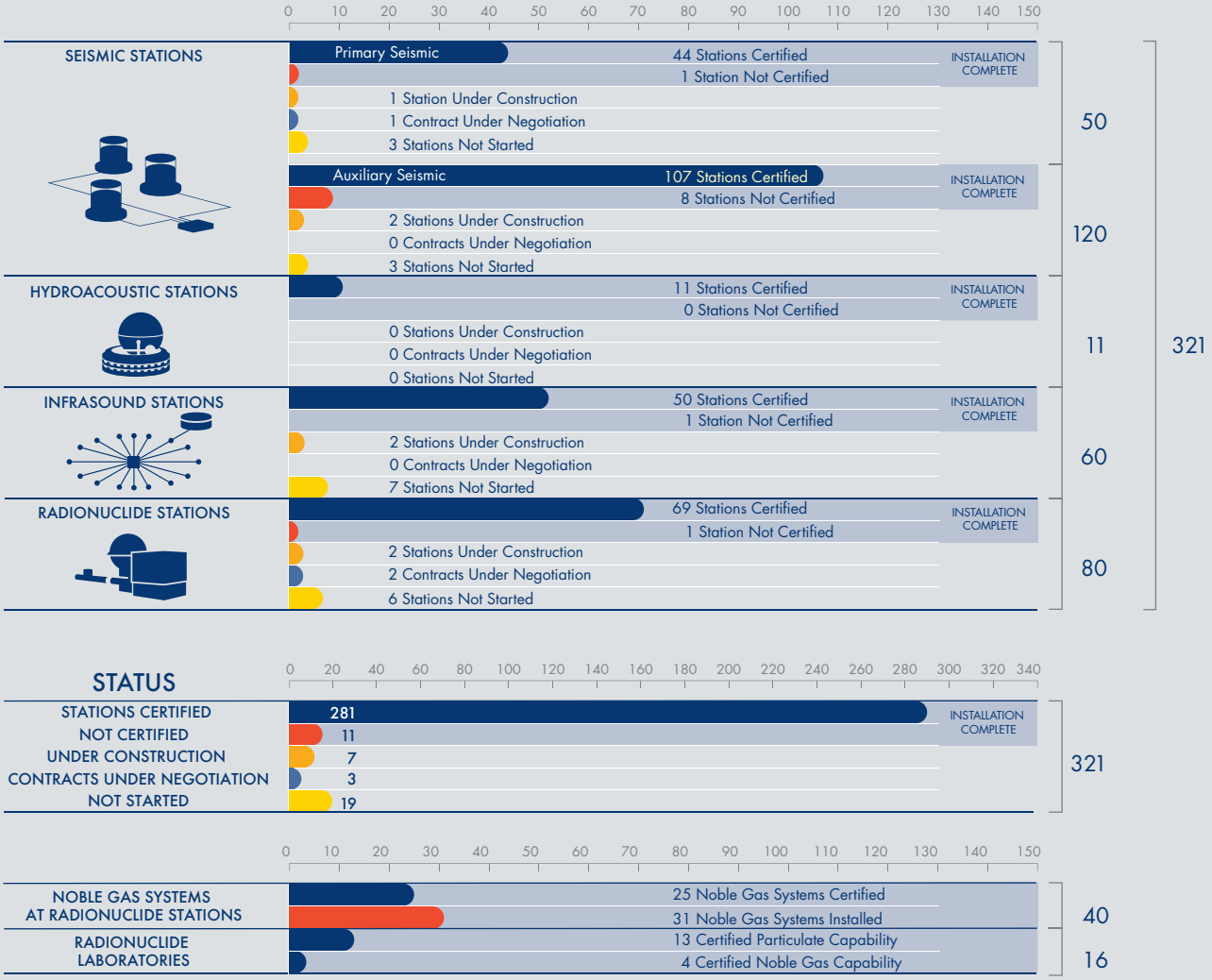
Installation of infrasound station IS3 (Antarctica).

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

The IMS uses seismic, hydroacoustic and infrasound ('waveform') monitoring technologies to detect and locate energy released by an explosion – whether nuclear or non-nuclear – or a natural event that takes place underground, underwater or in the atmosphere.

The IMS uses radionuclide monitoring technologies to collect particles and noble gases from the atmosphere. The acquired samples are analysed for evidence of physical products (radionuclides) that are created by a nuclear explosion and carried through the atmosphere. This analysis can confirm whether an event recorded by the other monitoring technologies was actually a nuclear explosion.

IMS INSTALLATIONS AND CERTIFICATIONS AS OF 31 DECEMBER 2017



COMPLETING THE INTERNATIONAL MONITORING SYSTEM

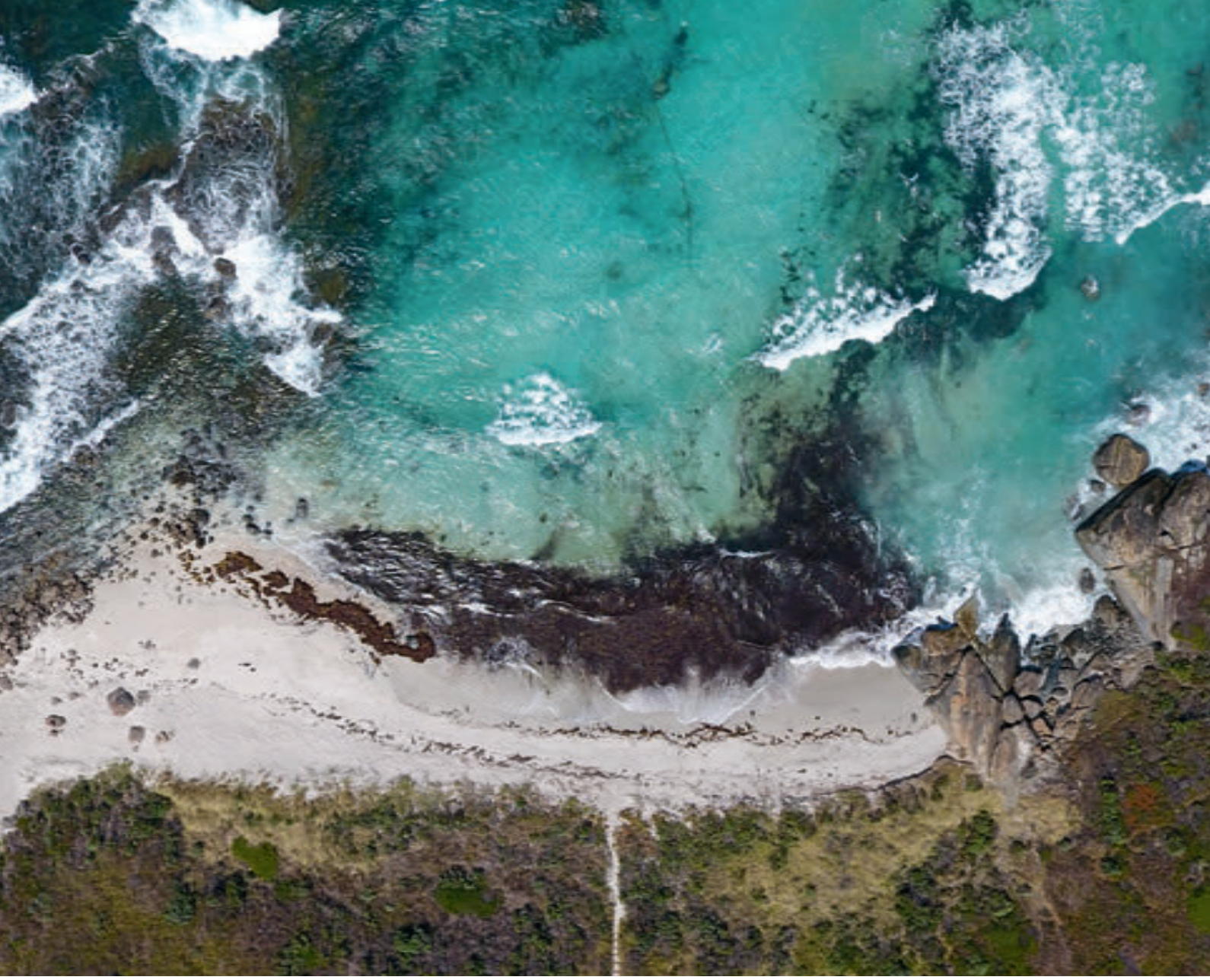
Establishment of a station is a general term referring to the building of a station, from its initial stages until its completion. *Installation* typically refers to all work performed until the station is ready to send data to the International Data Centre (IDC) in Vienna. This includes, for instance, 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. At this point the station is considered an operational facility of the IMS.

In 2017, following outreach to host States, the Commission made significant progress in the establishment of facilities in a number of States. Eight IMS stations were certified, as well as two radionuclide laboratories for noble gas analysis capability. The total number of certified IMS stations and laboratories thus reached 294 (87% of the network foreseen by the Treaty), improving both the coverage and the resilience of the network.

The build-up of the IMS during 2017 consisted of the certification of four stations in China. These included primary seismic stations PS12 in Hailar and PS13 in Lanzhou, as well as radionuclide stations RN20 in Beijing and RN22 in Guangzhou.

The Commission also concluded the installation and certification of infrasound station IS20 and the certification of radionuclide station RN24 (Galápagos Islands, Ecuador), the installation and certification of radionuclide station RN57 (Russian Federation), the certification of two radionuclide laboratories for noble gas analysis capability (RL15 in the United Kingdom and RL8 in France), the installation of infrasound station IS16 (China), and the installation of radionuclide station RN65 (Thailand).

In addition, hydroacoustic station HA4 (Crozet Islands, France) was certified in June 2017, marking the completion of the hydroacoustic component of the IMS network.



Shore landing area of hydroacoustic station HA1 (Australia).

Monitoring of radionuclide noble gases plays an essential role in the verification system of the Treaty, as was demonstrated following the announced nuclear tests by the Democratic People's Republic of Korea in 2006 and 2013. It also proved to be invaluable following the nuclear accident at Fukushima, Japan, in 2011. In line with its priorities, the Commission continued to focus on the noble gas monitoring programme in 2017 through close cooperation with the developers of next-generation noble gas systems.

By the end of the year, 31 noble gas systems were installed (78% of the planned total of 40) at IMS radionuclide stations. Of these, 25 systems were certified as meeting the stringent technical requirements.

The Commission continued to assess the quality of the laboratory analysis of noble gas data through yearly informal proficiency test exercises (PTEs). The IMS laboratories demonstrated very good performance in 2017. The noble gas proficiency test framework is reaching enough maturity to be considered to become official within the next few years, around the time when more IMS laboratories will be certified for noble gas analysis capability. PTEs are a key element of quality assurance and control (QA/QC) of IMS laboratories.

All of these advancements contribute to the prospect of the completion of the IMS network.

AGREEMENTS FOR MONITORING FACILITIES

The Commission has the mandate to establish procedures and a formal basis for the provisional operation of the IMS before the Treaty enters into force. This includes concluding agreements or arrangements with States that host IMS facilities to regulate activities such as site surveys, installation or upgrading work, certification and post-certification activities (PCAs).

In order to efficiently and effectively establish and sustain the IMS, the Commission needs to fully benefit from the immunities to which it is entitled as an international organization, including exemption from taxes and duties. 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 or explicitly list the privileges and immunities of the Commission. This may require a State that hosts one or more IMS facilities to adopt national measures to bring these privileges and immunities into effect.

In 2017, the Commission continued to address the importance of concluding facility agreements and arrangements and their subsequent national implementation. The absence of such legal mechanisms in some cases results in substantial costs (including in human resources) and major delays in sustaining certified IMS facilities. These costs and delays adversely affect the availability of data from the verification system.

Of the 89 States that host IMS facilities, 49 have signed a facility agreement or arrangement with the Commission, and 41 of these agreements and arrangements are in force. States are showing increased interest in this subject, and it is hoped that ongoing negotiations will be concluded in the near future and that negotiations with other States may be initiated soon.

POST-CERTIFICATION ACTIVITIES

Following the certification of a station and its incorporation into the IMS, its operation focuses on the 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 expenditure of the Commission related to PCAs in 2017 was US$21 151 673. This amount covers the costs related to PCAs for 171 facilities and noble gas systems.

Each station operator submits a monthly report on PCA performance, which the Provisional Technical

Cable inspection of hydroacoustic station HA1 (Australia). Opposite page, from top: certification of radionuclide station RN22 (China), certification of radionuclide station RN24 (Galápagos Islands, Ecuador), certification of radionuclide laboratory RL8 (France) for noble gas capability.


RN22 Certification Visit Summary


CTBTO
RN24
SERVICIO HIDROGRAFICO Y OCEANOGRAFICO
INSULAR DE LA ARMADA
ACTIVIDADES DEL SHOIAR


SORTIE

Lanzhou, China, location of primary seismic station PS13.

Secretariat (PTS) reviews for compliance with operation and maintenance (O&M) plans. The Commission has developed standardized criteria for the review and evaluation of the performance of station operators.

The Commission continued to standardize the services provided under PCA contracts. It requested operators of all newly certified stations and of existing stations that submitted new budget proposals to develop O&M plans in accordance with a standard template. By the end of 2017, the total number of O&M plans submitted in the standard format was 121 out of 160 stations under PCA contracts.

SUSTAINING PERFORMANCE

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

The life cycle of the IMS network proceeds from conceptual design and installation to operation, sustainment, disposal and rebuild. Sustainment covers maintenance through necessary preventive maintenance, repairs, replacement, upgrades 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, as IMS facilities reach the end of their designed life cycle, there is the need to plan, manage and optimize the recapitalization (i.e. replacement) of all components of each facility in order to minimize downtime and optimize resources.

The support activities for IMS facilities in 2017 continued to focus on preventing interruptions to the flow of data. They also aimed at preventive and corrective maintenance and recapitalization of IMS stations and station components as they reach the end of their life cycle. The Commission continued its efforts to develop and implement engineering solutions to improve the robustness and resilience of IMS facilities.

Optimizing and enhancing performance also involves the continuous improvement of data quality, reliability and resilience. Hence the Commission continued to emphasize QA/QC, state of health monitoring, IMS facility calibration activities (which are essential for the reliable interpretation of detected signals) and improvement of IMS technologies. These activities contribute to maintaining a credible and technologically relevant monitoring system.

LOGISTICS

The Commission further developed its capability for logistic support analysis in order to strive for the highest possible levels of data availability at

optimal cost. With over 290 certified IMS facilities around the world, often in remote sites, maintaining the highest levels of data availability requires continuous analysis, refinement and validation of IMS station life cycle costs and reliability variables. During 2017, the Commission continued its efforts to refine and validate models, with the aim of improving planning for the sustainment of the IMS network.

Effective configuration management strengthens overall confidence that IMS monitoring facilities meet IMS technical specifications and other requirements for certification. It ensures that changes at stations are rigorously assessed to determine their effect and, when the changes are implemented, reduces costs, effort and unforeseen drops in data availability.

In this context the Commission continued to implement and improve the internal IMS configuration management procedures that had been introduced at the end of 2013. It also worked with host States and station operators to further streamline State specific shipment procedures for IMS equipment and consumables and ensure their timely and cost-free customs clearance. Nonetheless, shipping and customs clearance processes continued to be very time consuming and resource intensive. This increases the time to repair an IMS station and reduces the data availability of that station. The Commission therefore continued to analyse and optimize the availability of IMS equipment and consumables at IMS stations, at its regional depots, at supplier depots and at the depot in Vienna.

MAINTENANCE

The PTS provides maintenance support and technical assistance at IMS facilities around the globe. During 2017, numerous maintenance requests were addressed, including long running data availability problems at six IMS facilities. The PTS also conducted preventive and corrective maintenance visits at nine certified IMS facilities. This low figure reflects a continued reliance on station operators, contractors and other sources of support to perform such tasks.

The Commission continued to establish and manage long term support contracts with manufacturers of IMS equipment and support providers. Some of these contracts were used to address support requirements for on-site inspection (OSI). In addition, the organization established and maintained a number of contracts with suppliers of equipment, material and technical services on a call-off basis. Both long term and call-off contracts ensure that necessary support can be provided to IMS monitoring stations in a timely and efficient manner.

As the entity closest to an IMS facility, the station operator is in the best position to prevent problems at stations and ensure timely resolution of any problems that occur. In 2017, the Commission continued to advance the technical capabilities of station operators. In addition to providing technical training for operators, station visits by PTS staff included hands-on training for local staff, with the aim of minimizing the need for PTS staff to travel from Vienna to resolve problems.

Up to date and reliable technical documentation for each IMS station is essential to ensure its sustainability and to maintain a high level of data availability. In 2017, the Commission made significant progress in further populating the PTS Quality Management System (QMS) with station specific documentation. By the end of 2017, full sets of documentation had been developed for 37 stations, and partial information had been acquired for an additional 26 stations.

The combination of technical training for station operators, better coordination between the operators and the Commission to optimize PCA contracts, and improved station specific O&M plans and station information contributed to enhancing the capability of station operators to undertake more sophisticated maintenance tasks at their stations. This is essential for

Installation of infrasound station IS16 (China).

optimizing the sustainment and performance of the IMS network.

RECAPITALIZATION

The final phase in the life cycle of equipment for IMS facilities involves its replacement (known as recapitalization) and disposal. In 2017, the Commission continued to recapitalize IMS facility components as they reached the planned end of their operational life cycle.

In managing recapitalization, the Commission and station operators took into account both life cycle data and station specific failure analysis and risk assessment. To optimize the obsolescence management of the IMS network and associated resources, the Commission continued to prioritize the recapitalization of components with high failure rates or risks and components whose failure would cause significant downtime. At the same time, recapitalization of components that proved to be robust and reliable was delayed beyond the planned end of their operational life cycle, where suitable, in order to optimize the use of available resources.

Several recapitalization projects were completed at certified IMS facilities in 2017, involving substantial investment of human and financial resources. In two cases, namely IS48 (Tunisia) and IS59 (United States of America), recapitalization was followed by revalidation to ensure that the stations continued to meet technical requirements. Major upgrades of IMS noble gas systems at two certified radionuclide stations (RN77 and RN79, United States of America) and one infrasound station (IS50, United Kingdom) were also completed.

ENGINEERING SOLUTIONS

The engineering and development programme for IMS facilities aims to improve the overall availability and quality of data and the cost effectiveness and performance of the IMS network by designing, validating and implementing solutions. Systems engineering is implemented throughout the life cycle of an IMS station and relies on open systems design through standardization of interfaces and modularity. It aims to improve systems and the reliability, maintainability, logistical supportability, operability and testability of equipment. Engineering and development solutions consider both end to end systems engineering of stations and optimized interaction with data processing by the IDC.

In 2017, the Commission carried out several complex repairs requiring substantial engineering work in order to return stations to operation. Improvements to infrastructure and equipment were implemented at several certified IMS facilities to improve their performance and resilience. Engineering solutions were also deployed to minimize station downtime during upgrades.

The Commission continued its work to optimize the performance of the IMS facilities and the monitoring technologies. Analysis of station incident reports and failures helped identify the main causes of data loss and assisted the subsequent analysis of the subsystem failures responsible for downtime. In particular, in 2017 the Commission carried out trend analyses of the downtime of each subsystem for all waveform technologies. It also continued systematic analysis based on incident reports for the radionuclide particulate and noble gas systems. The outcome of these activities provided valuable input to prioritize the design, validation and implementation of improvements for IMS stations and technologies.

In 2017, the Commission concentrated its engineering efforts on the following:

Site survey for infrasound station IS25 (French Guiana).

Primary seismic station PS12 (China).

- Acceptance testing of a new generation of seismoacoustic equipment including high resolution digitizers and infrasound sensors.
- Definition of standard processes for type approval, acceptance testing, initial calibration and on-site calibration of infrasound measurement systems with support from national metrology institutes.
- Collaboration with the International Bureau of Weights and Measures (BIPM) Consultative Committee for Acoustics, Ultrasound and Vibration (CCAUV) and addition of IMS traceability needs for seismoacoustic technologies into the new 2017-2027 BIPM/CCAUV strategy.
- Implementation of on-site calibration capability at two additional IMS infrasound stations (IS20, Ecuador, and IS24, France).
- Analysis of the results of the two pilot interlaboratory comparison studies for infrasound technology conducted with four expert laboratories in 2015 and 2017 with support from national metrology institutes.
- Further development of the standard station interface (SSI) in order to improve the software robustness and the provision of valuable state of health information to station operators.
- Assessment of the next generation of hydroacoustic stations and potential temporary solutions.
- Evaluation study on IMS hydroacoustic station HA8 (United Kingdom) to define corrective measures and cost effective solutions to improve its long term sustainability. The north triplet has not transmitted data to the IDC since March 2014 owing to cable damage.
- Establishment of a framework and acceptance document for the testing and integration of the next generation of noble gas systems.
- Continued improvement of high purity germanium detectors, with the testing of a hardened detector design with improved vacuum.

In addition, four next-generation noble gas systems are currently under development. The PTS continues collaboration with these developers in preparation for system testing against IMS certification requirements. The systems must demonstrate operation at 95% data availability for one year prior to deployment in the IMS.

Power requirements and standards for IMS radionuclide stations were drafted so the issue of poor power quality, which is one of the root causes of station downtime, can be addressed.

Testing of a prototype silicon PIN high resolution beta–gamma detector for noble gas measurements was finalized. A silicon PIN detector system was combined with a Swedish Automatic Unit for Noble Gas Acquisition (SAUNA) system for test purposes. This technology offers in particular improved discrimination between metastable xenon isotopes.

These initiatives further improved the reliability and resilience of IMS facilities. They also enhanced the performance of the network and increased the robustness of IMS stations, thus contributing to the extension of their life cycles and containing the risks of data downtime. Moreover, they increased the quality of data processing and of data products.

AUXILIARY SEISMIC NETWORK

The Commission continued to monitor the operation and sustainment of auxiliary seismic stations in 2017. The data availability of auxiliary seismic stations was maintained during the year.

In accordance with the Treaty, the regular O&M costs of each auxiliary seismic station, including the cost of physical security, are the responsibility of the State hosting it. However, practice has shown that this constitutes a significant challenge for auxiliary seismic stations in developing countries that do not belong to a parent network with an established maintenance programme.

The Commission has encouraged States that host auxiliary seismic stations with design deficiencies or with problems related to obsolescence to review their ability to cover the cost of upgrading and sustaining their stations. However, obtaining the appropriate level of technical and financial support remains difficult for several host States.

To address this, in 2017 the European Union (EU) continued to support the sustainment of auxiliary seismic stations that are hosted by developing countries or countries in transition. This initiative includes action to return stations to an operational state and the provision of transportation and funds for additional PTS personnel to provide technical support. The Commission continued its discussions with other States whose parent networks include several auxiliary seismic stations in order to make similar arrangements.

QUALITY ASSURANCE

In addition to improving performance at individual stations, the Commission accords great importance to ensuring the reliability of the IMS network as a whole. Hence, its engineering and development activities in 2017 continued to focus on measures for data surety and calibration.

The Commission further developed its calibration methodologies. In particular, it added two infrasound stations to the yearly calibration programme. The Commission also continued the scheduled calibration of primary and auxiliary seismic and T-phase stations and advanced the deployment of the SSI calibration module throughout the IMS seismic network.

Calibration plays a significant role in the verification system, as it determines and monitors parameters needed to properly interpret signals recorded by IMS facilities. It does this either by direct measurement or by comparison against a standard.

The QA/QC programme for radionuclide laboratories consisted of interlaboratory comparison activities. In this context, the Commission assessed the 2016 PTE and conducted the 2017 PTE. The Commission also undertook a laboratory surveillance visit to three radionuclide laboratories RL8 (France), RL15 (United Kingdom) and RL2 (Australia).

QA/QC activities for noble gas continued with the execution of two intercomparison exercises for the noble gas capability of radionuclide laboratories.

In an ever growing but also ageing IMS network, ensuring data availability is a daunting task. However, through close cooperation, all stakeholders – station operators, host States, contractors, States Signatories and the Commission – worked hard to ensure the solid and effective performance of the network.

Installation and certification of radionuclide station RN57 (Russian Federation).

PROFILES OF THE MONITORING TECHNOLOGIES

170 STATIONS
50 primary
120 auxiliary

76 COUNTRIES

SEISMIC STATIONS

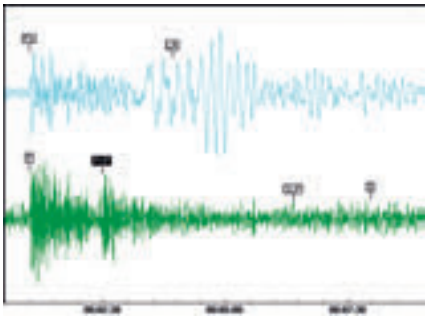
The objective of seismic monitoring is to detect and locate underground nuclear explosions. Earthquakes and other natural events as well as anthropogenic events generate two main types of seismic wave: body waves and surface waves. The faster body waves travel through the interior of the earth, while 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.

Seismic technology is very efficient at detecting a suspected nuclear explosion, as seismic waves travel fast and can be registered within minutes of an event. Data from seismic stations of the IMS provide information on the location of a suspected underground nuclear explosion and help identify the area for an OSI.

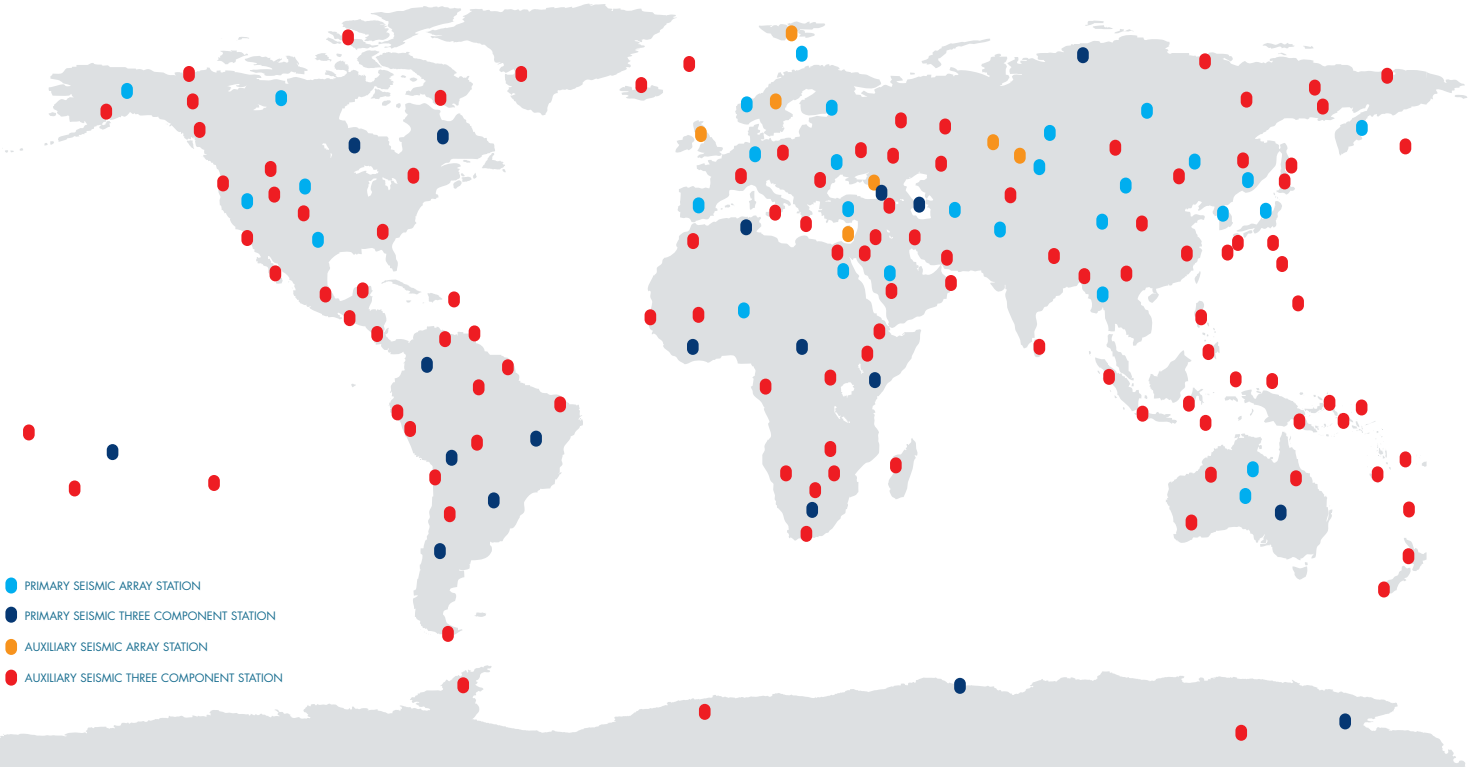
The IMS has primary and auxiliary seismic stations. Primary seismic stations send continuous data in near real time to the IDC. Auxiliary seismic stations provide data on request from the IDC.

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

An IMS seismic station can be either a three component (3-C) station or an array station. A 3-C station records broadband ground motion in three orthogonal directions. An array station generally consists of multiple short period seismometers and 3-C broadband instruments that are separated spatially. The primary seismic network is mostly composed of arrays (30 of 50 stations), while the auxiliary seismic network is mostly composed of 3-C stations (112 of 120 stations).



Example of seismic waveform.



60 STATIONS

34 COUNTRIES

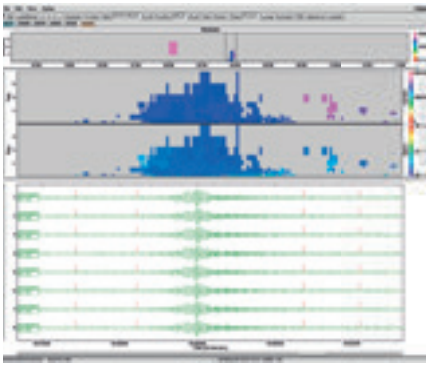
INFRASOUND STATIONS

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.

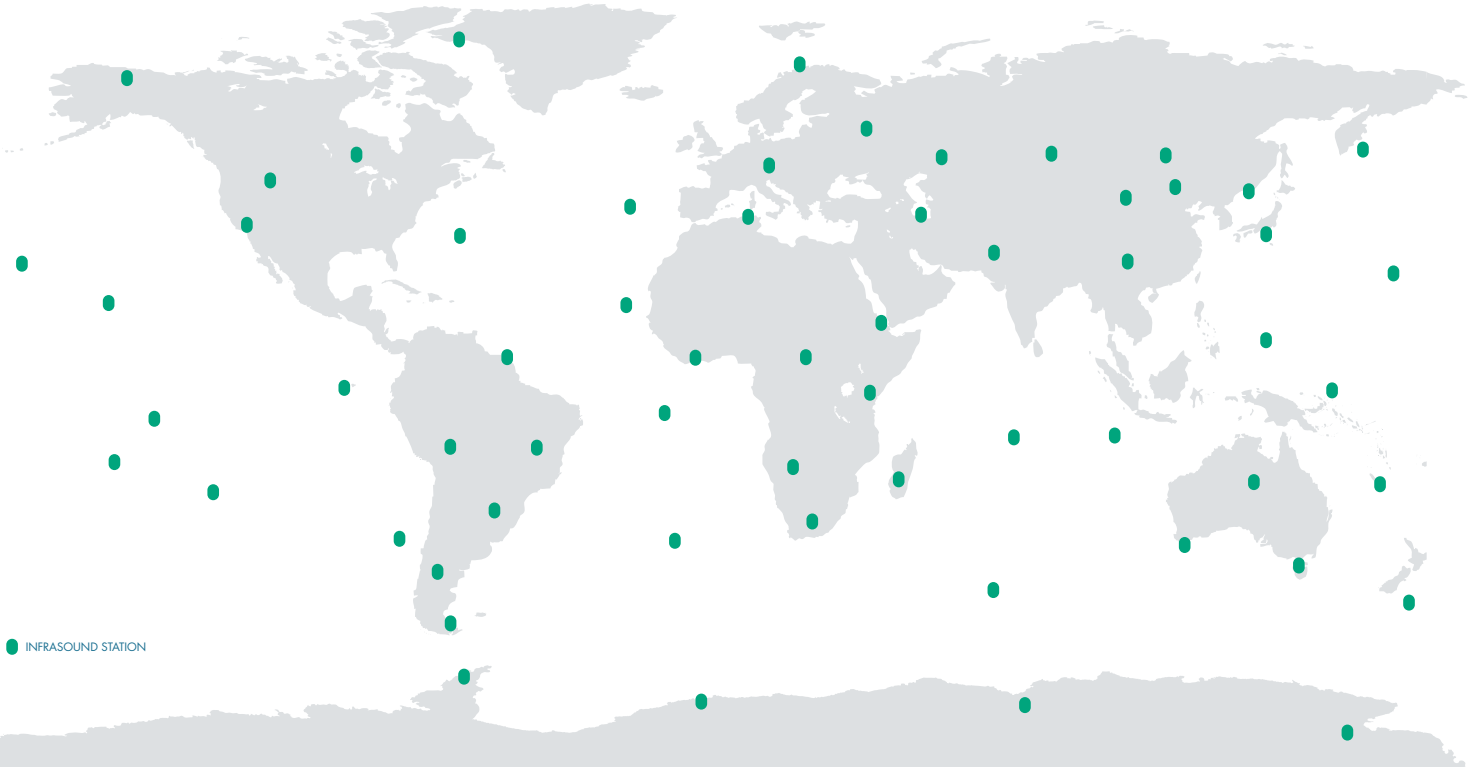
Infrasound waves cause minute changes in the atmospheric pressure that are measured by microbarometers. Infrasound has the ability to cover long distances with little dissipation, which is why infrasound monitoring is a useful technique for detecting and locating atmospheric nuclear explosions. In addition, 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.

The IMS infrasound stations exist in a wide variety of environments, ranging from equatorial rainforests to remote windswept islands and polar ice shelves. However, 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 (also known as an 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.



Example of infrasound waveform.



11 STATIONS
6 underwater
5 on land

8 COUNTRIES

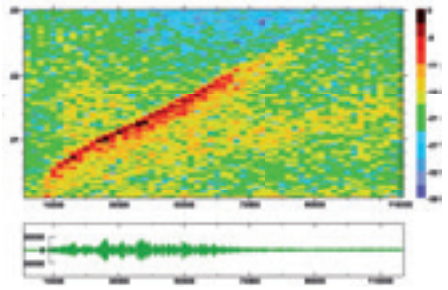
HYDROACOUSTIC STATIONS

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

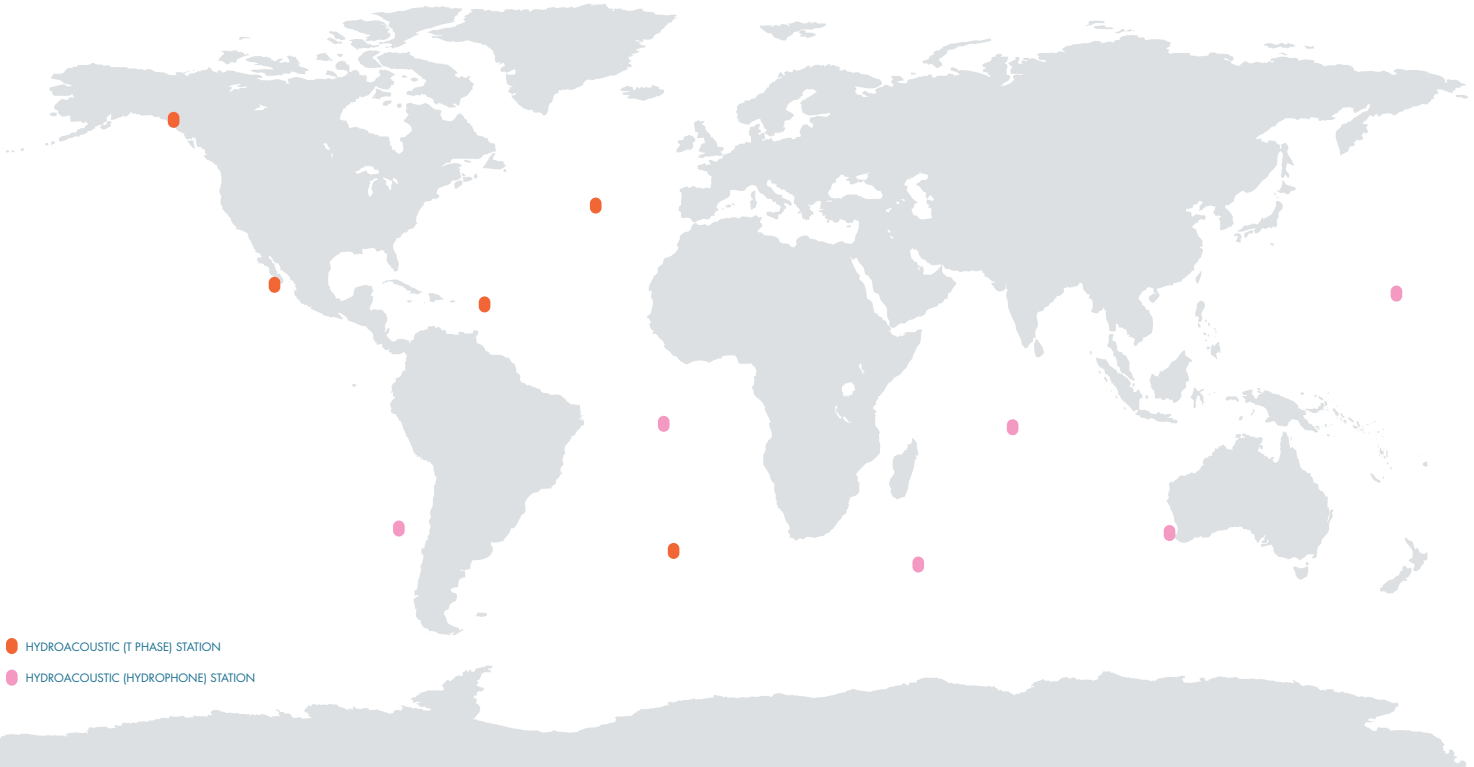
Hydroacoustic monitoring involves recording signals that show changes in water pressure generated by sound waves in the water. Owing to the efficient transmission of sound through water, even comparatively small signals are readily detectable at large distances. Thus 11 stations are sufficient to monitor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

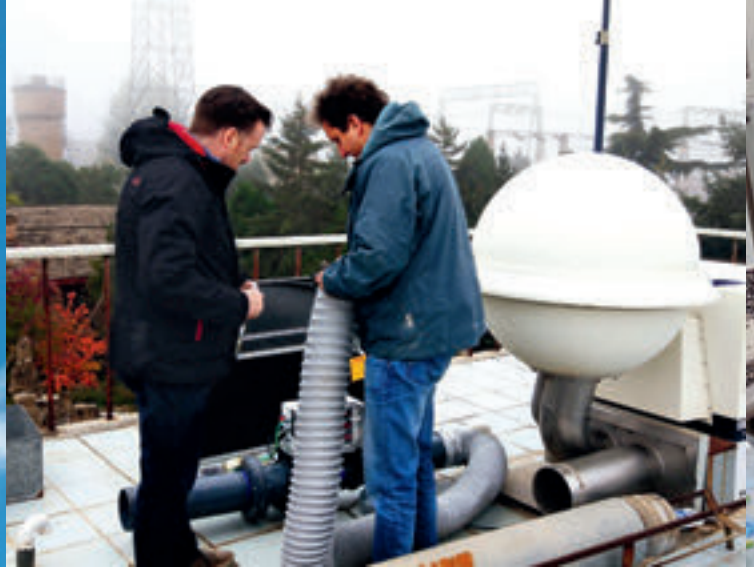
There are two types of hydroacoustic station: underwater hydrophone stations and T phase stations on islands or on the coast. The underwater hydrophone stations are among the most challenging and most costly monitoring stations to build. They must be designed to function in extremely inhospitable environments, exposed to temperatures close to freezing point, huge pressure 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 material and equipment.



Example of hydroacoustic waveform.





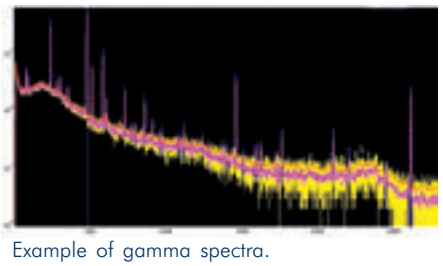
96 FACILITIES
80 stations
16 laboratories

41 COUNTRIES

RADIONUCLIDE PARTICULATE STATIONS

Radionuclide monitoring technology complements the three waveform technologies employed in the Treaty verification regime. It 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.



Example of gamma spectra.

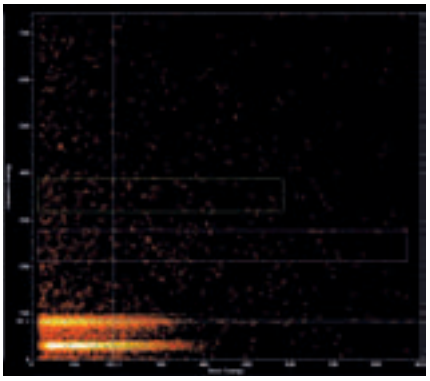
NOBLE GAS DETECTION SYSTEMS

The Treaty requires that, by the time it enters into force, 40 of the 80 IMS radionuclide particulate stations also have the capability to detect radioactive forms of noble gases such as xenon and argon. Special detection systems have therefore been developed and are being deployed and tested in the radionuclide monitoring network before they are integrated into routine operations.

Noble gases are inert and rarely react with other chemical elements. 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 that do not occur naturally but which 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.

All of the noble gas detection systems in the IMS work in a similar way. Air is pumped into a charcoal-containing purification device in which 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.

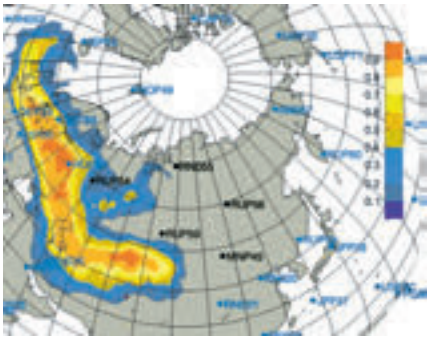


Example of beta–gamma spectra.

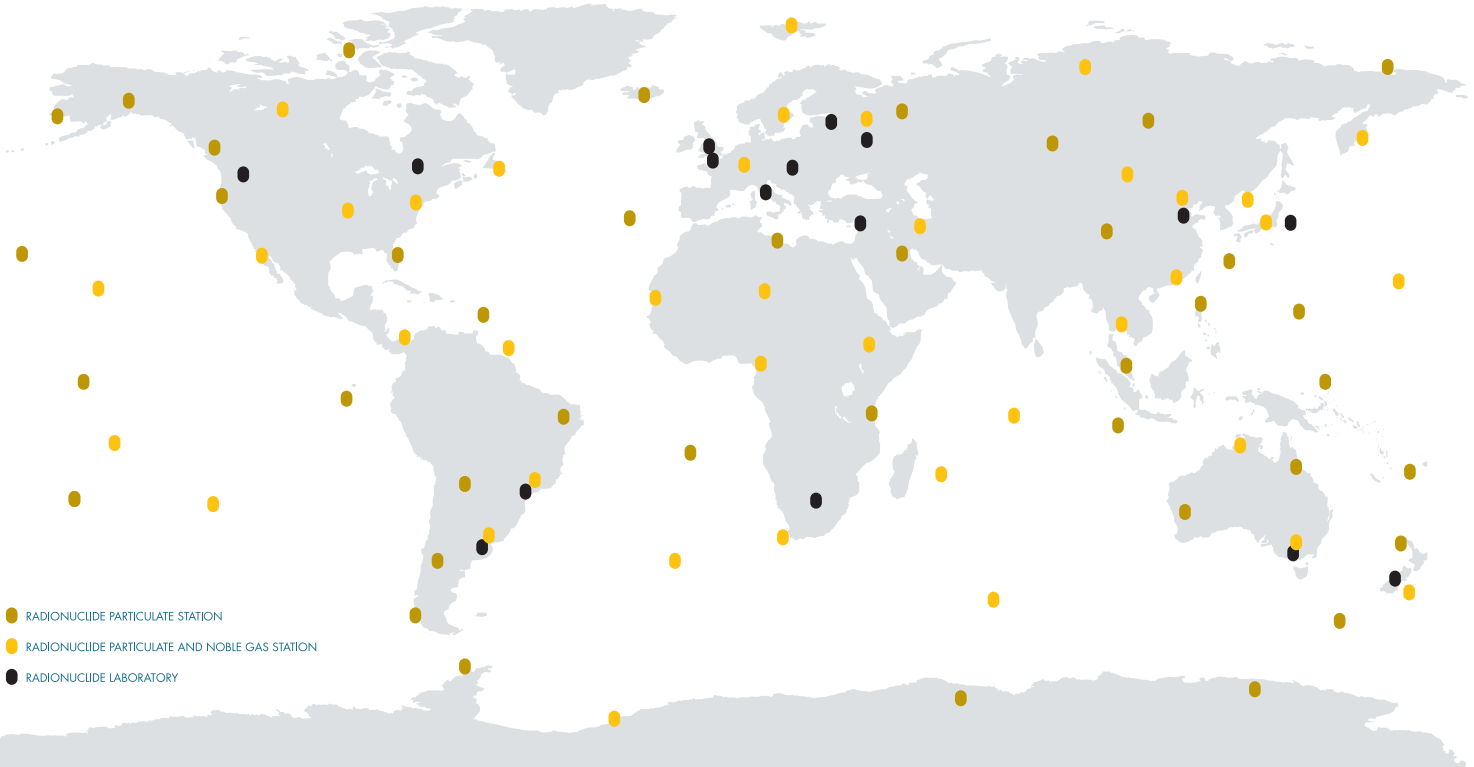
RADIONUCLIDE LABORATORIES

Sixteen radionuclide laboratories, each located in a different State, 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 or activation products that could be indicative of a nuclear test. In addition, they contribute to the quality control of station measurements and the assessment of network performance through regular analysis of routine samples from all certified IMS stations. These world class laboratories also analyse other types of sample, such as those collected during a station site survey or certification.

The radionuclide laboratories are certified under rigid requirements for analysis of gamma spectra. The certification process provides assurance that the results provided by a laboratory are accurate and valid. These laboratories also participate in the annual PTEs organized by the Commission. In addition, certification of IMS radionuclide laboratories for noble gas analysis capability started in 2014.



Example of atmospheric transport modelling.



THE GLOBAL COMMUNICATIONS INFRASTRUCTURE

HIGHLIGHTS IN 2017

High GCI availability maintained

An average of 36 gigabytes of data and products transmitted per day

Contractor selected and planning started for the third generation of the GCI for 2018-2028

GCI installation at infrasound station IS20 (Ecuador).

The Global Communications Infrastructure uses a combination of satellite and terrestrial communication links to enable the exchange of data by IMS facilities and States around the world with the Commission. The GCI first transports raw data from the IMS facilities in near real time to the IDC in Vienna for processing and analysis. It then distributes the analysed data to States Signatories along with reports relevant to verification of compliance with the Treaty. Increasingly, the GCI is also being used as a means for the Commission and station operators to monitor and control IMS stations remotely.

The current, second generation of the GCI began operation in 2007 under a new contractor. Its satellite communication links are required to operate with 99.5% availability and its terrestrial communication links with 99.95% availability. The GCI is required to send data from transmitter to receiver within seconds. It uses digital signatures and keys to ensure that the transmitted data are authentic and have not been tampered with.

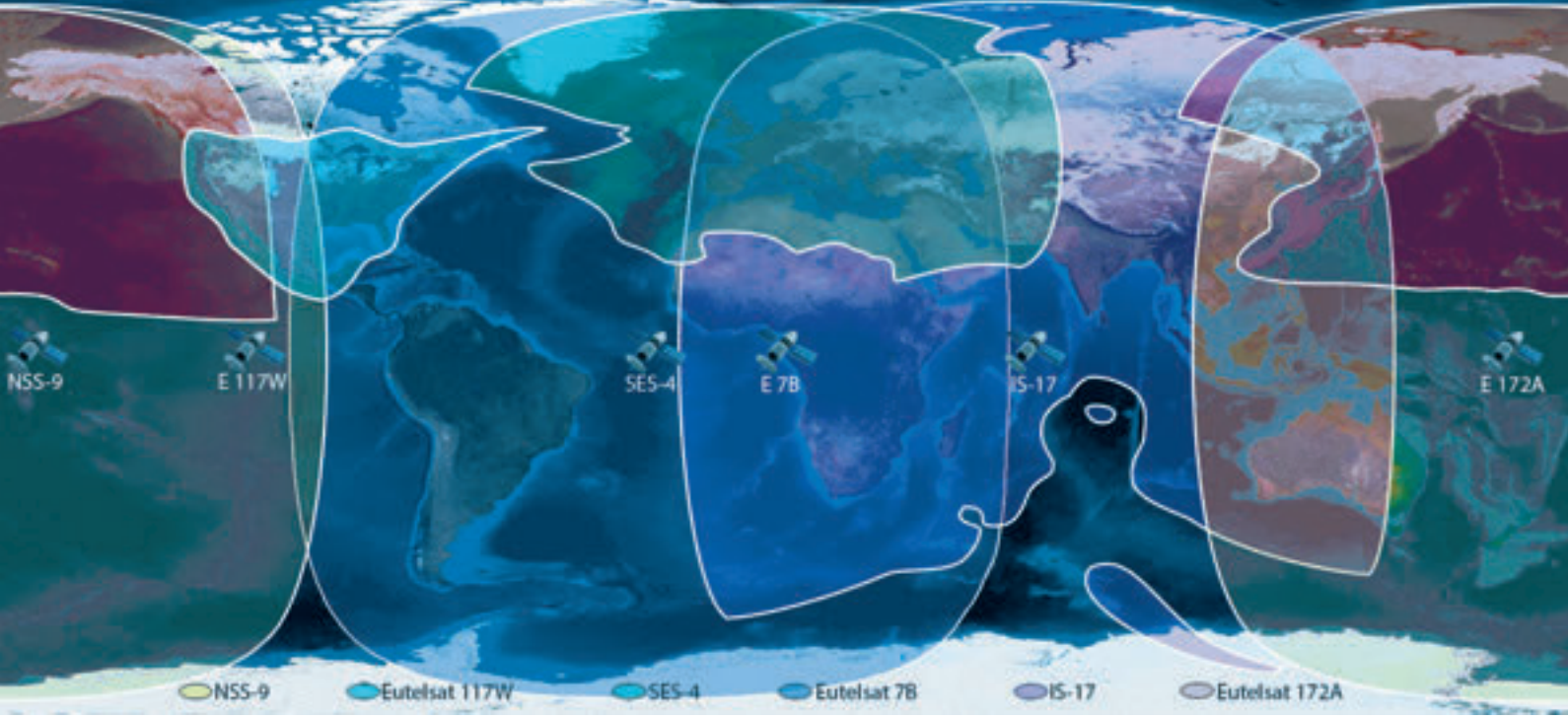
TECHNOLOGY

IMS facilities, the IDC and States Signatories can exchange data, via their local earth stations fitted with a very small aperture terminal (VSAT), through one of several commercial geostationary satellites. These satellites cover all parts of the world, other than the North and South Poles. The satellites route the transmissions to hubs on the ground, and the data are then sent to the IDC via terrestrial links. Complementing this network, independent subnetworks employ a variety of communications technologies to carry data from IMS facilities to their respective national communications nodes connected to the GCI, from where the data are routed to the IDC.

In situations where VSATs are not in use or are not operational, a virtual private network (VPN) can provide an alternative means of communication. A VPN uses existing telecommunications networks to transmit data privately. Most of the VPNs for the GCI use the basic public infrastructure of the Internet together with a variety of specialized protocols to support secure encrypted communications. VPNs are also used at some sites to provide a backup communication link in case of failure of a VSAT or terrestrial 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 December 2017, the GCI network included 224 VSAT stations (of which 27 have backup VPN links), 42 stand-alone VPN links, 5 terrestrial links using multiprotocol label switching (MPLS) connecting independent subnetworks, and a terrestrial MPLS link for US stations located in Antarctica. In addition, a total of 71 independent subnetwork links and 6 Antarctic communication links were operated by 10 States Signatories to carry IMS data to a GCI connection point. In total, the combined networks have nearly 351 different communication links to transport data to and from the IDC.

Top: Installation of GCI III on the roof of the Vienna International Centre.
Bottom: GCI installation at infrasound station IS20 (Ecuador).



Coverage of the six geostationary satellites of GCI II.

OPERATIONS

The Commission measures the compliance of the GCI contractor against the operational target of 99.5% availability in one year using a rolling 12 month adjusted availability figure. In 2017, this was 99.68%. The average availability each month did not fall below the 99.5% operational target. The rolling 12 month actual availability, which is a measure of the raw uptime of each GCI link over one year, was 97.28%, which diverges from the adjusted value by a similar amount as in 2016.

Over the year, the traffic transported over the GCI from IMS facilities to the IDC and from the IDC to NDCs averaged 36 gigabytes per day. In addition, data sent to NDCs that are directly connected to the IDC averaged 11.9 gigabytes per day. These figures are similar to those of 2016.

GLOBAL COMMUNICATIONS INFRASTRUCTURE III

After a bidding and evaluation process in 2016, negotiations were concluded with Hughes Network Systems of Maryland, United States of America, to install and operate GCI III, the third generation of the GCI, from 2018-2028. The contractor commenced planning the migration of the service in the first quarter of 2017, and actual migration started in December. The new GCI system uses a combination of transmission technologies and aims to increase bandwidth and operational reliability while lowering costs. Migration is planned to be completed by the end of June 2018.

The following GCI links were migrated to GCI III in 2017:

- SG-US7, United States of America (stations IS54, RN73, AS106, AS114);
- NDC-DE, Germany (NDC);
- NDC-PT, Portugal (NDC).

THE INTERNATIONAL DATA CENTRE

HIGHLIGHTS IN 2017

Provision of timely information to States Signatories on the announced nuclear test by the Democratic People's Republic of Korea

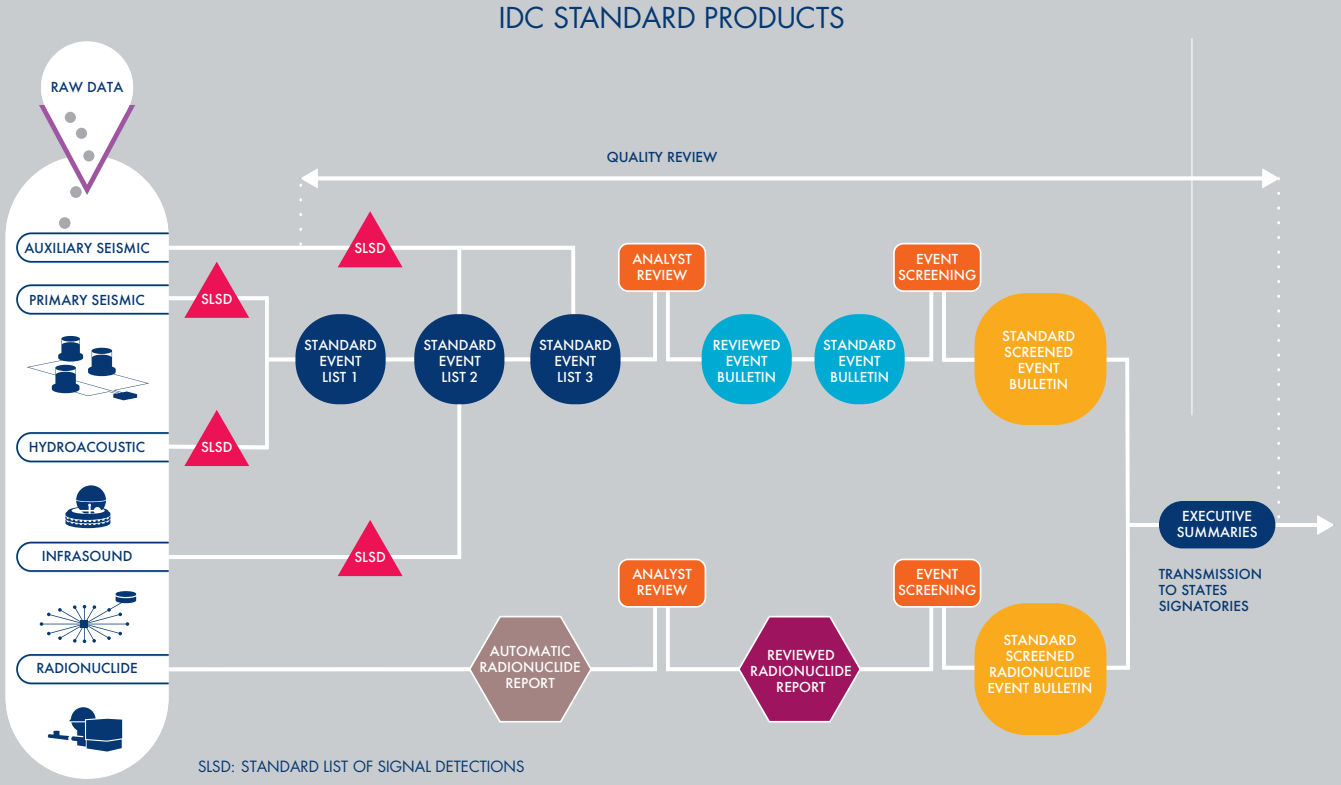
Conduct of Experiment 2 as part of IDC commissioning under the PTS performance monitoring and testing framework

Analysis of signal likely associated with the loss of the submarine *ARA San Juan*

Data analysis at the IDC (Vienna).

The International Data Centre operates the IMS and the GCI. It collects, processes, analyses and reports on the data received from IMS stations and radionuclide laboratories and then makes the data and IDC products available to States Signatories for their assessment. In addition, the IDC provides technical services and support to the States Signatories.

The Commission has created full computer network redundancy at the IDC to ensure a high level of availability of its resources. A mass storage system provides archiving capacity for all verification data, which now cover more than 15 years. Most of the software used in operating the IDC has been developed specifically for the Treaty verification regime.



OPERATIONS: FROM RAW DATA TO FINAL PRODUCTS

SEISMIC, HYDROACOUSTIC AND INFRASOUND EVENTS

The IDC processes the data collected by the IMS as soon as they reach Vienna. The first data product, known as ● Standard Event List 1 (SEL1), is an automated waveform data report that lists preliminary waveform events recorded by the primary seismic and hydroacoustic stations. It is completed within one hour of the data being recorded at the station.

The IDC issues a more complete waveform event list, ● Standard Event List 2 (SEL2), four hours after first recording the data. SEL2 uses additional data requested from the auxiliary seismic stations along with data from the infrasound stations and any other waveform data that arrive late. After a further two hours have elapsed, the IDC produces the final, improved automated waveform event list, ● Standard Event List 3 (SEL3), which incorporates any additional late arriving waveform data. All of these automated products are produced according to the schedules that will be required when the Treaty enters into force.

IDC analysts subsequently review the waveform events recorded in SEL3 and correct the automated results, adding missed events as appropriate to generate the daily ● Reviewed Event Bulletin (REB). The REB for a given day contains all waveform events that meet the required 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 2 days.

RADIONUCLIDE MEASUREMENTS AND ATMOSPHERIC MODELLING

Spectra recorded by particulate and noble gas monitoring systems at IMS radionuclide stations typically arrive several days later than the signals from the same events recorded by the waveform stations. The radionuclide data are automatically processed to produce an ● Automatic Radionuclide Report (ARR) within the schedules required after entry into force of the Treaty. After review by an analyst under the schedules for provisional operation, the IDC issues a ● Reviewed Radionuclide Report (RRR) for each full spectrum received.

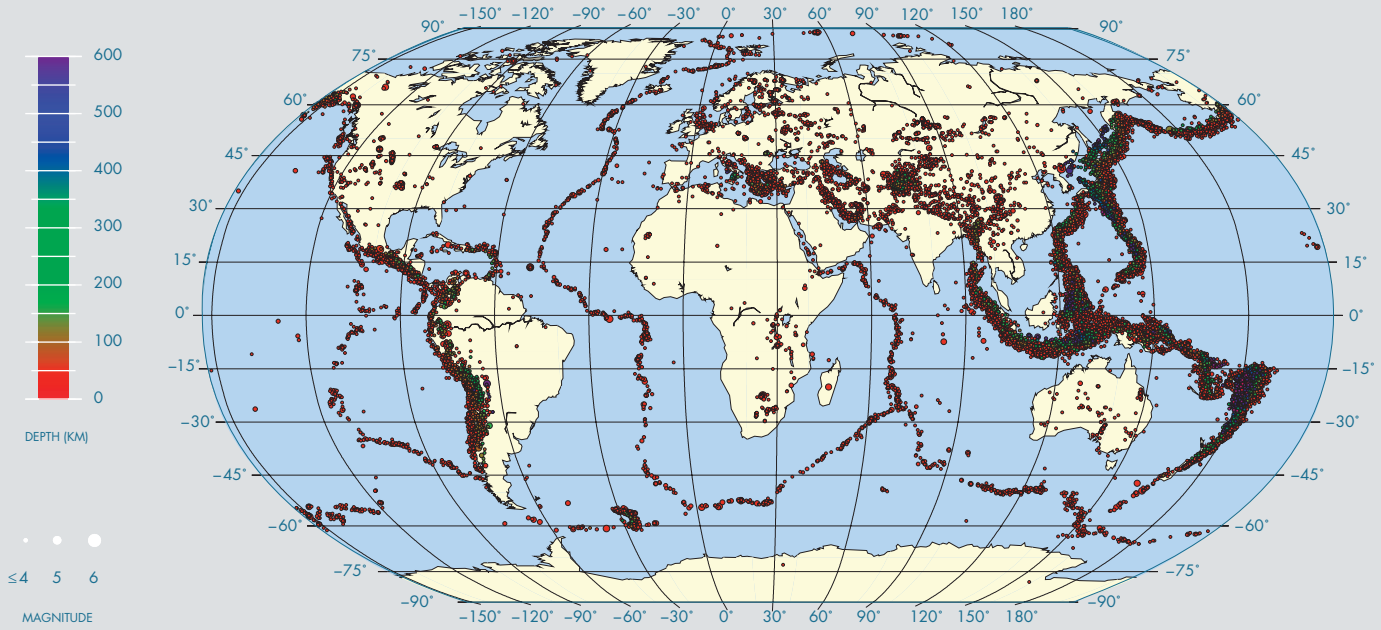
The Commission performs daily atmospheric backtracking calculations for each of the IMS radionuclide stations with near real time meteorological data obtained from the European Centre for Medium-Range Weather Forecasts; these are appended to each particulate RRR. Using software developed by the Commission, States Signatories can combine these calculations with radionuclide detection scenarios and nuclide specific parameters to define regions in which sources of radionuclides may be located.

To corroborate the backtracking calculations, the Commission collaborates with the World Meteorological Organization (WMO) through a joint response system. This system enables the Commission to send requests for assistance in the case of suspicious radionuclide detections to 10 regional specialized meteorological centres or national meteorological centres of the WMO located around the world. In response, the centres aim to submit their computations to the Commission within 24 hours.

DISTRIBUTION TO STATES SIGNATORIES

After these data products have been generated, they must be distributed in a timely way to the States Signatories. The IDC provides subscription- and Internet-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.

THE 34 745 EVENTS FROM
THE IDC 2017 REVIEWED EVENT BULLETIN



SERVICES

An NDC is an organization in a State Signatory that has technical expertise in the Treaty verification technologies and has been designated by the national authority of the State. Its functions may include receiving data and products from the IDC, processing data from the IMS and elsewhere, and providing technical advice to the national authority.

BUILD-UP AND ENHANCEMENT

INTERNATIONAL DATA CENTRE COMMISSIONING

The mandate of the IDC is provisional operation and testing of the system in preparation for operation after entry into force. The IDC Progressive Commissioning Plan provides milestones that mark progress in this endeavour and control mechanisms including:

- The Progressive Commissioning Plan itself;
- Draft Operational Manuals, which set requirements;
- The validation and acceptance test plan;
- A review mechanism, which allows States Signatories to determine if their verification requirements can be met by the system.

Build-up, continuous enhancement, performance monitoring and testing of the IDC are essential to its commissioning. The activities of the Commission in this respect are guided by a framework for monitoring and testing performance that has been developed by the PTS.

During 2017, the PTS conducted Experiment 2, a two week experiment of various capabilities of the IDC. The experiment used a subset of the tests described in the validation and acceptance test plan as its basis and provided valuable information that will be used in conducting and evaluating future experiments and tests of IDC capabilities in the IDC progressive commissioning process.

In 2017, the Commission continued drafting the validation and acceptance test plan that will be used in Phase 6 of IDC progressive commissioning. The activities in this area involved technical meetings, interaction on the Experts Communication System (ECS) and discussions during sessions of Working Group B (WGB).

SECURITY IMPROVEMENTS

The Commission continued to identify and address risks to its operational environment and to strengthen security controls on information technology. Measures to safeguard information technology assets included mitigating risks of malware attacks and phased implementation of network access control to prevent unauthorized access to the resources of the Commission.

To ensure an effective information security programme, the Commission continued to roll out its awareness programme to educate PTS staff on best practices in security. The programme focuses on the key tenets of information security: protection of confidentiality, integrity and availability of information assets. The Commission also developed a framework for security policies which serves as a foundation for the phased implementation of best practices.

SOFTWARE ENHANCEMENTS

In April 2017, the Commission released a major enhancement to the radionuclide

Data analysis at the IDC (Vienna).

components of the NDC in a box software distribution. This new version includes features to facilitate installation of the software on the equipment of the end user as well as a new capability for automatic background subtraction. The updated version automatically corrects sample peak areas for background/blank contribution and further improves consistency in activity results for particulate samples. Configuration updates included in this release addressed key line optimization for Cd-109, Tl-201 and Sc-46 to further reduce the number of false nuclide identifications in automatic mode.

A minor upgrade to the seismic, hydroacoustic and infrasound (SHI) components of NDC in a box was released in November 2017 in support of the planned NDC Preparedness Exercise (NPE). This release upgrades components for the processing of data from IMS hydrophone stations and includes a tutorial on how to perform hydroacoustic data processing using the tools available in NDC in a box.

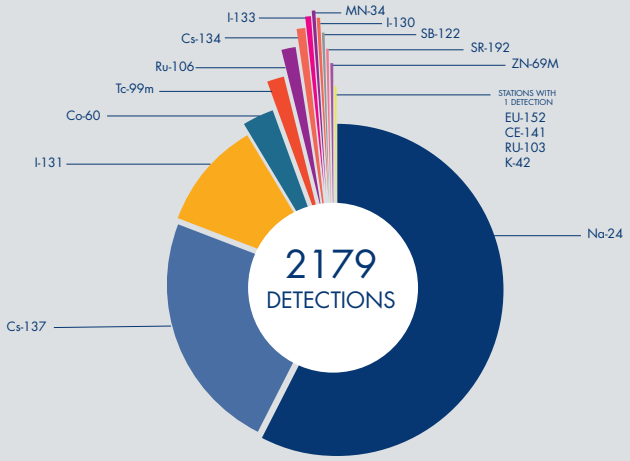
The Commission continued to make progress in improving the regional seismic travel time models. It organized training sessions in Namibia on NDC in a box to promote increasing the number of ground truth events available in Africa. In turn, the ground truth events will serve as input to improving the seismic travel time models.

The Commission also continued to develop new automatic and interactive software that uses state of the art machine learning and artificial intelligence. The enhanced NET-VISA software is now fully capable for the three waveform technologies and performs better than the existing operational event detection system in terms of both the number of false events it builds and the number of real events detected. In 2017, efforts focused on assessing and improving NET-VISA event location. A study based on reference ground truth events confirmed that NET-VISA built more events than the current operational software, has superior depth estimation and matches or surpasses the operational software in terms of location accuracy. An enhancement to analyst review tools allows analysts to access, on demand, NET-VISA events not built by the current operational software.

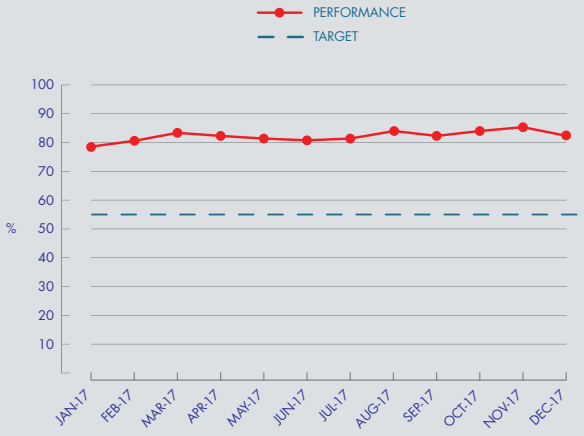
The new infrasound detector and interactive review tools based on progressive multi-channel correlation, namely DTK-PMCC and DTK-GPMCC, were further improved and tested in the IDC environment, in preparation for an operational release in 2018. The software package processes infrasound data in real time for all IMS infrasound arrays in the IDC development area. Hydroacoustic capabilities are also being considered.

Phase 2 of IDC re-engineering, a project initiated in January 2014, was completed in April 2017 and delivered a software architecture that is intended to guide the further development and sustainment of the waveform processing software. The project concluded with a technical meeting in Vienna on 20-21 April 2017. The meeting brought together experts from States Signatories to review the latest project deliverables and the project as a whole and to discuss possible options for developing software based on the phase 2

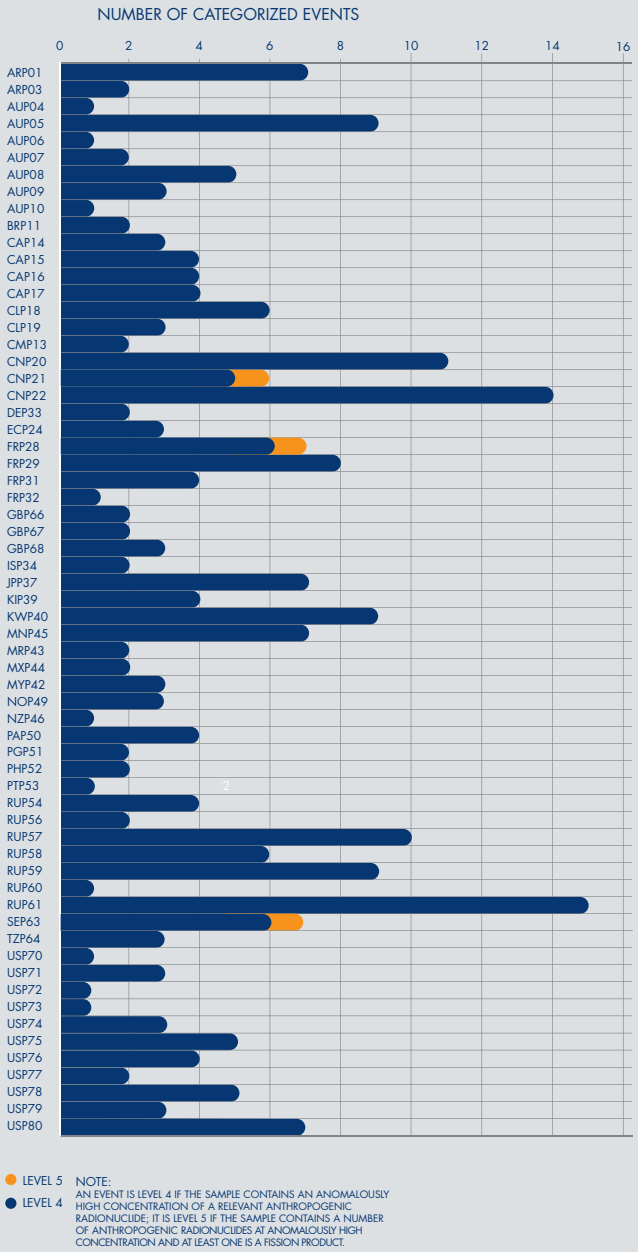
TREATY RELEVANT RADIONUCLIDES DETECTED IN 2017



CORRECTLY CATEGORIZED AUTOMATICALLY PROCESSED RADIONUCLIDE SPECTRA



RADIONUCLIDE EVENTS RECORDED BY IMS STATIONS IN IDC OPERATIONS IN 2017

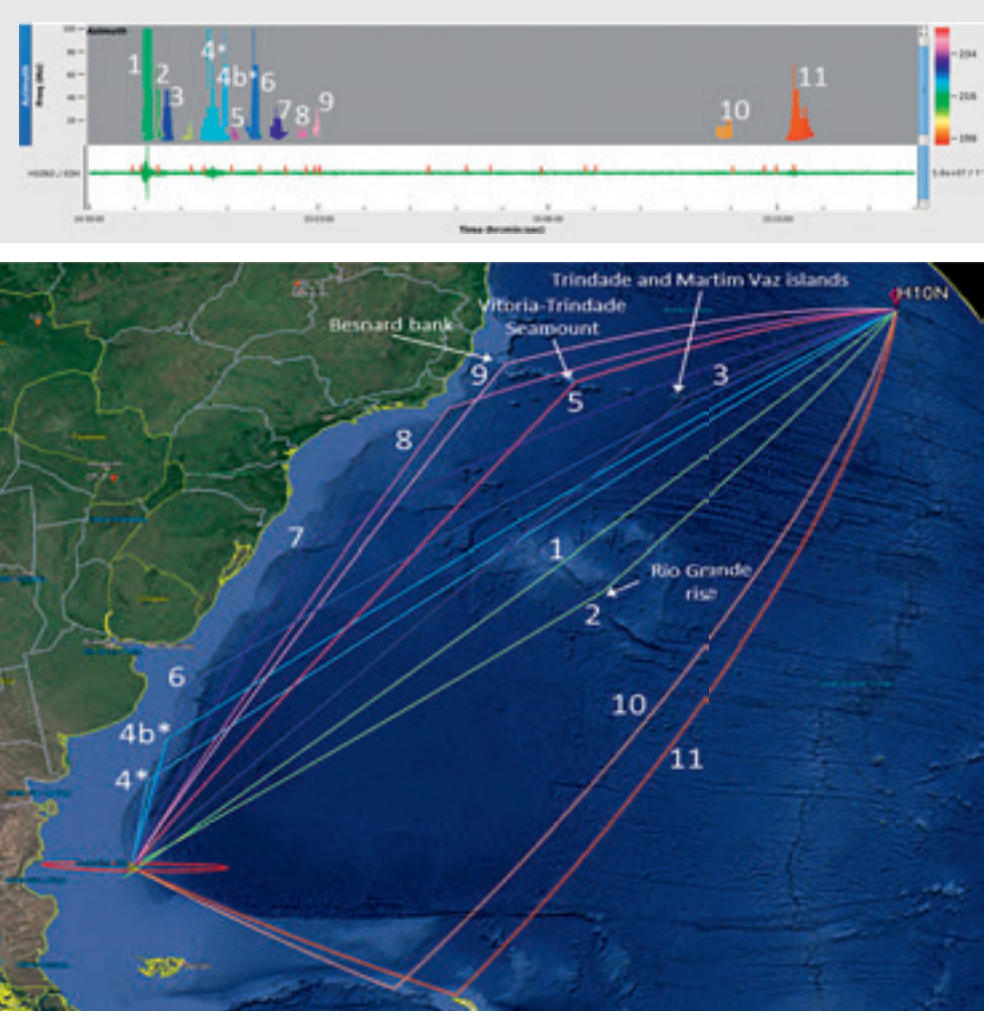


architecture in a subsequent phase of IDC re-engineering.

In 2017, the focus for the IDC software for radionuclide processing was on completing a new generation of interactive review tools that combine particulate and noble gas functionality and provide functional and ergonomic improvements based on open source third party tools. The Commission also continued to explore alternatives to the net count calculation method for beta–gamma analysis that is currently used in IDC software, with a view to integrating such alternatives in future releases.

A new version of the FLEXPART Lagrangian transport and dispersion model software was implemented in IDC operations, providing performance improvements to increase the spatial and temporal resolution of the atmospheric transport modelling (ATM) pipeline. An ATM pipeline configuration with increased spatial resolution (0.5 degrees) is being tested and validated the IDC development environment.

The newly developed WEB-GRAPE IBS (Internet based service) provides



Analysis of a signal likely associated with the loss of the submarine *ARA San Juan*. Top: Progressive multi-channel correlation processing of a signal from the north triplet of hydroacoustic station H10 in the time window 14:58 – 15:16 on 15 November 2017, showing the main arrival with onset time 14:59:07 and the later arrivals. Bottom: Map showing the reflected signal travel paths from the source location to the station. The numbering of arrivals in the top figure corresponds to the numbered paths on the map. Arrivals 2, 3 and 5 are consistent with reflections on islands (Trindade and Martin Vaz Archipelago) or seamounts (Rio Grande Rise and Vitória-Trindade Seamounts) in the Atlantic. A group of six late arrivals (4*, 4b*, 6, 7, 8, 9) between 15:00:00 and 15:03:00 are consistent with reflections from the Argentinian continental slope. Two very late arrivals (10, 11) between 15:12:00 and 15:13:30 are consistent with reflections from the South Georgia Island slope. All times displayed are GMT on 15 November 2017.

authorized users the capability to visualize and analyse the products of the ATM pipeline through a web application. The first version of the WEB-GRAPE IBS software, covering a subset of the WEB-GRAPE capabilities, was deployed and beta tested by a group of 16 NDC representatives. Their feedback enabled the development team to finalize the first version of the software to be released in the first quarter of 2018.

INTERNATIONAL NOBLE GAS EXPERIMENT AND ATMOSPHERIC RADIOXENON BACKGROUND

The 31 noble gas systems that are in provisional operation at IMS radionuclide stations continued to send data to the IDC during 2017. The 25 certified systems sent data to IDC operations, while data from the remaining 6 non-certified systems were processed in the IDC testing environment. The Commission made significant efforts to ensure a high level of data availability for all systems through preventive and corrective maintenance and regular interaction with station operators and system manufacturers.

Although the background levels of radioxenon are currently measured at 33 locations as part of the International Noble Gas Experiment, they are still not understood in all cases. A good understanding of the noble gas background is crucial for the identification of signs of a nuclear explosion.

An initiative funded by the EU to improve understanding of the global radioxenon background, which started in December 2008, continued in 2017. The objective of this project is to supplement knowledge on the global radioxenon background over longer periods. By performing measurements for at least 12 months, this project will provide more representative periods at selected sites. This will provide empirical data for validating network performance, for testing xenon equipment, for data analysis, and for training local experts.

In 2017, the Commission continued operating mobile noble gas systems in Manado, Indonesia, and in Kuwait City, Kuwait. After processing and review by the IDC, the data from both campaigns were made available to radionuclide experts for further analysis. In September 2017, the campaign in Manado terminated and the system was shipped to Mutsu, Japan. The Commission plans to use the results and conclusions from these campaigns to further develop its noble gas categorization scheme and to gain a better understanding of the inventory, transport and time variation of radioxenon in the atmosphere

CIVIL AND SCIENTIFIC APPLICATIONS OF THE VERIFICATION REGIME

In November 2006, the Commission agreed to provide continuous IMS data in near 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 Organisation to provide data for tsunami warning purposes. By the end of 2017, 15 such agreements or arrangements had been made with organizations in Australia,

France, Greece, Indonesia, Japan, Malaysia, Myanmar, the Philippines, Portugal, the Republic of Korea, the Russian Federation, Thailand, Turkey and the United States of America.

IMS infrasound data and IDC products can provide valuable information on a global scale regarding bodies entering the atmosphere. Several large atmospheric airbursts related to near-earth objects (NEOs) entering the atmosphere were featured in the IDC products of 2017, with the largest NEO to date reported on 15 December 2017 over northern Kamchatka (Russian Federation) and detected as far away as Antarctica, 15 000 km away. The infrasound technology continued to attract interest beyond the verification regime, in particular with a collaboration beginning in July 2017 with the University of Oldenburg in Germany and the European Space Agency, focusing on a near real time monitoring system for atmospheric impacts from small NEOs.

Real time detection of a volcanic eruption can help reduce the hazard to air traffic of ash clouds clogging jet engines. Worldwide eruptions are recorded by IMS infrasound stations and reported in IDC products. It is now established that information obtained by infrasound technology is also useful to the civil aviation community.

The Commission collaborated with the Volcanic Ash Advisory Centre in Toulouse, France, under the patronage of the WMO and the International Civil Aviation Organization, and the Atmospheric dynamics Research InfraStructure in Europe (ARISE) project to develop an infrasound volcanic information system. The Commission will continue to serve on the ARISE2 advisory board for the duration of the project (2015-2018).

The deployment campaign and processing results of the mobile infrasound system installed in Romania in September 2016 in collaboration with the Romanian NDC were presented at the CTBT: Science and Technology 2017 conference (SnT2017) and at the 2017 Infrasound Technology Workshop. In light of the performance of the system and the increased knowledge of infrasound sources in the region it was decided to extend the campaign for a second year, until September 2018.

The Commission contributes to radiological and nuclear emergency response in the framework of its membership in the Inter-Agency Committee on Radiological and Nuclear Emergencies. In 2017, the Commission participated in international exercises including ConvEx-3.

On 15 November 2017, two hydroacoustic stations detected an unusual signal in the vicinity of the last known position of the missing submarine *ARA San Juan*. IMS data was made available to assist the Argentinian authorities in their search for the missing submarine.

The range of scientific applications of IMS data is increasing, including to studies of marine life, the environment, climate change and other areas. Several new contracts for cost-free access to specific IMS data through the virtual Data Exploitation Centre were signed with academic institutions.

Omniglobe exhibit at the CTBT: Science and Technology 2017 conference.


Poster Area

CTBT: SCIENCE AND TECHNOLOGY CONFERENCES

To keep abreast of scientific developments, the Treaty verification regime relies on the latest advancements in science and technology as well as interaction with the global scientific and technological community. The ongoing interaction allows the Commission to build partnerships with the scientific communities engaged in various aspects of test ban monitoring. Against the backdrop of a dynamic technological landscape, the process is one of collaboration, support and sharing insight. This helps to maintain the relevance of the verification regime by understanding and overcoming challenges. It also allows the verification regime to benefit from cutting edge research.

The CTBT: Science and Technology process seeks to track promising relevant innovations from the conferences through development, testing and evaluation and, where appropriate, to incorporate results into the operational systems of the Commission. Examples include the use of cross-correlation methods in the processing of large aftershock sequences, the detection and location of events using Bayesian methods applied to SHI data, improving seismoacoustic velocity models of the earth and atmosphere, and improving uncertainty measures for ATM.

Opposite: Poster presentations at the CTBT: Science and Technology 2017 conference.

The CTBT: Science and Technology 2017 conference was held in Vienna on 26-30 June 2017. Over 900 participants, including scientists, researchers, technologists, policy makers and students from more than 110 countries, attended. The event provided a forum for scientists from around the world to exchange knowledge and share advances in Treaty-relevant monitoring and verification technologies. It was the sixth and largest conference in the series thus far, with more than 100 presentations and approximately 400 posters.

Participants were able to access the conference programme through a new mobile app and a dedicated web site that was integrated with the training management system of the PTS. The mobile app provided state of the art functionality, such as live updates on ongoing events and the ability to post questions for presenters during conference sessions.

A range of hands-on interactive exhibits, including the 'OmniGlobe' with a visualization of the IMS and its applications and the virtual reality film *Collisions*, were very well received by participants. The involvement of a large contingent of members of the CTBTO Youth Group also raised the profile of the event

CTBT: SCIENCE AND TECHNOLOGY 2017 CONFERENCE

Clockwise from top: Panel discussion "Mobile Devices as Geophysical Sensors: Promising Paths and Blind Alleys", poster presentations, opening remarks by the Executive Secretary at the high level opening of the conference, sharing ideas, exhibition on hydroacoustic station HA4 in the Crozet Islands, panel discussion "The International Monitoring System: Challenges from Installation Through Certification to Sustainment of this Unique Global Network".

ON-SITE INSPECTION

HIGHLIGHTS IN 2017

Implementation of the OSI action plan for 2016-2019

Training courses in the third OSI training cycle

Design of the permanent Equipment Storage and Maintenance Facility and preparations for construction in 2018

Health, Safety and Security Training Course (Jordan).

The IMS and IDC monitor the world for evidence of a nuclear explosion. If such evidence were to be detected, the Treaty provides for concerns about possible non-compliance with the Treaty to be addressed through a consultation and clarification process. After the Treaty enters into force, States can also request an OSI, which is the final verification measure under the Treaty.

The purpose of an OSI is to clarify whether a nuclear explosion has been carried out in violation of the Treaty and to gather facts that 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 policies and procedures to be developed and inspection techniques to be validated before the Treaty enters into force. In addition, OSIs require adequately trained personnel, approved core inspection equipment, appropriate logistics and related infrastructure 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, safety and confidentiality.

Over the years, the Commission has continuously strengthened its OSI capabilities through the preparation and development of OSI elements, the conduct of field exercises and the evaluation of its OSI activities. With the conclusion and evaluation of the 2014 Integrated Field Exercise (IFE), the Commission started a new cycle of OSI development and implemented a new action plan for OSI activities in 2016-2019.

Tabletop exercise on inspection team functionality, field team functionality and search logic (Vienna).

ON-SITE INSPECTION ACTION PLAN FOR 2016–2019

Activities during 2017 focused on the implementation of the OSI action plan for 2016-2019 and initial activities of the OSI exercise plan for 2016-2020, which is derived from the review and evaluation process of the 2014 IFE. Action plan projects and exercises aim to further OSI capabilities towards the establishment of a balanced, coherent and robust verification regime when the Treaty enters into force, within an integrated PTS-wide development, testing, training and exercise framework. The plans were presented to the Forty-Sixth Session of WGB and approved by the Commission at its Forty-Sixth Session in June 2016.

The OSI action plan for 2016-2019 comprises 43 projects categorized into five categories: policy development, methodology and documentation, operations and operations support, techniques and equipment development, and inspectorate development and infrastructure development.

During 2017, six projects were successfully completed and 33 were under implementation, addressing 85% of the recommendations from previous build-up exercises (BUEs) and the 2014 IFE as contained in the OSI database of issues and lessons identified.

POLICY PLANNING AND OPERATIONS

OSI policy planning and operations efforts during 2017 were closely related to the launch and implementation of OSI action plan projects and the OSI exercise plan, including overall coordination of the action plan and the management of 13 individual projects.

Two expert meetings were organized and conducted in 2017. The first, related to inspection team functionality (ITF), field team functionality (FTF) and search logic, was held in January 2017. It involved 18 experts from 6 States Signatories and the PTS. The participants discussed the ITF manual and the standard operating procedure (SOP) on FTF as well as information led search logic and internal reporting. They also discussed the general approach and development concept of the Geospatial Information Management for OSI (GIMO) system, which is the next-generation information management system for OSI, and reviewed the concept and planning of the tabletop exercise on ITF, FTF and search logic held in November 2017 in Vienna. Recommendations from the meeting were addressed and implemented in the framework of the OSI action plan and the OSI exercise plan.

The second expert meeting, on information security related to OSIs, was held in March 2017. It brought together 25 experts from 8 States Signatories, 2 international organizations and the PTS. The participants discussed the draft policy on information security related to OSIs and risk assessment and protective measures in light of experience gained by other international organizations and PTS Divisions. They also deliberated on protection of data, integrity and authenticity of samples and media (chain of custody) in light of lessons from the 2014 IFE, and integrity and authenticity of electronic data. Other topics included classification of information, handling of highly protected information and information security measures at the base of

operations (BOO). The participants made a number of recommendations that were incorporated into the policy and implemented.

Three policy documents, on information security, health and safety, and headquarters support during OSIs, were prepared and entered the formal review process. The cross-cutting policy on headquarters support was formally approved as a QMS document. The ITF manual and SOP on FTF were updated to incorporate the recommendations and lessons from the 2014 IFE and the expert meeting on ITF, FTF and search logic. A study was launched to investigate the effects of environmental conditions on OSI operations, with the aim of developing a plan for the testing of equipment and procedures in different environments.

The formalization of OSI related operations support mechanisms within the Treaty verification regime was developed. This project has delivered new insight on the types of data and information that an inspection team will likely need during the launch phase of an OSI and on the processes to ensure that such data and information reach the inspection team in a timely manner. The concept of the Operations Support Centre (OSC) at PTS headquarters was further developed on the basis of discussions with IDC experts, lessons from the 2014 IFE and current trends in operations centre concepts. The updated concept incorporates a situation centre as a central part of the OSC.

The specifications for the GIMO system were developed on the basis of lessons from the 2014 IFE. Initial modules were tested during the tabletop exercise on ITF, FTF and search logic. The OSI Databank was installed and maintained on the OSC server cluster in the PTS computer centre. A virtual data centre has been commissioned to support multiple operating system environments.

OSI communications equipment underwent maintenance and updating, and some of it was used in training and testing activities. The automatic acquisition antenna positioner, the spectrum analyser and the repeater station were delivered to the temporary storage area. The Motorola repeater (VHF system) and associated duplexer were successfully tested during a field test of OSI telemetry equipment in Austria in September 2017. The equipment performed reliably under variable environmental conditions.

Following recommendations from OSI Workshop-23, capability gaps in the health and safety equipment portfolio were filled. A cable avoidance tool, accessories for detection of underground pipes and electrical services, equipment for atmospheric monitoring of confined spaces, medical equipment, decontamination equipment and transport containers were procured and brought into service.

ON-SITE INSPECTION EXERCISE PLAN FOR 2016-2020

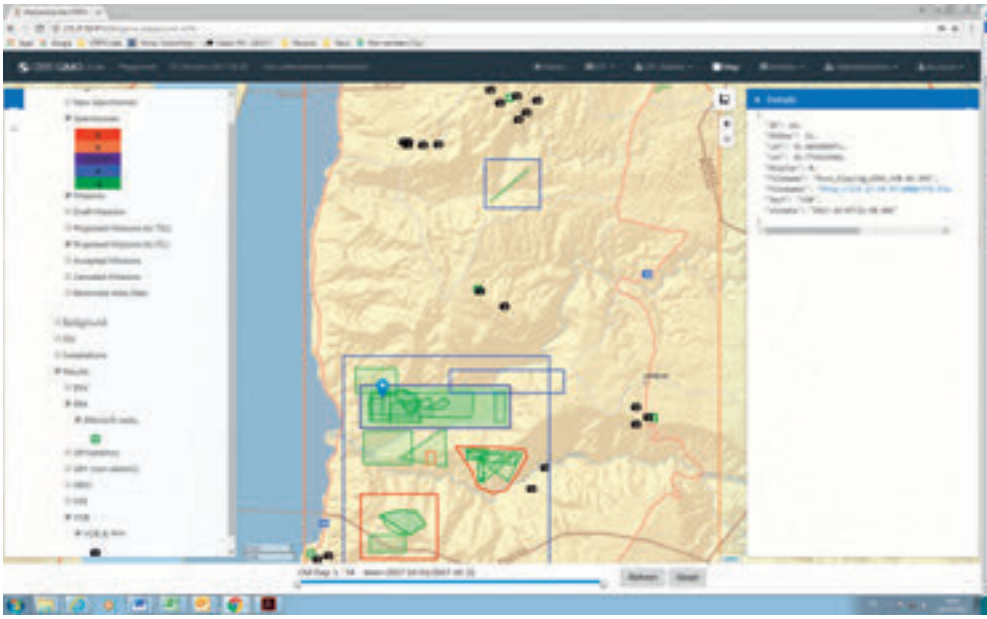
The OSI exercise plan for 2016-2020 outlined the intention of the PTS to conduct a series of exercises aimed at validating key products of projects under the OSI action plan for 2016-2019. The OSI exercise plan includes proven exercise concepts, in particular tabletop exercises and field exercises.

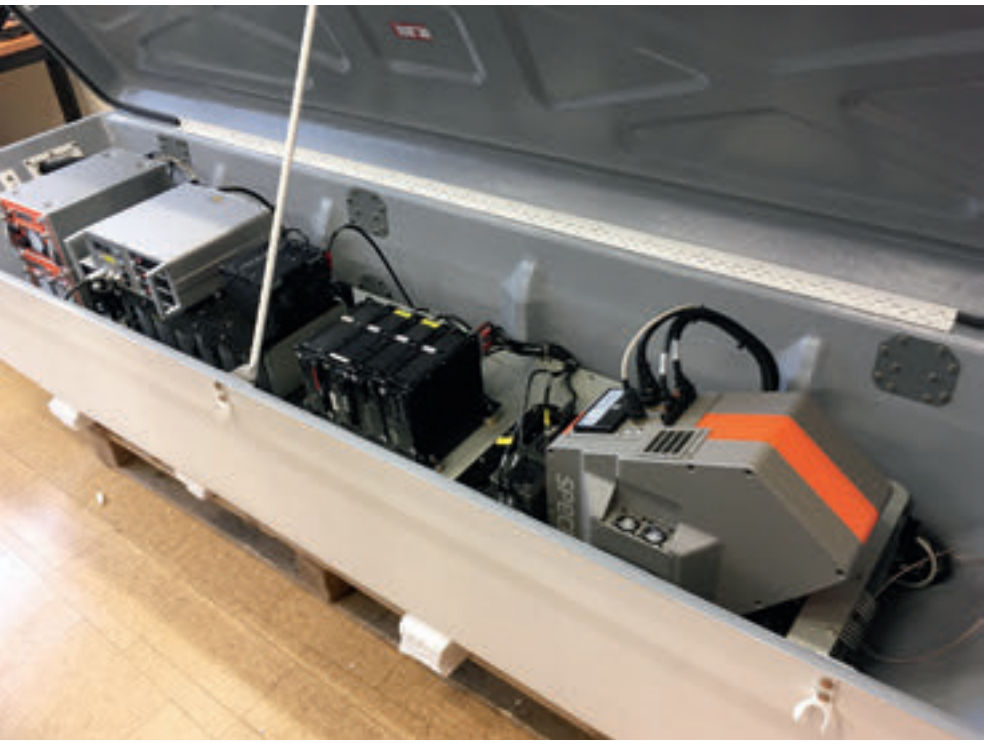
The tabletop exercise on ITF, FTF and search logic in November 2017 involved 35 experts from 19 States Signatories and the PTS, including 12 participants from the third training cycle for surrogate inspectors. The exercise served as a means to test the procedures outlined in the updated ITF manual and the SOP on FTF. It also provided an opportunity to test the initial modules of the new GIMO system.

The tabletop exercise was subject to an external evaluation by the Quality Management and Performance Monitoring (QMPM) Section of the PTS. The evaluation aimed to provide credible and evidence based information on progress made in bridging capability gaps and identifying areas where further development and training is needed. The GIMO system was found to be a clear improvement in comparison with the previous OSI information management system, and its features were well-received by participants. Recommendations and input from exercise participants will be considered in the further development of GIMO modules.

The PTS drafted a detailed concept for future BUEs to be conducted in the 2019-2020 time frame. The concept includes the principal planning approach, the main parameters of the exercises, resource and cost requirements and areas in which support from States Signatories would be welcome. The draft exercise and evaluation concepts were discussed at an expert meeting in January 2018 with a view to obtaining recommendations from States Signatories.

Screenshot from the new Geospatial Information Management for OSI (GIMO) system.





Above: Custom built mount for the airborne MSIR system. Left: Components of the airborne MSIR system.

EQUIPMENT, PROCEDURES AND SPECIFICATIONS

The implementation of OSI action plan projects related to inspection techniques and capabilities continued throughout 2017 as a means to further develop OSI equipment and associated procedures and specifications. In addition, regular operational activities in support of the programme of the Equipment and Implementation Section of the OSI Division were undertaken and significant input was provided to the third OSI training cycle.

In order to mitigate the risk of detrimental impacts on the OSI programme due to resource and operational constraints at the temporary storage area, the Commission continued to cooperate with the Austrian authorities on OSI training and exercise activities. This cooperation included use by the PTS of facilities and resources of the Austrian Ministry of Defence and Sports to facilitate the development and testing of OSI techniques, notably in the fields of OSI airborne systems and data transmission in challenging terrain.

In 2017, contributions were made to the General Assembly of the European Geosciences Union, the first meeting of the Preparatory Committee for the 2020 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), SnT2017 and the European Researchers' Night: beSCIENCEd, all in Vienna. In addition, support was provided to the open day of the United Nations Office at Geneva and to the International Noble Gas Experiment Workshop 2017 in the United Kingdom.

AIRBORNE TECHNIQUES AND VISUAL OBSERVATION

Upon invitation by Natural Resources Canada, the PTS participated in a winter field test of airborne gamma survey equipment in Ottawa on 20-24 February 2017. The PTS played a notable role in designing the activities to be conducted. The activity coincided with heavy snowfall, which resulted excellent testing conditions.

Lessons from the test informed the project on operationalization of OSIs in different environments. The results were presented at SnT2017.

As part of the implementation of EU Council Decision VI, the final configuration of components of the airborne multispectral including infrared (MSIR) system was tested and delivered to the PTS. It comprises components that are part of EU Council Decision V as well as new components including a laser scanner and a multispectral sensor. In parallel, a custom built mount for the airborne MSIR system using an external helicopter pod was engineered. The mount supports the multispectral sensor array and the ancillary position and system control devices. As a result, only a single monitor is located in the cabin, freeing space for inspectors. All devices can be shipped in the pod, reducing the overall transport footprint. Training was also provided in Vienna on the operation of the integrated system.

To facilitate the airborne and ground based acquisition of visual observation and multispectral field data and the subsequent processing of these data, two software projects were commissioned. The software is user friendly, fully compliant with the Treaty and the draft OSI Operational Manual, consistent with established procedures and workflows and fully compatible with the GIMO system.

Ground based position finding equipment and procedures were upgraded. The upgraded equipment includes four distinct subsystems that can work as a fully integrated system to meet the requirements of paragraph 69a of the Protocol to the Treaty.

A desk study on the potential of air and ground based remotely controlled autonomous systems for data gathering and in-field support activities within the context of an OSI was initiated. A technical report on the findings of the study will be issued in 2018.

GEOPHYSICAL INSPECTION TECHNIQUES

As part of the technology refreshment project for the seismic aftershock monitoring system (SAMS), a major field test and expert meeting on OSI telemetry was conducted in Austria in September 2017 to validate equipment specifications for SAMS data transmission. The field test also demonstrated the potential applications of the telemetry system for other OSI techniques, such as position finding, gamma radiation monitoring and environmental sampling, and its potential benefits for increasing the operational security of OSI equipment. This activity provided the basis for the draft concept of operations for in-field data transmission during an OSI.

Portable data transmission modems were also obtained, set up and tested. Although these modems are primarily used for the SAMS mini-arrays, they can also be utilized for other OSI techniques.

Within the project on resonance seismometry, numerical simulations of seismic wave propagation in a geological environment with features of an underground nuclear explosion (UNE) continued. The results will be used for wavefield analyses in order to understand the possibility of identifying resonance phenomena for OSI purposes.

Within the project on non-seismic geophysical techniques for shallow applications, a contract for the field testing of non-seismic geophysical inspection instruments taking into account the specifications proposed during OSI Workshop-23 was concluded. The testing results, which are expected during the first half of 2018, will not only validate the final proposed specifications but also include a list of equipment that meets these specifications.

MEASUREMENTS OF RADIOACTIVITY AND RADIONUCLIDE PARTICULATE RELATED INSPECTION TECHNIQUES

The deployment of airborne gamma survey equipment in harsh environmental conditions was practised in February 2017 in Ottawa, Canada. Two technical meetings on OSI airborne gamma radiation monitoring were held with the Austrian military authorities in August and October 2017 in Linz,

Field test of OSI telemetry equipment (Austria).

Expert meeting on OSI QMS documentation (Vienna).

Austria. The meetings focused on the development of airborne gamma radiation monitoring systems on different airframes and their ultimate certification for airworthiness.

Three high efficiency portable gamma radiation spectrometric scanners were brought into OSI operational status and used during the Visual Observation and Radionuclide Training Course in October 2017. In addition, specifications to upgrade handheld low sensitivity scanners were drafted, and the purchase of new hardware was initiated to increase the sensitivities of these units, as per the recommendations of an expert meeting on radionuclides and noble gases in 2015.

Two car borne gamma radiation survey systems provided to the PTS by Lawrence Livermore National Laboratory in the United States of America as contributions in kind were tested during a telemetry field test in Austria in September 2017. The test provided useful feedback on specifications for future upgrades of transportable radiation scanners and a better understanding of telemetry capability. OSI capabilities were also significantly increased with the delivery of two ruggedized and compact in situ high purity germanium systems that are also intended for dual use in the OSI field laboratory. Preliminary tests of these systems were conducted to establish a baseline for long term performance monitoring.

Activities supporting the action plan project on environmental sampling (which covers both radionuclide particulate and noble gas techniques) included the preparation of environmental sampling kits for OSI training events. The challenge of training a much larger group in comparison with the 2014 IFE was addressed by redesigning the configuration to deliver tools and consumables to field teams and by assembling 16 environmental sampling kits, which more than tripled the previous capacity for training or field deployment. To support improvements in the chain of custody and the automated collection of metadata for samples, compact, ruggedized and accurate global navigation units were procured for use in the field.

The first cross-calibration of a range of OSI field deployable gamma spectrometers, including sensors for airborne surveys, handheld scanners and high resolution in situ detectors, was conducted after a small scale field activity in June 2017 supported by Geological Survey Austria. In addition to better characterizing the response functions of each sensor, this exercise provided useful input for analysing flight survey data and highlighted the resources and time required for analysing field data. The results of the activity, together with airborne cross-calibration data obtained over Allentsteig, Austria, were jointly presented at SnT2017.

Supporting the OSI action plan project on the radionuclide field laboratory, three high efficiency germanium detectors were characterized for Monte Carlo simulations, allowing accurate assessment of their efficiency calibrations for specific field sampling geometries. IMS and OSI staff developed and tested work instructions for the periodic and long term assessment of their performance. An evaluation of more compact and robust cooling technology was launched in October 2017. Two units for contamination monitoring, including an automated system with sample changer, were delivered at the end of June 2017. In addition, two units for contamination screening of personnel were delivered at the end of the year. The current status and plans for the

development of quality controls for the OSI field radionuclide laboratory, work instructions and relevant quality assurance procedures were presented and discussed at an expert meeting on OSI QMS documentation in November 2017.

The transportable 20 foot container and tents that currently provide the hosting infrastructure for mobile OSI radionuclide field analysis were moved from the Vienna International Centre (VIC) to the temporary storage area in November 2017. Conceptual proposals for intermodal rapid deployment containers and modularized and extendable options were developed and evaluated by experts.

NOBLE GAS RELATED INSPECTION TECHNIQUES

Work to adapt mobile xenon and argon measurement devices for flight pods and to improve these systems commenced. Further development of the MARDS system was reviewed by the PTS and the project team of the Institute of Nuclear Physics and Chemistry of the Chinese Academy of Engineering Physics during a technical coordination meeting in September 2017.

Four new manual samplers to increase OSI noble gas sampling capacity were brought into service. Work to improve gas separation in the field for smaller and more easily transportable samples was initiated.

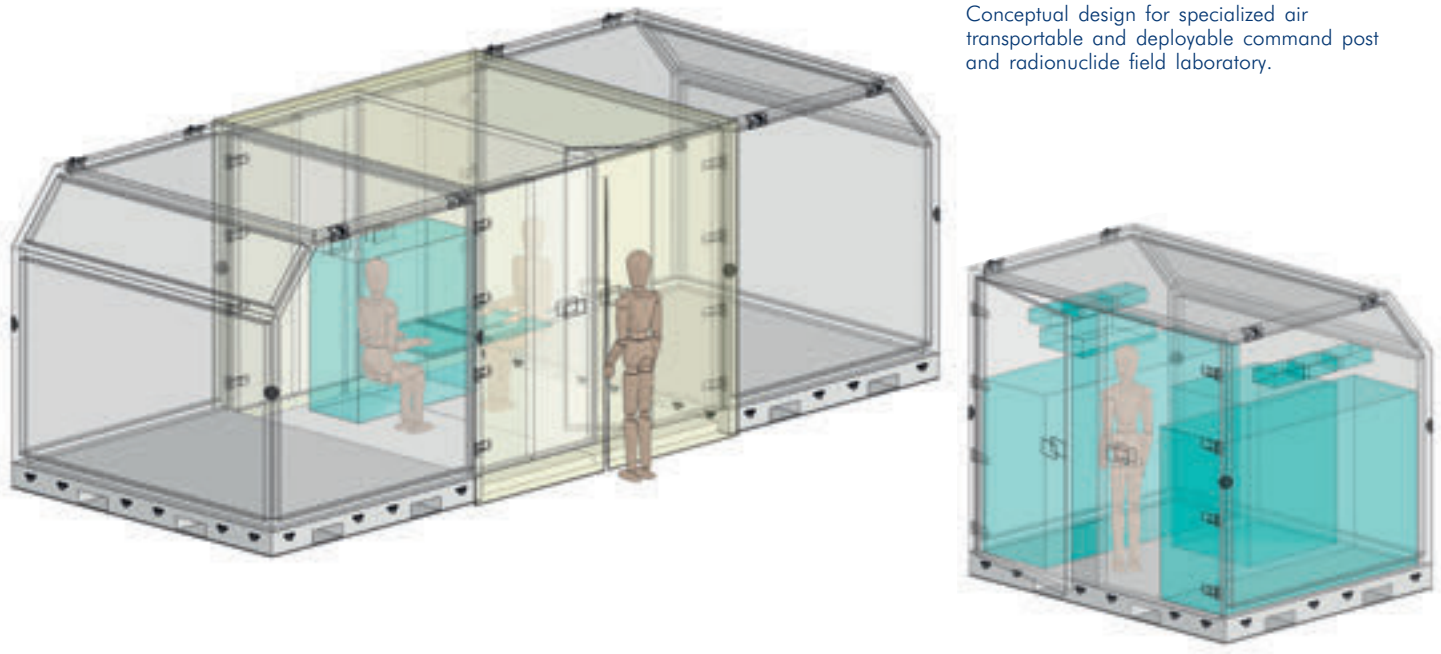
The PTS continued to cooperate on a voluntary basis with States Signatories on establishing a global radionuclide background baseline to provide a context for the analysis of noble gas data. All measurement results are in agreement with atmospheric concentrations observed thus far. The results, together with interpretation and correlation with other tracers, were presented at SnT2017.

LOGISTICS AND OPERATIONS SUPPORT

Logistics and operations support activities focused on preserving and further developing capabilities for rapid deployment and in-field operations. Scheduled maintenance, calibration and certification of all major auxiliary OSI equipment components (e.g. generator sets, uninterruptible power supplies) were routinely implemented, as were regular functionality checks of these components. This also included continuous servicing and replacement of BOO infrastructure as required to extend the life cycle of current equipment modules. A programme for the systematic and incremental upgrading of selected components is being implemented to address requirements identified in the OSI action plan projects.

All projects of the OSI action plan related to OSI logistics and operations support proceeded on schedule, with the exception of the implementation of the physical security system. However, significant progress was made, primarily in the areas of OSI rapid deployment, auxiliary equipment and security planning. In addition, substantial support was provided to training, testing and outreach activities carried out by the OSI Division and to PTS-wide efforts such as SnT2017.

The operational requirements for a comprehensive security system were outlined on the basis of parameters in the OSI policy on physical security, findings and recommendations from expert meetings on physical security and information security, and various field tests. Development of a customized, integrated, deployable security and surveillance system for OSI was initiated, with delivery and implementation of the new system expected to be completed in 2018.



Conceptual design for specialized air transportable and deployable command post and radionuclide field laboratory.

The conceptual design for specialized air transportable and deployable command post and field laboratory units was completed at the end of 2017. A comprehensive review of potential options and arrangements to ensure guaranteed access to strategic airlift capability for OSI purposes was also initiated. Testing of options for unit load devices and specialized air cargo pallets that are transportable by air was launched to assess their potential in the context of OSI deployment.

Upgrades for the BOO infrastructure, including medical and decontamination units and field warehouses, were delivered subsequent to a systematic review of operational requirements and the successful testing of high pressure softshell infrastructure elements and an improved insulation system. This new infrastructure provides significantly improved capability to deploy in challenging environmental conditions and to address gaps in operational capabilities identified during the 2014 IFE.

Gradual upgrades of some auxiliary equipment components, such as field air conditioner units, electrical distribution components and a single fuel concept for small engines, were undertaken as part of the life cycle management programme. The upgraded components improved operational capability and resulted in significant savings in terms of weight and size for more efficient transportation and handling.

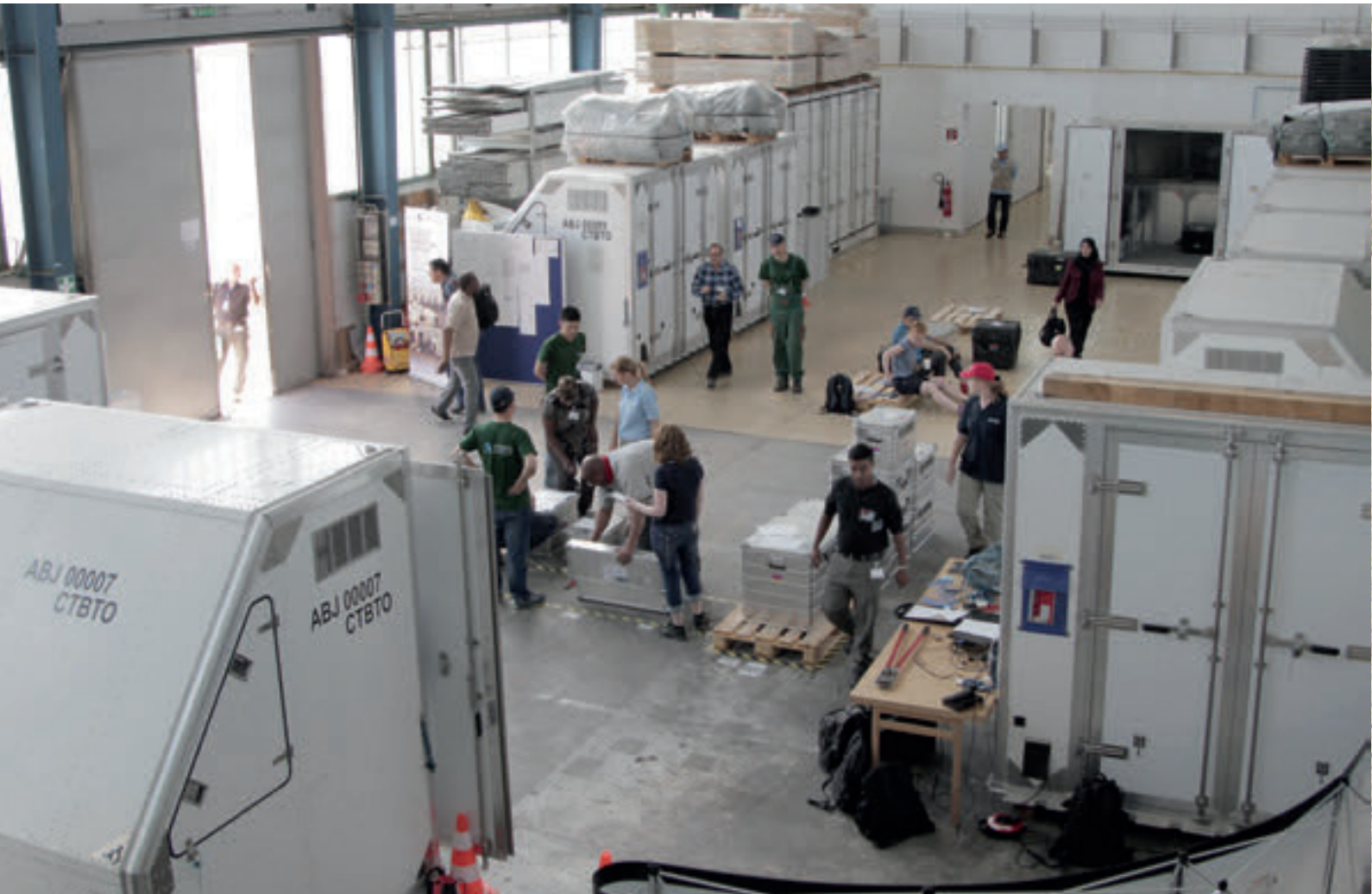
TEMPORARY STORAGE AREA AND PERMANENT EQUIPMENT STORAGE AND MAINTENANCE FACILITY

Throughout 2017, the temporary storage area provided infrastructure and logistics support to OSI programmatic activities. It also includes a testing environment simulating the working and receiving areas of an OSI BOO to allow further development and testing of OSI techniques and related data flow processes. Staff of the OSI Division continued to serve as a core part of the PTS-wide project team that manages the temporary storage area facilities and provides logistics support services.

The OSI Division continued to manage the project for the establishment of a permanent Equipment Storage and Maintenance Facility (ESMF) in Seibersdorf, Austria, for OSI and other PTS operational functions including storage, maintenance, testing and training. With external technical project support, the design was finalized and the tendering process for an independent contractor to construct the ESMF progressed to near-completion. Permit applications for the construction and operation of the facility were filed, and the lease agreement for the site on the premises of the Austrian Institute of Technology was signed.

Plans for further testing and development of the OSI radionuclide particulate and noble gas field analysis modules operating in three designated containers at the VIC were adjusted to fit with the concurrent efforts to build the permanent ESMF. The container for the radionuclide particulate field analysis module was moved to the temporary storage area and the containers for the noble gas field analysis module were returned to their owners, as this module was relocated to the OSI workshop within the VIC.

Temporary storage area (Seibersdorf, Austria).



ON-SITE INSPECTION DOCUMENTATION

Activities during 2017 involved providing support to WGB and implementing action plan projects, including further development and revision of OSI QMS documents and the conduct of an expert meeting on OSI QMS documentation.

The PTS continued to provide substantive, technical and administrative assistance to WGB in its third round of elaboration of the draft OSI Operational Manual and, based on the results of discussions at WGB, issued the updated Model Text in June 2017.

Preparations for OSI Workshop-24, to be held on 12-16 November 2018 in Southampton, United Kingdom, were initiated. Discussions will focus on OSIs in different climates and geophysical environments, events other than UNEs, events in areas beyond the jurisdiction or control of any state, and the practical and organizational challenges of mounting an OSI on the high seas.

A new work instruction on drafting OSI related policy documents was drafted, reviewed, approved and issued in March 2017. Four newly developed OSI QMS policy documents were reviewed. Subsequent to its review, the policy on headquarters support for OSIs was revised and approved. The review of three other OSI related policy documents, on physical security in relation to OSIs, information security related to OSIs and OSI health and safety, continued.

An expert meeting on OSI QMS documentation was held on 1-3 November 2017 in Vienna. A total of 29 participants from 8 States Signatories, 2 international organizations (the Organisation for the Prohibition of Chemical Weapons (OPCW), the International Atomic Energy Agency (IAEA)) and the PTS attended. The objectives of the meeting were to consider the QMS architecture as a whole as it applies to OSI QMS documentation and to review the prioritization of OSI QMS documentation requirements in relation to the key deliverables listed in the OSI action plan for 2016-2019, the projected BUEs in 2019-2020 and related training and draft OSI Operational Manual requirements.

Considerable efforts were made to coordinate the development or revision of OSI QMS documents and to ensure consistency and coherence in terminology and definitions across all documents. In addition, the SOP on the preparation of OSI Division documents was revised.

A project report on the expert review of the progress inspection report and the preliminary findings document generated during the 2014 IFE was finalized.

TRAINING

HEALTH, SAFETY AND SECURITY TRAINING COURSE OF THE THIRD TRAINING CYCLE

The Health, Safety and Security Training Course was held in Jordan on 29 January – 4 February 2017. A total of 84 participants, comprising 73 new trainees and 11 surrogate inspectors from the first and second training cycles who attended the course for refresher training, participated. Fifty-one States Signatories were represented. The primary objectives of the course

Health, Safety and Security Training Course (Jordan).

In-Field Operations Support Course (Austria).

were to familiarize participants with sound health, safety and security practices in the field and to emphasize safe work practices. The course focused on general and applied safety culture and risk management issues and provided trainees with the knowledge and skills to work safely in field conditions where radioactivity fields or contamination may be present. The programme also covered injury and illness prevention, fire prevention and response, natural phenomena hazards, emergency response, risk assessment, vehicle safety and mission planning.

IN-FIELD OPERATIONS SUPPORT COURSE OF THE THIRD TRAINING CYCLE

The In-Field Operations Support Course was held at the Austrian Armed Forces International Training Centre in Götzendorf, Austria, and at the temporary storage area on 15-19 May 2017. A total of 72 trainees representing 48 States Signatories from the 6 geographical regions defined in the Treaty took part in the activity. The purpose of the course was to provide an overview of OSI in-field operations support concepts and procedures for operational self-sufficiency throughout all phases of an OSI, with an emphasis on the pre-inspection and post-inspection phases. The training course comprised multiple training mechanisms, including e-learning, tabletop exercises, station rotations and hands-on outdoor activities, aimed at developing an inspection team that is capable of establishing its own operations support arrangements, including a BOO, and maintaining all equipment in different environmental and weather conditions.

VISUAL OBSERVATION AND RADIONUCLIDE TRAINING COURSE OF THE THIRD TRAINING CYCLE

The Visual Observation and Radionuclide Training Course took place at the Nevada National Security Site in the United States of America on 1-6 October 2017. Fifty-eight trainees representing 38 States Signatories from the 6 geographical regions defined in the Treaty participated. The course familiarized trainees with the geological, anthropogenic and radionuclide observables associated with UNEs and explored how visual observation informs the selection of radionuclide sampling locations. The course, which was conducted at a unique legacy nuclear explosive testing site, helped to bridge gaps between previous theoretical training and first-hand observation and analysis of actual observables from UNEs.

E-LEARNING DEVELOPMENT

The knowledge and training portal continued to support the activities of the third training cycle through the development of individual course homepages and the OSI e-learning library. The platform contains assessment materials, e-learning modules, background documents, logistical documents related to specific courses and an evaluation mechanism and enables users to track progress on learning activities.

Four new e-learning modules, on in-field operations support, photo and video procedures, radionuclide techniques, and point of entry procedures, were developed in 2017. These resources were used as preparatory learning materials for the activities of

the third training cycle. A USB stick containing the complete set of modules in the OSI e-learning library was developed and distributed to participants, providing the option to use the modules offline and in low bandwidth situations. Users can also track their progress offline and synchronize their scores on the knowledge and training portal when an Internet connection is established.

TRAINING EVENT REGISTRATION MECHANISM, ON-SITE INSPECTION INSPECTORATE DATABASE AND CALL-UP MECHANISM

The integration of the OSI inspectorate database with the services, training and management system and the conference, training and workshop registration platform commenced in 2017. Legacy data from the previous inspectorate database was migrated to the services, training and management system test environment to assess compatibility and to determine the requirements for further developments to support the functionality requirements of the OSI inspectorate database. The first phase of the project, which comprised updating the services, training and management system and the conference, training and workshop registration platform to allow for an electronic registration mechanism for OSI Division activities, was completed in 2017. This new mechanism was used to support the processing of nominations and registrations for OSI Regional Introductory Course 23.

ON-SITE INSPECTION E-TRAINING SYSTEM

Developers of the OSI e-training and simulation system from the All-Russia Research Institute of Automatics continued work on the prototype system. They presented a preliminary design which allows synthesized data from the e-training simulation system on gravity measurements, magnetic fields and gamma radiation to be visualized in OSI information management tools. The OSI Division received a data simulation module capable of creating background fields for gamma radiation, magnetic field mapping and gravitational field mapping as well as a mechanism for integrating these data models into the GIMO system.

The integration of the data simulation module allows for additional training scenarios with OSI operational tools such as remote familiarization and refresher training. This module also provides the possibility of developing various OSI scenarios with realistic data for classroom based training. Development of a prototype three dimensional system that simulates the daily operations cycle of an individual inspector and utilizes data simulation models for conducting virtual field missions continued.

THE RESPONSE OF THE VERIFICATION SYSTEM TO THE ANNOUNCED NUCLEAR TEST BY THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

Press briefing on 3 September 2017 (Vienna).

Capturing the evidence of nuclear tests and providing timely data and data analysis to States Signatories is at the core of the mission of the CTBTO.

The readiness of the Commission to fulfil this mission was again tested in 2017, with the announced nuclear test by the Democratic People's Republic of Korea on 3 September. Prior to 2017, the Democratic People's Republic of Korea had conducted five nuclear tests: one each in 2009, 2011 and 2013, and two in 2016.

With a body wave magnitude of 6.1, the 2017 test was significantly larger than all previous tests. Several aftershocks were recorded, the largest of which occurred 8.5 minutes after the announced test and had a body wave magnitude of 4.1. Since then, several other aftershocks have continued to be recorded by the IMS and analysed by the IDC. The performance of the IMS and the IDC indicates that these capabilities are reaching full maturity for routine operations and are ready for post-entry into force conditions.

ANNOUNCED NUCLEAR TEST IN 2017

Meeting of the Preparatory Commission on 4 September 2017, following the announced nuclear test by the Democratic People's Republic of Korea on 3 September 2017.

The announced test was detected by the IMS facilities. The data were shared with States Signatories in near real time. States Signatories received automatic and reviewed products in accordance with the draft IDC Operational Manual. The Standard Screened Event Bulletins were issued within post-entry into force time lines.

All automatic standard event lists (SEL1, SEL2 and SEL3) were issued. These provided analysts with a good starting point to further refine automatic solutions.

To report on the 3 September 2017 event, the REB used data from 125 seismic, hydroacoustic and infrasound stations, ranging in distance from 4 degrees (PS37, Russian Federation and PS31, Republic of Korea) to 165 degrees (PS1, Argentina). This includes two hydroacoustic stations (HA1, Australia, and HA11, United States of America) which recorded primary seismic waves and one infrasound station (IS46, Russian Federation) which recorded both seismic and infrasonic waves. Data from 104 IMS stations were used to compute the location. The area of the error ellipse was 110 km^2, well within Treaty requirements for an OSI. The body wave magnitude was determined to be 6.1.

Figure 1 shows the primary seismic, auxiliary seismic, hydroacoustic and infrasound stations of the IMS that detected the event on 3 September 2017.

Figure 2 shows the REB error ellipse for the announced nuclear test on 3 September 2017 compared with the error ellipses from all previous announced tests.

Figure 3 shows a comparison of the waveforms for all six announced nuclear tests by the Democratic People's Republic of Korea. The scale is uniform and emphasizes the much larger amplitude recorded for the test on 3 September 2017.

The event in 2017 was large enough to be detected by a sufficient number of stations for its explosion characteristics to be clearly seen on the basis of the data from the seismic stations alone. It was classified as having non-earthquake characteristics in the Standard Screened Event Bulletin. The large aftershock shortly following the announced test was classified as a having earthquake characteristics.

Atmospheric scientists at the IDC conducted transport calculations using meteorological forecast models from the National Centers for Environmental Prediction to predict when particulate and noble gas emissions from the location determined by the seismic analysis would reach the IMS radionuclide stations. At the time of this report, no unambiguous correlation between the seismic recording of the test and radionuclide observations had been made.

The PTS is developing a set of tools for special analysis of selected events. Among these tools is a cross-correlation based technique to refine the REB location relative to a master event. The technique determines relative locations of events with respect to each other. This was used to locate the main aftershock that occurred 8.5 minutes after the announced test (Figure 4).

In response to the announced test, the PTS held technical briefings for States Signatories to discuss the findings of the verification system. The Commission thanked the PTS for its timely response to the events and its technical briefings. It also expressed satisfaction with the performance of the verification regime of the Treaty.

During the meetings, States Signatories made statements presenting their national positions. States condemned the tests, expressing grave concern over the serious negative effect of such tests on international peace and security and rejecting any and all nuclear explosive tests. They called on the Democratic People's Republic of Korea to refrain from any further nuclear tests and re-emphasized the importance and urgency of the entry into force of the Treaty.

A press conference was also held, and relevant information was disseminated to the media and on the public web site and social media platforms of the Commission.

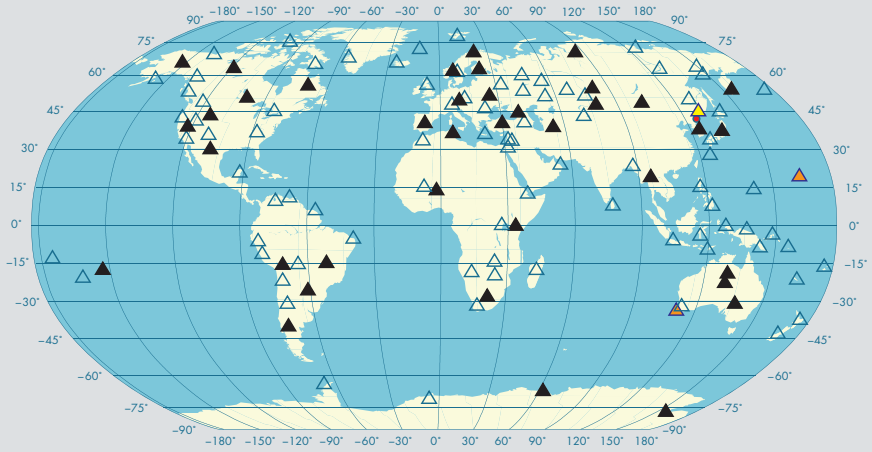


Figure 1. IMS stations that detected the seismic event on 3 September 2017. Black triangles represent primary seismic stations. Empty triangles represent auxiliary seismic stations. Orange triangles represent hydroacoustic stations. Yellow triangles represent infrasound stations. The red dot shows the location of the event.

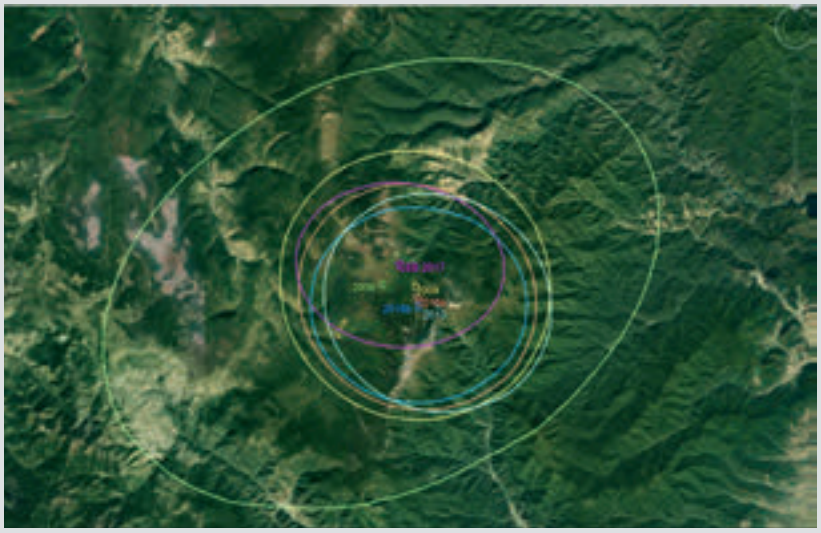


Figure 2. REB error ellipse for the announced nuclear test on 3 September 2017 compared with the REB error ellipses from the five previous announced nuclear tests. The area of the ellipse for the 3 September 2017 event is 110 km^2.

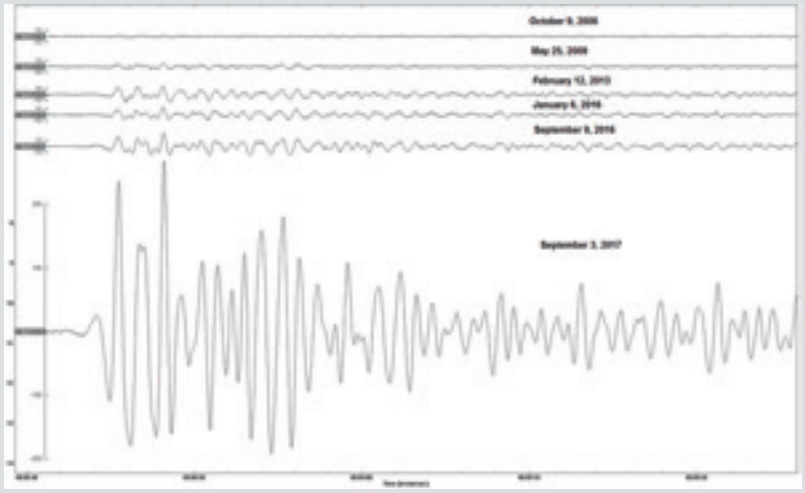


Figure 3. Waveform comparison for station AS59 (Kazakhstan) showing the waveforms filtered between 0.6 Hz and 4.5 Hz for all six announced nuclear tests.

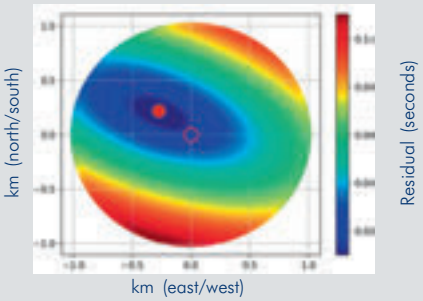


Figure 4. Estimate of the relative locations of the announced test (open circle in centre of figure) and the aftershock that occurred 8.5 minutes afterwards (red circle, north-west of the main event).

IMPROVING PERFORMANCE AND EFFICIENCY

HIGHLIGHTS IN 2017

Further development and consolidation of the Quality Management System

Enhancement of the performance reporting tool and refinement of the key performance indicators

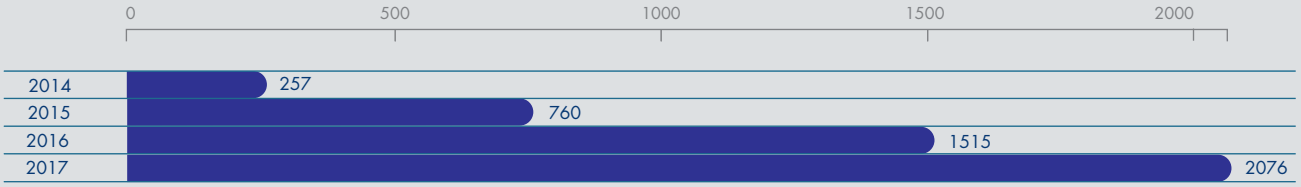
Technical evaluation of IDC Progressive Commissioning and the OSI tabletop exercise

Evaluation Week 2017 (Vienna).

At all stages of the process of establishing the Treaty verification system, the Commission aims for effectiveness, efficiency, client (i.e. States Signatories and NDCs) orientation and continual improvement through the implementation of its QMS. The implementation of the QMS is meant to ensure that work to establish the verification regime complies with the requirements of the Treaty, its Protocol and relevant Commission documents.

Establishing the QMS is a continual process towards the fulfilment of the goals and objectives set out in the Quality Policy of the Commission and, in particular, instilling a quality culture in the PTS.

QMS DOCUMENT REPOSITORY 2014–2017



QUALITY MANAGEMENT SYSTEM

To ensure continuous provision of high quality products and services, the Commission pursued further improvement of the QMS in 2017. The QMS is a living system that can be adjusted in line with the emphasis placed by the Commission on the needs of States Signatories and NDCs and on continual improvement.

Advances were made in promoting the QMS and staff awareness of the use of QMS products. The procedure for controlling and coding QMS documents was consolidated, and use of the document management system significantly increased. With more than 2000 documents filed, the QMS provides the functionality to univocally locate the latest approved versions of documentation.

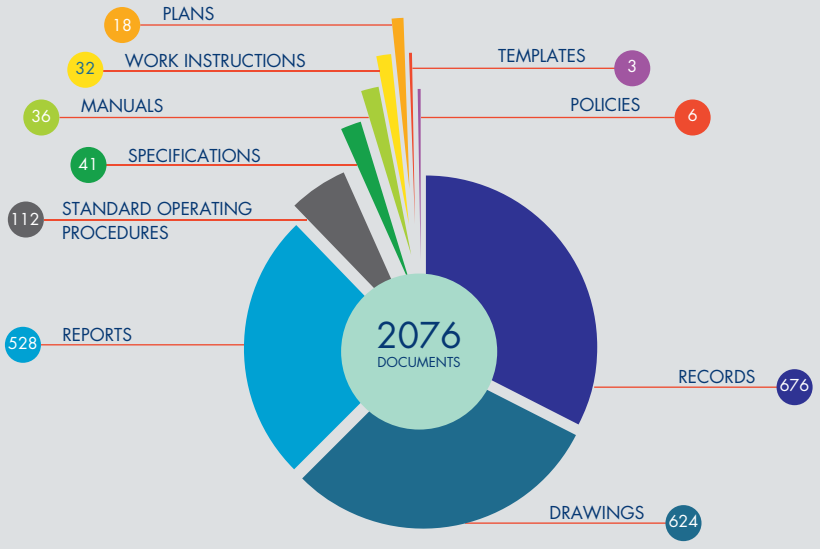
The Commission continued to consolidate a glossary of terms related to the QMS. The PTS provided States Signatories with an updated Glossary of CTBT Verification Related Terms in 2017. The compilation contains all of the terms in the glossaries of the draft IMS and IDC Operational Manuals and the Model Text for the draft OSI Operational Manual. It also includes terms from glossaries in PTS Information Papers and Task Leader documents. Work on a supplement to the glossary aimed to establish a common vocabulary continued as an ongoing activity associated with the development of the QMS.

The Quality Policy of the Commission emphasizes client orientation. Therefore the Commission continued to prioritize feedback from NDCs, which are the main users of its products and services, and to encourage NDCs to relay questions through the established channels and to review the implementation of recommendations during follow-up sessions in workshops.

The PTS continued to monitor the implementation of recommendations from NDC workshops and issued an updated report on the status of the implementation of recommendations from previous workshops, including the agreements reached during follow-up sessions.

Following the conclusion of the 2016 Quality Management Workshop organized by the PTS, the QMPM Section prepared a report on the workshop implementation, discussions, conclusions and recommendations and presented it to WGB. The workshop aimed to review progress and gather feedback on the implementation of the QMS, to improve understanding among its users, and to ensure that the system is applied and continues to fulfil its purpose.

NUMBER OF QMS DOCUMENTS BY CATEGORY IN 2017



PERFORMANCE MONITORING

The PTS continued to enhance the performance reporting tool (PRTool). The new version released in 2017 included three new metrics, on timeliness of radionuclide particulate and noble gas RRRs and REB timeliness. All three metrics were aligned with the key performance indicators set out in the Programme and Budget for 2016-2017. Documentation accompanying the new version includes revisions of the Process Metrics Manual to ensure full consistency between the definitions of the metrics and the reported information.

The PTS continued to use PRTool for performance monitoring and assessment of the quality of processes, data and products related to the

development and provisional operation of the verification regime.

Work continued on the integration of the Evaluation Information Management System, which is the OSI recommendations tracking module, and the CTBTO Organizational Management Programme Achievement Status System project management tool. This includes establishment of a 'test instance' for training and demonstration purposes and the corresponding user manuals.

EVALUATION

The technical evaluation report on Experiment 1 of the IDC Progressive Commissioning Plan was issued. The evaluation comprised a review of performance monitoring results, a review of related documentation, and the use of survey questionnaires, spot checks and interviews. A total of 74 recommendations were issued. The recommendations and lessons learned from the evaluation of Experiment 1 will help the IDC improve its procedures, documentation and testing capabilities.

In preparation for Experiment 2 on 18-29 September 2017, the QMPM Section developed an evaluation framework to provide an overarching instruction to the evaluation team and to set out the details for the comprehensive evaluation. Four external evaluators were involved in the evaluation of Experiment 2. The QMPM Section began analysing the information and drafting its evaluation report upon completion of the experiment.

An evaluation framework was also developed in preparation for the evaluation of the OSI tabletop exercise on ITF, FTF and search logic held in November 2017.

The Commission hosted and co-organized the United Nations Evaluation Group event "2017 Evaluation Week" with the IAEA, the United Nations Industrial Development Organization (UNIDO) and the United Nations Office on Drugs and Crime (UNODC). Approximately 140 participants representing 52 United Nations organizations attended the event.

A joint meeting of the evaluation and internal audit functions of the Commission, the IAEA and the OPCW was held at the VIC on 27 June 2017. The meeting aimed at exchanging good practices and lessons on quality management systems and evaluation and internal audit activities.

INTEGRATED CAPACITY DEVELOPMENT

HIGHLIGHTS IN 2017

Increased capacity development activities

Ensuring integration of NDC capacity building with policy and educational outreach activities

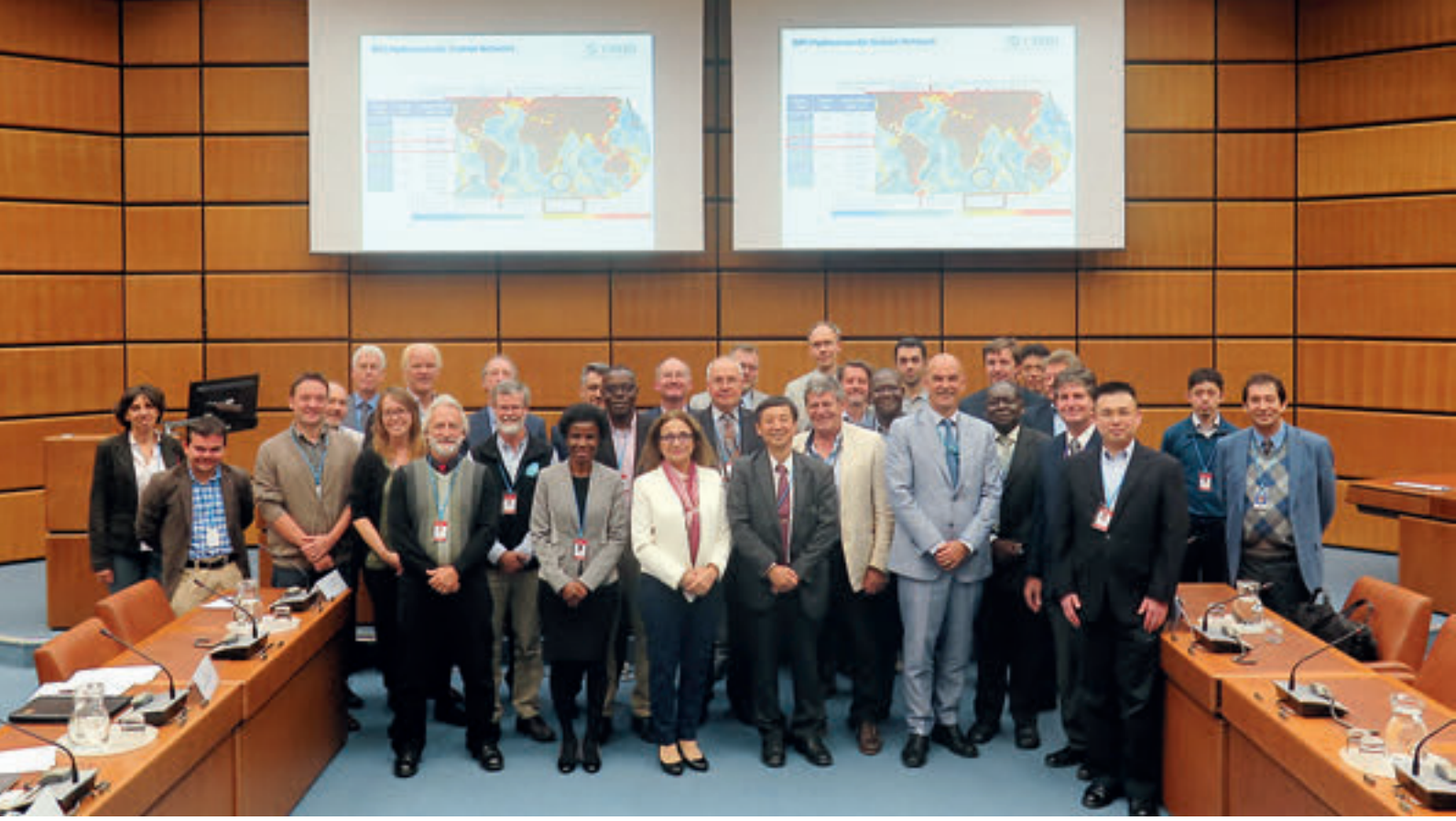
Further development of e-learning

Technical training for station operators.

The Commission offers States Signatories training courses and workshops on technologies associated with the three pillars of the verification regime – the IMS, the IDC and OSI – as well as on the political, diplomatic and legal aspects of the Treaty. These courses help to strengthen national scientific and decision making capabilities in relevant areas and assist in developing capacities in States Signatories to effectively confront the political, legal, technical and scientific challenges facing the Treaty and its verification regime.

In some cases, the Commission provides equipment to NDCs to increase their capacity to participate actively in the verification regime by accessing and analysing IMS data and IDC products. There is a need to update the knowledge and experience of national experts as technologies expand and improve. By enhancing the technical capabilities of States Signatories, these activities empower all stakeholders to participate in the implementation of the Treaty and to enjoy the civil and scientific benefits of its verification regime.

Training courses are held at the Commission headquarters in Vienna and at other locations, often with the assistance of hosting States. The capacity building programme is funded through the Regular Budget of the Commission and through voluntary contributions. All training activities have a well-defined target group, offer detailed content, and are complemented by the educational platform and other outreach activities to the broader scientific community and civil society.



International Hydroacoustic Workshop 2017 (Vienna).

INTEGRATED CAPACITY DEVELOPMENT

The Commission offered States Signatories a wide range of training courses and workshops aimed at strengthening capacities in areas relevant to the Treaty. Capacity development activities also included the provision of hardware and software to NDCs, especially those in developing countries, enabling them to access and analyse IMS data and IDC products.

Integrated capacity development and training activities in 2017 included 9 NDC training events, 11 station operator courses, 7 technical meetings/workshops, 2 NDC workshops, SnT2017 and an OSI Regional Introductory Course, as well as the participation of experts from developing countries in official technical meetings of the Commission.

The East Asia Regional NDC Workshop was held on 7-11 August 2017 in Hanoi, Viet Nam. Thirty-one experts from 11 States Signatories and the PTS attended the workshop, which focused on strengthening knowledge of the CTBT and the work of the Commission in order to build capacity of States Signatories in the region.

The International Hydroacoustic Workshop was held on 11-13 September 2017 in Vienna. Thirty-five experts from 18 States Signatories and the PTS attended the workshop, which covered three aspects of hydroacoustic monitoring of the CTBT: technological advancements in marine engineering, signal processing methods, and civil and scientific applications of IMS data and IDC products.

The Infrasound Technology Workshop was held on 23-27 October 2017 in Tromsø, Norway. Over 85 experts from 32 States Signatories and the PTS attended the workshop, the purpose of which was to create an international forum for presenting and discussing recent advancements in infrasound research and the operational capabilities of global and regional networks. The programme featured a visit to infrasound station IS37 in Bardufoss and, for the first time, a special session on atmospheric and space sciences that exhibit potential synergies with infrasound technology.

The Regional Seismic Travel Time Workshop was held on 13-17 November 2017 in Windhoek, Namibia. Thirty-four experts from 21 States Signatories and the PTS attended the workshop, the objectives of which were to strengthen knowledge of the CTBT and the work of the Commission, to build national and regional capabilities in implementing the Treaty and participating in the verification regime, to promote the civil and scientific applications of the verification technologies and to share data and develop the regional seismic travel time model in Africa through the acquisition of ground truth seismic locations.

The International Noble Gas Experiment Workshop was held from 27 November to 1 December 2017 in the United Kingdom. Approximately 100 experts from 26 States Signatories and the PTS attended the workshop, the purpose of which was to present and evaluate the most recent advances in noble gas monitoring in support of the CTBT. A major area of discussion was the acceptance process for new IMS noble gas monitoring systems.

Activities under the EU Council Decision VI project for 2016-2017 continued supporting capacity building in the South East Asia, the Pacific and the Far East and the Middle East and South Asia regions. PTS capacity building and training activities in all regions included advanced training courses in Vienna and expert visits in the field for on the job training.

The PTS installed three sets of basic NDC equipment to increase the capacity of States Signatories to participate fully in the verification regime and to enhance their civil and scientific activities by obtaining, analysing and reporting on IMS data and IDC products. Planning was initiated for the installation of another four sets in 2018. A technical maintenance plan for these capacity building systems was also launched.

Approximately 120 participants subscribed to the NDC e-learning course on access to and application of IMS data and IDC products in 2017.

A pilot training course for NDCs on infrasound data analysis was held on 4-8 December 2017 in Vienna. The new version of the NDC in a box virtual machine that was made available to NDCs in October 2017 was used during the course, which also included a component on the NPE. The upgraded virtual machine provides the capability to process data from IMS hydrophone stations in addition to SHI data.

ON-SITE INSPECTION REGIONAL INTRODUCTORY COURSE

Preparations for the OSI Regional Introductory Course 23 for the Latin America and the Caribbean geographical region were finalized. The objectives of the course, to be held in April 2018, are to acquaint national technical experts and personnel with the OSI regime, to broaden the pool of regional experts for participation in OSI related activities and to identify potential candidates for the roster of surrogate inspectors. The programme includes brief lectures, hands-on training, equipment demonstrations, tabletop exercises and a two day field exercise.

PARTICIPATION OF EXPERTS FROM DEVELOPING COUNTRIES

The Commission continued to implement the project to facilitate the participation of experts from developing countries in its official technical meetings. The aims of this project, which was initiated in 2007, are to strengthen the universal character of the Commission and to build capacity in developing countries. In November 2015, the Commission extended the project for three years (2016-2018), subject to the availability of sufficient voluntary contributions. A detailed annual report on the status of implementation of the project was issued in November 2017.

In 2017, the project supported the participation of experts from 12 States: Argentina, Ecuador, Iraq, Madagascar, Morocco, Myanmar, Namibia, Nepal, Niger, the Sudan, Tunisia and Viet Nam. These experts took part in the Forty-Eighth and Forty-Ninth Sessions of WGB, including formal meetings and meetings of the expert groups. They also benefitted from technical discussions with the PTS on key verification related issues.

Since its inception in 2007, the project has supported 42 experts from 35 States, including 13 women. Ten of these States are or were least developed countries. The participants came from 11 States in Africa (Algeria, Burkina Faso, Ethiopia, Kenya, Madagascar, Morocco, Namibia, Niger, South Africa, the Sudan, Tunisia), 1 in Eastern Europe (Albania), 8 in Latin America and the Caribbean (Argentina, Bolivia, Brazil, the Dominican Republic, Ecuador, Mexico, Paraguay, Peru), 6 in the Middle East and South Asia (Iraq, Jordan, Kyrgyzstan, Nepal, Sri Lanka, Yemen) and 9 in South East Asia, the Pacific and the Far East (Indonesia, Mongolia, Myanmar, Papua New Guinea, the Philippines, Samoa, Thailand, Vanuatu, Viet Nam).

Voluntary contributions from China, Germany, Kazakhstan, Turkey and the United Kingdom were used to finance the project in 2017, and part of these funds was carried over to 2018. The Commission continues to seek additional voluntary contributions to ensure the financial sustainability of the project.

Technical training for station operators.

OUTREACH

HIGHLIGHTS IN 2017

Growing high level engagement with States

Comprehensive public and media outreach strategy

Active involvement of youth in outreach activities

Exhibit at the World Science Forum (Jordan).

The outreach activities of the Commission aim to encourage the signature and ratification of the Treaty, enhance understanding of its objectives, principles and verification regime and of the functions of the Commission, and promote the civil and scientific applications of the verification technologies. These activities entail interaction with States, international organizations, academic institutions, the media and the general public.

Side event on enhancing the role of the CTBT in the NPT review process during the Preparatory Committee for the 2020 Review Conference of the Parties to the NPT (Vienna).

TOWARDS ENTRY INTO FORCE AND UNIVERSALITY OF THE TREATY

The CTBT will enter into force when it is ratified by the 44 States listed in Annex 2 of the Treaty. These 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. Eight of the 44 States have not yet ratified.

As of 31 December 2017, 183 States had signed and 166 States had ratified the Treaty, including 36 Annex 2 States.

Despite the lack of ratifications by the remaining eight Annex 2 States, the Treaty is already widely considered to be an effective instrument of collective security and an important pillar of the nuclear non-proliferation and disarmament regime. Political support for the Treaty, for its urgent entry into force and for the work of the Commission continued to be strong in 2017. This was shown by the emphasis placed on the Treaty at numerous high level events and by many senior governmental officials and non-governmental leaders.

An increasing number of States, key decision makers, international and regional organizations, and representatives of civil society participated in activities aimed at advancing further ratifications of the Treaty, including by the remaining Annex 2 States. The Commission conducted consultations with many of the States that had not yet ratified or signed the Treaty.

GROUP OF EMINENT PERSONS AND CTBTO YOUTH GROUP

The Group of Eminent Persons was established by the Executive Secretary in 2013 to advance entry into force of the Treaty. The group examines political and technical developments related to the CTBT and identifies concrete action and new initiatives that could be explored to accelerate entry into force of the Treaty.

Twenty years after the opening for signature of the CTBT, it is clear that entry into force and implementation will be in the hands of the next generation of leaders and policy makers. Therefore the CTBTO Youth Group was launched in 2016.

The objectives of the Youth Group are to revitalize the discussion around the CTBT among decision makers, academia, students, expert society and the media; to raise awareness of the importance of the nuclear test ban; to build a basis for knowledge transfer to the younger generation; to involve new technologies in the promotion of the CTBT (social media, digital visualization, interactive means of delivering information); and to place the CTBT on the global agenda.

Since its launch in 2016, the Group has grown to approximately 400 members. A considerable number of its members come from the Annex 2 States whose ratification is needed for the CTBT to enter into force.

Revitalizing the discussion around the CTBT, the Youth Group members participated in SnT2017 and were active on the sidelines of the United Nations General Assembly, the tenth Article XIV conference and the 8th World Science Forum. They also organized a side event in connection with the Preparatory Committee for the 2020 Review Conference of the Parties to the NPT on enhancing the role of the CTBT in the NPT review process.

Youth Group members have also worked on developing regional strategies for promoting CTBT universalization and ratification, notably during the CTBTO Youth Group Conference in Moscow in October 2017.

The group is open to all students and young graduates who are directing their careers to contribute to global peace and security and who wish to actively engage in promoting the CTBT and its verification regime.

Videos posted by CTBTO Youth Group members
on the Youth Newsroom of the CTBTO public web site.

YOUTH FOR CTBT

Youth Group members interview Executive Secretary Zerbo

Youth makes an impact at #Snt2017

UBC #CTBT Countdown Challenge

Shizuka Kuramitsu, Japan

Bronwyn McCarter, Canada

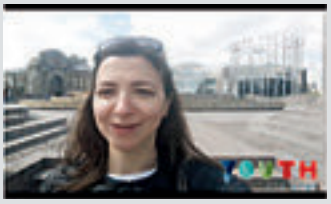
Christopher Cruz & Lesly Tobon, USA

Sweta Basak, India

Muhammad Qasim, Pakistan

Veronika Ruskova, Canada

Deepak Raj Shah, Nepal



Natalia Zhurina, Russia

Juan Bustamante, Ecuador

Rizwan Asghar, Pakistan

Lyhen Tan, Cambodia

Alan Juarez, Mexico

Veronica Tjokro, Indonesia

Peace ceremony in Hiroshima, Japan, August 2017.

INTERACTING WITH STATES

The Commission continued efforts to facilitate the establishment of the verification regime and to promote participation in its work. It also maintained a dialogue with States through bilateral visits in capitals and interaction with Permanent Missions in Berlin, Geneva, New York and Vienna. A major focus of such interaction was on States that host IMS facilities and States that have not yet signed or ratified the Treaty, in particular those listed in Annex 2.

The Executive Secretary increased his proactive high level engagement with States to promote the Treaty, advance its entry into force and universalization, and promote the use of the verification technologies and data products.

The Executive Secretary participated in several bilateral meetings and other high level events at which he met several heads of State and Government. These included Federal President Alexander Van der Bellen of Austria, President Roch Marc Christian Kaboré of Burkina Faso, and Prime Minister Mahammad Boun Abdallah Dionne of Senegal.

During his visits and in Vienna, the Executive Secretary also met with several foreign ministers and other ministers of States Signatories and observers. They included the foreign ministers of Belarus, Ecuador, the Islamic Republic of Iran, Japan, Finland, France, Namibia, the Russian Federation, Slovakia, Slovenia, Sweden, Kazakhstan, Tunisia and the High Representative of the European Union for Foreign Affairs and Security Policy. He also met the Minister of Science and Technology of Angola; the Minister for Emergency Situations of Belarus; the Minister of Energy of Burkina Faso; the Minister and the Deputy Minister of Science, Technology and the Environment of Cuba; the Vice-Minister of Foreign Affairs, Regional Integration and International Cooperation of Ecuador; the State Minister for Foreign Affairs of Japan; the Deputy Minister of Foreign Affairs of Kazakhstan; the First Deputy Minister on Multilateral Matters of Romania; the Deputy Minister of Foreign Affairs of the Russian Federation; the Minister of Higher Education and Research of Senegal; the Undersecretary of Foreign Affairs of Uruguay and the Governor-General of Australia.

In addition, the Executive Secretary met other senior government representatives from the following States Signatories and observers: Brazil, China, Germany, Japan, Nepal, the Netherlands, the Republic of Korea, South Sudan and the United States of America.

Promoting parliamentary engagement, the Executive Secretary also met the speakers of the Parliaments of Burkina Faso, the Islamic Republic of Iran and Kazakhstan, as well as members of the Parliaments of the Russian Federation and Thailand.

OUTREACH THROUGH THE UNITED NATIONS SYSTEM, REGIONAL ORGANIZATIONS, OTHER CONFERENCES AND SEMINARS

The Commission continued to take advantage of global, regional and subregional conferences and other gatherings to enhance understanding of the Treaty and to advance its entry into force and the build-up of the verification regime. The Commission was represented at meetings of the IAEA, the Inter-Parliamentary Union, the Agency for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (OPANAL), the 2017 Preparatory Committee for the 2020 Review Conference of the Parties to the NPT, the North Atlantic Treaty Organization, the OPCW, the United Nations General Assembly and its First Committee, UNIDO, UNODC, the Tokyo International Conference of African Development and the World Science Forum.

During these meetings and conferences, the Executive Secretary met with a number of heads and other senior officials of international and regional organizations including the Secretary-General of OPANAL, the Director-General of the OPCW and the Secretary-General and the High Representative for Disarmament Affairs of the United Nations.

In September 2017, the Executive Secretary attended the commemoration of the twentieth anniversary of UNODC at the VIC.

In April 2017, the Executive Secretary attended the commemorative ceremony and related events marking the twentieth anniversary of the Chemical Weapons Convention and the OPCW in The Hague, Netherlands.

In August 2017, the Executive Secretary participated in the opening ceremony of the Low Enriched Uranium Bank, which was held on the International Day against Nuclear Tests in Astana, Kazakhstan.

Top: CTBTO Youth Group side event during the Preparatory Committee for the 2020 Review Conference of the Parties to the NPT (Vienna). Middle and bottom: CTBTO Youth Group Conference (Moscow).

World Science Forum (Jordan).

In December 2017, the Executive Secretary met with the Secretary General of the International Organisation of la Francophonie in Paris, France.

The Executive Secretary also attended several conferences, meetings and seminars, where he gave keynote speeches or participated in panels or discussions on the Treaty. During these events, the Executive Secretary met with a number of prominent figures from academia, leading think tanks and other non-governmental entities.

PUBLIC INFORMATION

During 2017, the public web site and social media outlets of the CTBTO averaged more than 205 000 visits per month. The Commission also continued to expand its presence on YouTube, Facebook, Twitter and Flickr.

The 42 videos that were added to the CTBTO YouTube channel in 2017 attracted over 100 000 views. Among the most viewed videos were those from SnT2017 as well as the media briefing following the announced nuclear test by the Democratic People's Republic of Korea. The Public Information Section also released several videos related to the installation of hydroacoustic station HA4 in the Crozet Islands (France).

SnT2017 generated much attention on social media and online. The conference was among the top trends on Twitter in Vienna in June (#SnT2017). Active participation of CTBTO Youth Group members in the conference and content on the Youth Newsroom of the public web site generated significant interest. Interactive exhibits at SnT2017, such as the OmniGlobe and an exhibit on the installation of hydroacoustic station HA4, were very popular.

The most newsworthy stories of the year – on the announced nuclear test, SnT2017 and the contribution of the organization to the search for the Argentinian submarine *ARA San Juan* – highlighted the technical capabilities and effectiveness of the verification regime. These events generated a considerable level of interest in the work of the organization and requests for more detailed information about its activities.

The CTBTO Youth Group was another 2017 highlight, in particular because of the new Youth Newsroom on the public web site, its contribution to SnT2017 and the first CTBTO Youth Conference in Moscow. The conference brought together nationals of seven of the eight remaining Annex 2 States and was widely covered by Russian media.

The year 2017 also offered numerous opportunities to present exhibits on the work of the Commission at a wide range of external meetings, conferences and similar events such as the Global Platform for Disaster Risk Reduction (Mexico), the World Science Forum (Jordan), TEDx Adventures (Vienna), the Long Night of Research (Vienna), the Carnegie International Nuclear Policy Conference (Washington, DC), the Preparatory Committee for the 2020 Review Conference of the Parties to the NPT (Vienna) and the Open Day of the United Nations Office at Geneva.

GLOBAL MEDIA COVERAGE

Global media coverage of the Treaty and its verification regime remained high, with more than 1360 articles and citations in online media. These included interviews with the Executive Secretary by Xinhua News Agency,

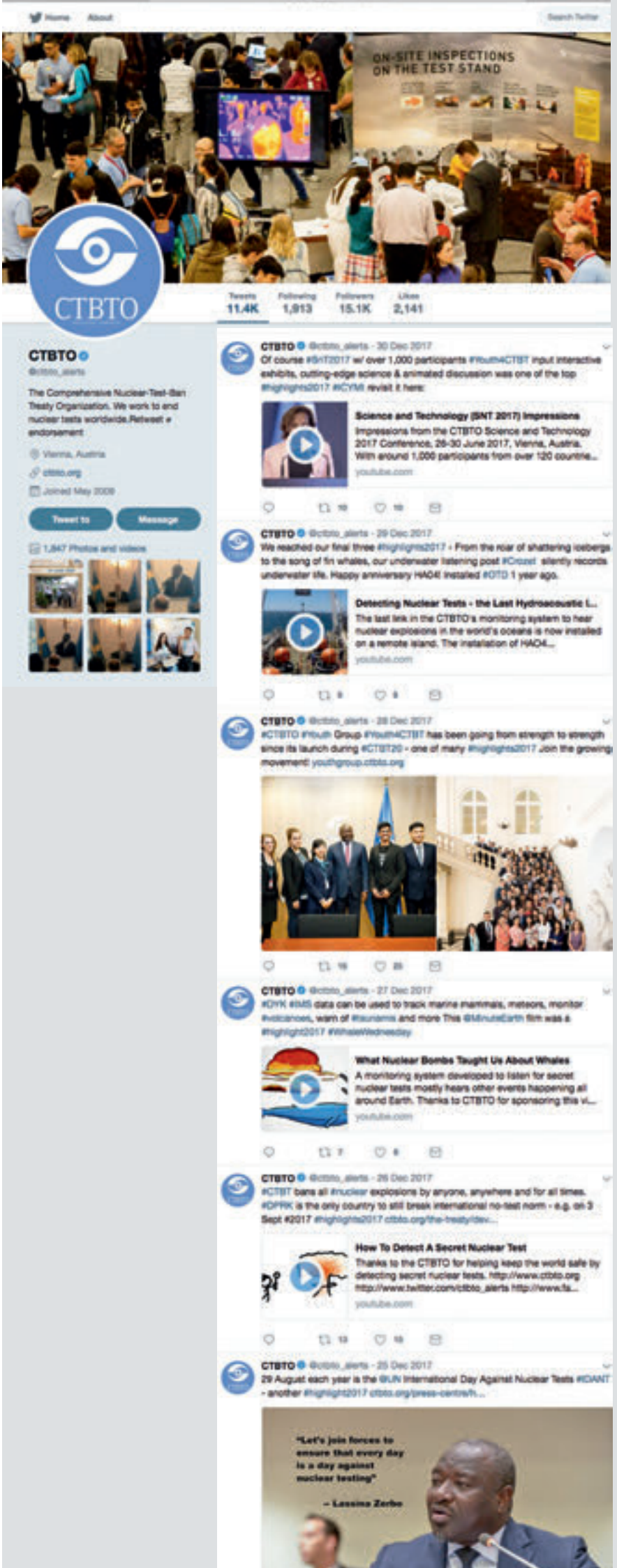
Reuters, AP, AFP, CNN, Nature, Sputnik, Russia Today, France 24, Izvestitya, Vesti, Reforma, Sky News, BBC Newsnight, NHK World, The Astana Times, UN Radio and P.M. Magazin.

Other significant articles on the Treaty and its verification regime were published by the Washington Post, Nature, Wired, Spiegel Online, Clarín, Fox News, Die Welt, Reuters, BBC, 38 North, CNN, Al Jazeera, ORF, Kazakh TV, Sputnik, Focus, Der Standard, Phys.org, Observador, Arms Control Today, UN News Centre, News.com.au, 9 News, The Conversation and In Depth News.

NATIONAL IMPLEMENTATION MEASURES

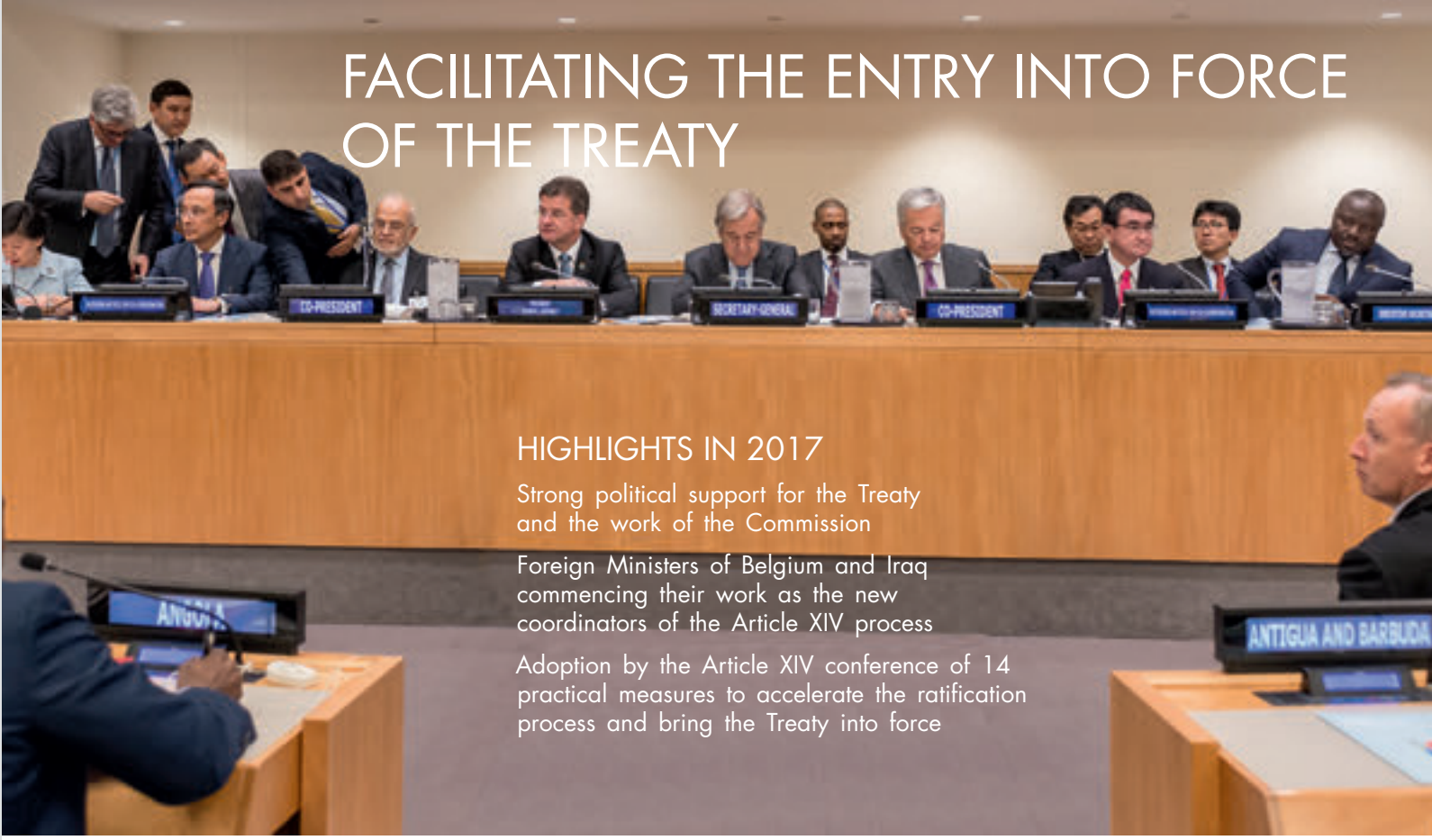
Part of the mandate of the Commission is to facilitate the exchange of information between States Signatories on the legal and administrative measures for implementation of the Treaty and, when requested, to provide related advice and assistance. Some of these implementation measures will be required when the Treaty enters into force and some may already be necessary during the provisional operation of the IMS and to support activities of the Commission.

In 2017, the Commission continued to promote the exchange of information between States Signatories on national implementation measures. It also delivered presentations on aspects of national implementation at workshops, seminars, training courses, external events and academic lectures.



Twitter feed of the Commission.

FACILITATING THE ENTRY INTO FORCE OF THE TREATY



HIGHLIGHTS IN 2017

Strong political support for the Treaty and the work of the Commission

Foreign Ministers of Belgium and Iraq commencing their work as the new coordinators of the Article XIV process

Adoption by the Article XIV conference of 14 practical measures to accelerate the ratification process and bring the Treaty into force

Article XIV conference, September 2017 (New York).

Article XIV of the Treaty concerns entry into force. The article foresees a mechanism of regular conferences to facilitate entry into force (commonly referred to as 'Article XIV conferences') if this has not taken place three years after the Treaty is opened for signature. The first Article XIV conference took place in Vienna in 1999. Subsequent conferences were held in New York in 2001, 2005, 2009, 2011, 2013 and 2015, and in Vienna in 2003 and 2007.

The Secretary-General of the United Nations convenes the Article XIV conferences at the request of a majority of States that have ratified the Treaty. Both ratifying and signatory States participate in these conferences. Decisions are taken by consensus of the ratifying States, taking into account views expressed at the conference by signatory States. Non-signatory States, international organizations and non-governmental organizations are invited to attend as observers.

Article XIV conferences discuss and decide on what measures, consistent with international law, may be undertaken to accelerate the ratification process in order to facilitate entry into force of the Treaty.

Article XIV conference, September 2017 (New York).

CONDITIONS FOR ENTRY INTO FORCE

The entry into force of the Treaty requires ratification by all 44 States listed in its Annex 2. These so-called Annex 2 States are States that formally participated in the final stage of the negotiation of the Treaty in the Conference of Disarmament in 1996 and possessed nuclear power reactors or nuclear research reactors at that time. As of 31 December 2017, 36 of these 44 States had ratified the Treaty. Of the eight Annex 2 States that had yet to ratify the Treaty, three still had not signed it.

NEW YORK, 2017

The tenth Conference on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty was held on 20 September 2017 on the margins of the opening of the 72nd session of the United Nations General Assembly in New York.

The conference presented an opportunity to demonstrate the sustained political commitment and support of the international community for the entry into force of the Treaty and its universality.

Over 90 States Signatories attended the conference. They reviewed the latest developments and discussed strategies to generate further support for the Treaty and its universality. A high number of foreign ministers and high level officials from ratifying, signatory and non-signatory States participated in the conference, including representatives from five States whose ratification is required for entry into force: China, Egypt, the Islamic Republic of Iran, Israel and the United States of America.

The United Nations Secretary-General, Mr António Guterres, and the President of the United Nations General Assembly, Mr Miroslav Lajčák, addressed the opening session. The High Representative of the European Union for Foreign Affairs and Security Policy, Ms Federica Mogherini, also delivered a statement on behalf of the EU.

In addition to foreign ministers and high level State representatives, the conference was attended by members of the Group of Eminent Persons, including Ms Federica Mogherini; Mr Kevin Rudd, former Prime Minister of Australia; Ms Amina Mohamed, Cabinet Secretary for Foreign Affairs and International Trade of Kenya; Ms Angela Kane, former United Nations High Representative for Disarmament Affairs; and Mr Wolfgang Hoffmann, Executive Secretary Emeritus of the Commission, as well as officials from international organizations, specialized agencies and non-governmental organizations. Mr Kevin Rudd and Ms Amina Mohamed presented the statement of the Group of Eminent Persons.

SHARED PRESIDENCY

The presidency of the conference was shared by the Deputy Prime Minister and Minister of Foreign Affairs of Belgium, Mr Didier Reynders, and the Foreign Minister of Iraq, Mr Ibrahim Al-Jaafari.

Ahead of the conference, the Foreign Ministers of Belgium and Iraq together with the Executive Secretary co-authored a joint op-ed stressing the need and urgency of prohibiting nuclear testing. They stressed that "by addressing the unfinished business of the CTBT, the international community would demonstrate beyond a doubt that effective, multilaterally verifiable nuclear non-proliferation and disarmament measures are indeed possible." Furthermore, they noted that "as a confidence building measure it could unite countries in unwrapping other difficult security issues, including the crisis on the Korean peninsula."

EXPRESSIONS OF STRONG SUPPORT

The participants, including ministers and other senior officials, underlined the significance of the Treaty for nuclear disarmament and non-proliferation and the established norm against nuclear testing. They called on non-ratifying States, in particular the remaining Annex 2 States, to ratify the Treaty as soon as possible. They also expressed appreciation for the activities of the Commission and the effective performance of its verification regime.

The Secretary-General of the United Nations stated that "a CTBT that is in force would be a milestone on the road to a world free of nuclear weapons. It has the potential to prevent a nuclear arms race and an escalation of regional and bilateral tensions." He further added: "I applaud the CTBT Preparatory Commission for raising awareness about the dangers associated with testing and for its partnership with the United Nations."

The Executive Secretary highlighted the importance of the Treaty for international peace and security: "Above all, given the present situation, it would diffuse tensions in 'nuclear hotspots' such as the Korean Peninsula. The world needs to calmly and resolutely find a means of de-escalating that crisis. A testing moratorium – at the very least – should be part of that solution."

The conference unanimously adopted a Final Declaration that affirms that "a universal and effectively verifiable Treaty constitutes a fundamental instrument in the field of nuclear disarmament and non-proliferation." It further reaffirms "the vital importance and urgency of the entry into force of the CTBT" and urges "all States to remain seized of the issue at the highest political level."

The Final Declaration calls on the remaining States to sign and ratify the Treaty without delay and welcomes opportunities to engage with the non-signatory States, in particular Annex 2 States.

The Final Declaration also calls on all States "to refrain from nuclear weapon test explosions or any other nuclear explosions, the development and use of new nuclear weapon technologies and any action that would undermine the object and purpose and the implementation of the provisions of the CTBT and to maintain all existing moratoria on nuclear weapon test explosions, while stressing that these measures do not have the same permanent and legally binding effect to end nuclear weapon testing and all other nuclear explosions, which can only be achieved with the entry into force of the Treaty."

It also proposes 14 practical measures to accelerate the ratification process and bring the Treaty into force. These include support for bilateral, regional and multilateral outreach initiatives, capacity building and training activities, and cooperation with civil society, international organizations and non-governmental organizations.

The Final Declaration stresses that participating States will continue to provide the political and tangible support required to enable the Commission to complete all of its tasks in the most efficient and cost effective way, in particular the further build-up of all the elements of the verification regime. It also expresses appreciation for the civil and scientific benefits of the monitoring technologies, including for tsunami warning.

In addition, the Final Declaration welcomes the range of mutually supportive ratification outreach activities, including the activities of the Group of Eminent Persons and the CTBTO Youth Group and the individual efforts of States Signatories.

From top: United Nations Secretary-General António Guterres. Ms Julie Bishop, Minister for Foreign Affairs of Australia. The Foreign Minister of Iraq, Mr Ibrahim Al-Jaafari; the President of the United Nations General Assembly, Mr Miroslav Lajčák; and the United Nations Secretary-General. The High Representative of the European Union for Foreign Affairs and Security Policy, Ms Federica Mogherini. Signing of the Final Declaration by the Deputy Prime Minister and Minister of Foreign Affairs of Belgium, Mr Didier Reynders, and the Foreign Minister of Iraq, Mr Ibrahim Al-Jaafari.

POLICY MAKING

HIGHLIGHTS IN 2017

Addressing the announced nuclear test by the Democratic People's Republic of Korea

Authorization to submit an application for membership in the United Nations Joint Staff Pension Fund

Reappointment of the Chairperson of Working Group B

Session of Working Group B (Vienna).

The plenary body of the Commission, which is composed of all States Signatories, provides political guidance and oversight to the PTS. The plenary is assisted by two Working Groups.

Working Group A (WGA) deals with budgetary and administrative matters, while WGB considers scientific and technical issues related to the Treaty. Both Working Groups submit proposals and recommendations for consideration and adoption by the plenary meeting of the Commission.

In addition, an Advisory Group of experts serves in a supporting role, advising the Commission through WGA on financial and budgetary matters.

MEETINGS IN 2017

The Commission and its subsidiary bodies each met in two regular sessions in 2017. There was also a joint meeting of WGA and WGB on 2 March 2017 and two resumed Sessions of the Commission on 2 March 2017 and 4 September 2017.

Among the major issues addressed by the Commission during 2017 were the promotion of the Treaty, responding to the nuclear test by the Democratic People's Republic of Korea, progress in the verification regime of the Treaty, the situation of the Provident Fund of the Commission, the adoption of the 2018-2019 Programme and Budget proposals and the adoption of changes to the Regulations and Rules of the Commission.

SUPPORTING THE 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. The PTS provides substantive and organizational support for the meetings of the Commission and its subsidiary bodies and in the periods between sessions, thus facilitating the decision making process.

With tasks ranging from organizing conference facilities and arranging interpretation and translation to drafting the official documents of the various sessions, planning the annual schedule of sessions, and providing substantive and procedural advice to the Chairpersons, the PTS is a vital element in the work of the Commission and its subsidiary bodies.

VIRTUAL WORKING ENVIRONMENT

Through the ECS, the Commission provides a virtual working environment for those who are unable to attend its regular meetings. Using state of the art technology, the ECS records and transmits the proceedings of each official plenary meeting live around the globe. Meetings are then archived for reference purposes. In addition, the ECS distributes supporting documents for each session to States Signatories and alerts participants of new documents by email.

The ECS is a single sign-on infrastructure of the Commission that provides a platform for continuous and inclusive discussion among States Signatories and experts on scientific and technical issues related to the verification regime.

As part of the virtual paper approach, through which the Commission is seeking to limit its output of printed documentation, the PTS continued to provide a 'print on demand' service at all sessions of the Commission and its subsidiary bodies.

INFORMATION SYSTEM ON PROGRESS IN FULFILLING THE MANDATE OF THE TREATY

The Information System with Hyperlinks on Tasks Assigned by the Resolution Establishing the Preparatory Commission monitors progress made in meeting the mandate of the Treaty, the Resolution establishing the Commission and the guidance of the Commission and its subsidiary bodies. It uses hyperlinks to the official documentation of the Commission to provide up to date information on the tasks that remain to be completed in preparing for the establishment of the CTBTO at entry into force and the first session of the Conference of the States Parties. The system is available to all ECS users.

ADDRESSING THE ANNOUNCED NUCLEAR TEST BY THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

In response to the announced nuclear test by the Democratic People's Republic of Korea on 3 September 2017, the Commission held several informal briefings and a Resumed Session on 4 September 2017.

Delegations made statements regarding their national positions on the nuclear tests. They unanimously and strongly condemned the announced nuclear test by the Democratic People's Republic of Korea and expressed grave concern over the serious negative effect of any such

Sessions of the Preparatory Commission and its subsidiary bodies in 2017.

MEETINGS OF THE COMMISSION AND ITS SUBSIDIARY BODIES IN 2017

BODY	SESSION	DATES	CHAIRPERSON
PREPARATORY COMMISSION	RESUMED FORTY-SEVENTH	2 MARCH	AMBASSADOR PAULINA FRANCESCHI NAVARRO (PANAMA)
	FORTY-EIGHTH	22-23 JUNE	
	RESUMED FORTY-EIGHTH	4 SEPTEMBER	
	FORTY-NINTH	13-14 NOVEMBER	
WORKING GROUP A	FIFTY-FIRST	31 MAY	AMBASSADOR ADNAN OTHMAN (MALAYSIA)
	FIFTY-SECOND	23 OCTOBER	
WORKING GROUP B	FORTY-EIGHTH	20 FEBRUARY – 3 MARCH	MR JOACHIM SCHULZE (GERMANY)
	FORTY-NINTH	21-31 AUGUST	
ADVISORY GROUP	FORTY-EIGHTH	2-4 MAY	MR MICHAEL WESTON (UNITED KINGDOM)
	FORTY-NINTH	2-3 OCTOBER	

test on international peace and security. They rejected firmly any and all nuclear explosive tests. They also called on the Democratic People's Republic of Korea to refrain from any further nuclear tests and abide by the Treaty on the Non-Proliferation of Nuclear Weapons, the United Nations Security Council resolutions and its other international obligations.

The Commission underlined the importance and urgency of the entry into force of the Treaty and called on the remaining Annex 2 States including the Democratic People's Republic of Korea to sign and ratify the Treaty without further delay in order to strengthen nuclear non-proliferation and disarmament.

SITUATION OF THE PROVIDENT FUND

In 2017, the Commission reviewed the situation of the Provident Fund, which is the social security scheme of the staff of the organization. In light of concern over the performance of the fund, it authorized the Secretariat to submit to the United Nations Joint Staff Pension Fund board an application to become a member organization and to take the necessary steps to effectuate the application.

REAPPOINTMENT OF THE CHAIRPERSON OF WORKING GROUP B

The Commission decided to reappoint Mr Joachim Schulze as the Chairperson of Working Group B for a term of three years beginning 1 January 2018.

The term of office of the Chairpersons and Vice-Chairpersons of the Working Groups is three years.

Working Group B Chairmanship and its support team (Vienna).

MANAGEMENT

HIGHLIGHTS IN 2017

Improving human resources policies, procedures and processes

Allocation of 80% of the budget to verification related activities

Strengthening of oversight

Annual management retreat.

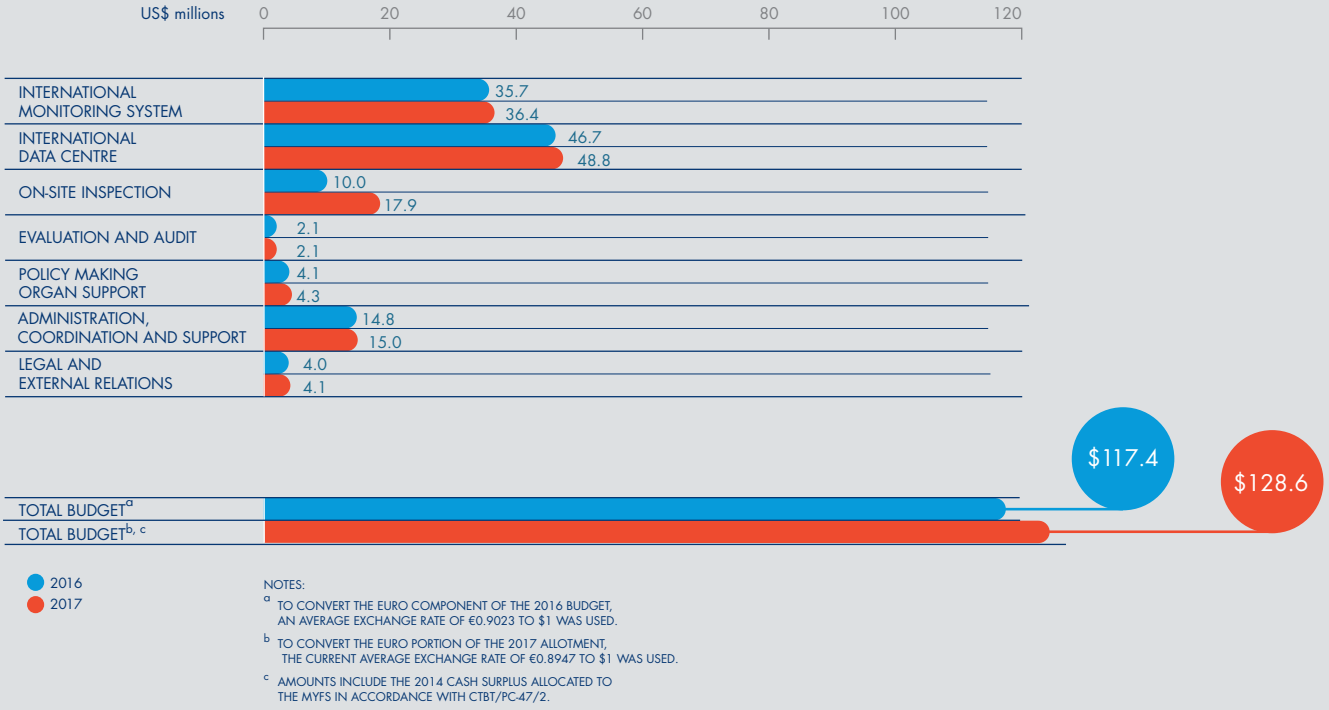
The PTS ensures effective and efficient management of its activities, including support of the Commission and its subsidiary bodies, mainly through the provision of administrative, financial and legal services.

The PTS also provides a wide variety of general services, 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 they are being provided in the most efficient, effective and economical way.

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

Throughout 2017, the Commission continued to focus on smart planning to streamline its activities and to increase synergy and efficiency. It also prioritized results based management.

DISTRIBUTION OF THE 2016–2017 BUDGET BY AREA OF ACTIVITY



NOTES:

[a] TO CONVERT THE EURO COMPONENT OF THE 2016 BUDGET, AN AVERAGE EXCHANGE RATE OF €0.9023 TO $1 WAS USED.

[b] TO CONVERT THE EURO PORTION OF THE 2017 ALLOTMENT, THE CURRENT AVERAGE EXCHANGE RATE OF €0.8947 TO $1 WAS USED.

[c] AMOUNTS INCLUDE THE 2014 CASH SURPLUS ALLOCATED TO THE MYFS IN ACCORDANCE WITH CTBT/PC-47/2.

OVERSIGHT

Internal Audit is an independent and objective internal oversight mechanism. Through the provision of audit, investigation and advisory services, it contributes to the improvement of the risk management, control and governance processes of the PTS.

To maintain its organizational independence, Internal Audit, through its Chief, reports directly to the Executive Secretary and has direct access to the Chairperson of the Commission. The Chief of Internal Audit also independently prepares and submits to the Commission and its subsidiary bodies an annual report on Internal Audit activities.

In 2017, Internal Audit fully accomplished its approved work plan by performing seven audits, which resulted in the identification of opportunities to mitigate risks and strengthen the control environment. In addition, Internal Audit performed follow-up exercises on the status of implementation of its recommendations and submitted relevant progress reports to the Executive Secretary.

Internal Audit continued to perform management support activities, such as providing advice on policy documents and procedures and participating as an observer at various meetings. Furthermore, Internal Audit acted as the PTS focal point for the external auditor.

Internal Audit revised its manual in line with the new International Standards for the Professional Practice of Internal Auditing. The manual is primarily designed to establish uniformity and consistency. It also aims to foster high standards and assure quality in the conduct of internal audit work.

Internal Audit continued to be actively engaged in forums, such as the Representatives of Internal Audit Services of the United Nations Organizations, whose goal is to share expertise amongst organizations dealing with similar issues.

FINANCE

2016-2017 PROGRAMME AND BUDGET

The Budget for 2016 amounted to US$37 248 800 and €72 317 100, corresponding to slightly less than zero real growth. The Commission uses a split currency system to lessen its exposure to fluctuations in the value of the US dollar against the euro. At the budget exchange rate of €0.796 to $1, the total US dollar equivalent of the 2016 Budget was $128 115 600. This represented a nominal growth of 1.5% but was almost constant in real terms (a decrease of $43 800).

On the basis of the actual average exchange rate in 2016 of €0.9023 to $1, the final total US dollar equivalent of the 2016 Budget was $117 396 312. Of the total Budget, 80% was originally allocated to verification related activities, including $13 958 434 for the Capital Investment Fund, which is dedicated to the build-up of the IMS, and $8 340 601 for the multiyear funds that are dedicated to other long term verification related projects.

The Budget for 2017 totalled $37 741 400 and €73 509 000, corresponding to slightly less than zero real growth. The Commission uses a split currency system to lessen its exposure to fluctuations in the value of the US dollar against the euro. At the budget exchange rate of €0.796 to $1, the total US dollar equivalent of the 2017 Budget was $130 088 300. This represented a nominal growth of 1.6% but was almost constant in real terms (a decrease of $26 200).

On the basis of the actual average exchange rate in 2017 of €0.8947 to $1, the final total US dollar equivalent

of the 2017 Budget was $128 623 705. Eighty per cent of the total Budget was originally allocated to verification related activities, including $13 563 439 for the Capital Investment Fund, which is dedicated to the build-up of the IMS, and $17 331 032 for the multiyear funds that are dedicated to other long term verification related projects.

ASSESSED CONTRIBUTIONS

As of 31 December 2017, the collection rates of the assessed contributions from States Signatories for 2017 were 86.3% of the US dollar portion and 91.0% of the euro portion. The number of States that had paid their 2017 assessed contributions in full as of 31 December 2017 was 88.

EXPENDITURE

The expenditure for the Programme and Budget in 2017 amounted to $129 467 521, of which $16 318 744 was from the Capital Investment Fund, $14 112 390 was from the multiyear funds, and the remainder from the General Fund. For the General Fund, the unused budget was $6 042 858.

GENERAL SERVICES

The PTS implemented a major office space utilization optimization plan across the organization between March and November 2017. The plan focused on improving the efficiency of the use of office space allocated to the organization at the VIC. Its successful implementation is the result of excellent planning and coordination amongst internal and external stakeholders, especially with the VIC Buildings Management Service.

The PTS provided administrative support for SnT2017, including the travel and hotel bookings for approximately 250 conference participants, as well as for other events of the Commission.

The PTS interacted with a wide array of stakeholders, including external vendors and other VIC based international organizations that provide common services at the VIC, during the implementation of Internal Audit recommendations on work processes and procedures.

Cross-Divisional administrative and logistical support was provided as part of efforts to streamline PTS equipment shipments as well as services and amenities at the temporary storage area.

PROCUREMENT

The Financial Regulations and Rules and the Administrative Directive related to procurement were updated in 2017 to include the best practices of the Procurement Section as well as those of other international organizations. Efforts focused on streamlining the procurement process (including technological system enhancements) for efficiency and effectiveness while ensuring transparency and accountability.

The Commission obligated $78 941 281 through 957 procurements for high value purchases and $842 320 through 586 contractual instruments for low value purchases.

As of 31 December 2017, 141 IMS stations, 28 noble gas systems, 12 radionuclide laboratories and 2 radionuclide laboratories with noble gas capability were under contract for testing and evaluation or for PCAs.

Annual management retreat.

FIXED TERM STAFF MEMBERS BY GRADE AND GENDER, 2016 AND 2017

VOLUNTARY SUPPORT FORUM

The Voluntary Support Forum was initiated in 2014 as a forum for interaction with the donor community and to ensure that voluntary contributions serve the strategic goals of the Commission. The forum attempts to consolidate efforts to mobilize extrabudgetary funding, to strengthen interaction with donors and to increase transparency and accountability regarding the use of voluntary contributions. Since 1999, the Commission has received approximately $77 million in cash contributions and $55 million in contributions in kind.

The Voluntary Support Forum held one meeting in November 2017. All States Signatories and observers were invited. During the meeting the PTS presented several projects for which it sought voluntary contributions in 2018-2019 as outlined in Appendix II of the 2018-2019 Programme and Budget. The projects covered capacity building, advocacy and other outreach activities aimed at scientists and policy makers including parliamentarians, primarily in Annex 2 States, as well as support to the CTBTO Youth Group, the Group of Eminent Persons and the third OSI training cycle for surrogate inspectors. The total amount sought for all projects was approximately $1.1 million.

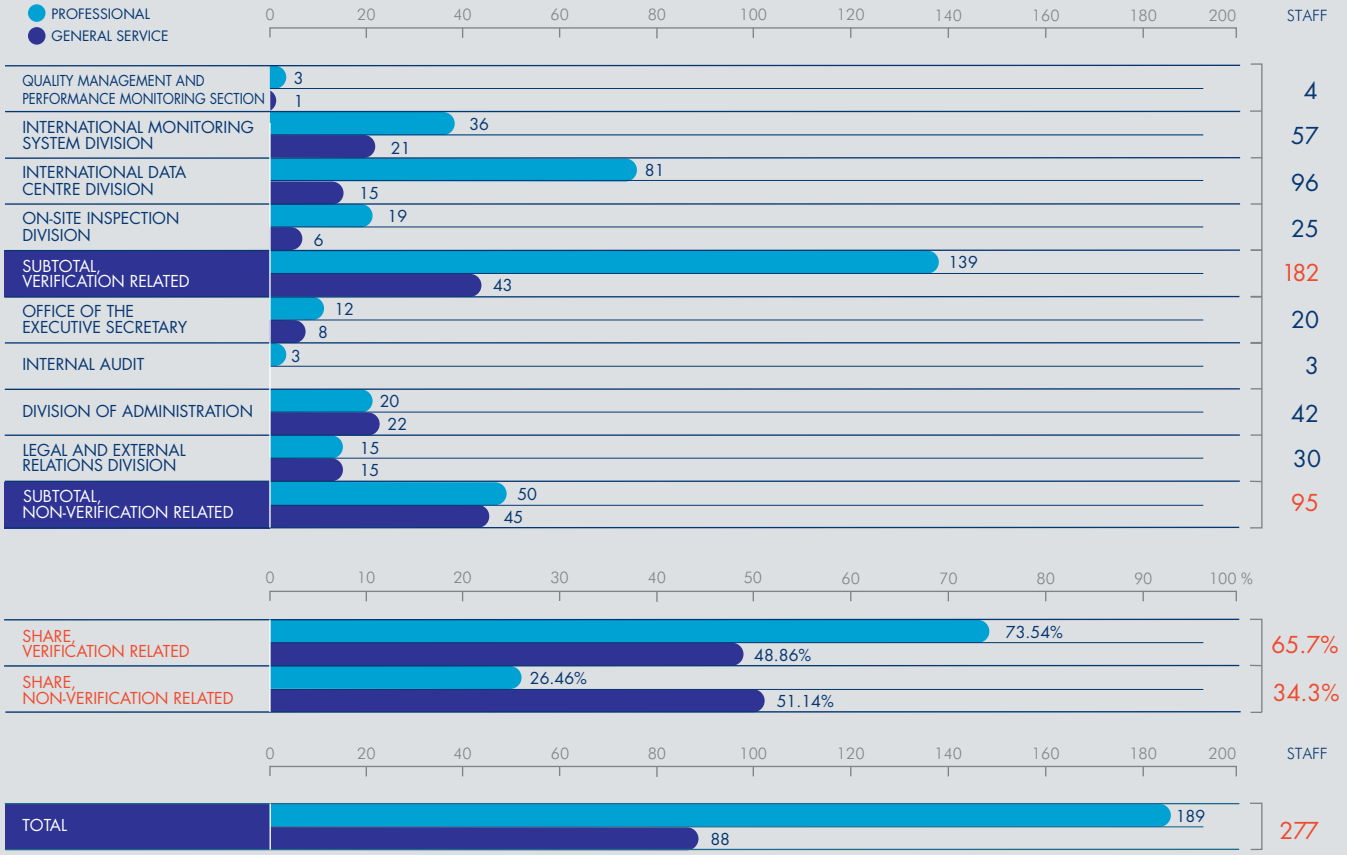
HUMAN RESOURCES

The organization secured the human resources for its operations by recruiting and retaining highly competent and diligent staff. Recruitment was based on obtaining the highest standards of professional expertise, experience, efficiency, competence and integrity. Full attention was paid to the principle of equal employment opportunities, to the importance of recruiting staff on as wide a geographical basis as possible and to other relevant criteria in the Treaty and the Staff Regulations.

Throughout the year, the PTS continued its efforts to improve human resources policies, procedures and processes.

As of 31 December 2017, there were 277 regular fixed term staff members of the PTS from 86 countries, compared with 274 staff members from 82 countries on 31 December 2016. In 2017, there were 189 staff members in the Professional and higher categories, while in 2016 there were 184.

FIXED TERM STAFF MEMBERS BY FIELD OF WORK AS OF 31 DECEMBER 2017

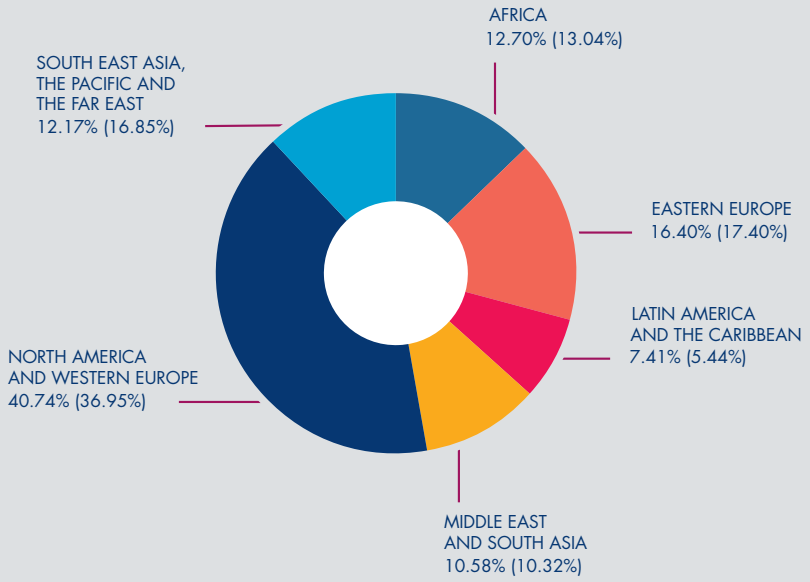


USE OF THE 2014 CASH SURPLUS FOR THE ACTIVITIES OF THE COMMISSION

During its Forty-Seventh Session, the Commission decided to authorize the PTS to use the 2014 cash surplus in the total amount of approximately $9.8 million for the establishment of a permanent ESMF, for capacity building activities and for the financing of an Article XIV conference in 2017.

STAFF MEMBERS IN THE PROFESSIONAL CATEGORY BY GEOGRAPHICAL REGION AS OF 31 DECEMBER 2017

(PERCENTAGES AS OF 31 DECEMBER 2016 ARE SHOWN IN BRACKETS.)



SIGNATURE AND RATIFICATION

STATUS AS OF 31 DECEMBER 2017

183 STATES SIGNATORIES

- 166 RATIFIED
- 17 SIGNED BUT NOT RATIFIED

STATES WHOSE RATIFICATION IS REQUIRED FOR THE TREATY TO ENTER INTO FORCE

ANNEX 2

44 STATES

- 36 RATIFIED
- 5 SIGNED BUT NOT RATIFIED
- 3 NOT SIGNED

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

STATE (CONT.)	DATE OF SIGNATURE	DATE OF RATIFICATION
IRAN (ISLAMIC REPUBLIC OF)	24 SEP. 1996	
ISRAEL	25 SEP. 1996	
ITALY	24 SEP. 1996	1 FEB. 1999
JAPAN	24 SEP. 1996	8 JUL. 1997
MEXICO	24 SEP. 1996	5 OCT. 1999
NETHERLANDS	24 SEP. 1996	23 MAR. 1999
NORWAY	24 SEP. 1996	15 JUL. 1999
PAKISTAN		
PERU	25 SEP. 1996	12 NOV. 1997
POLAND	24 SEP. 1996	25 MAY 1999
REPUBLIC OF KOREA	24 SEP. 1996	24 SEP. 1999
ROMANIA	24 SEP. 1996	5 OCT. 1999
RUSSIAN FEDERATION	24 SEP. 1996	30 JUN. 2000
SLOVAKIA	30 SEP. 1996	3 MAR. 1998
SOUTH AFRICA	24 SEP. 1996	30 MAR. 1999
SPAIN	24 SEP. 1996	31 JUL. 1998
SWEDEN	24 SEP. 1996	2 DEC. 1998
SWITZERLAND	24 SEP. 1996	1 OCT. 1999
TURKEY	24 SEP. 1996	16 FEB. 2000
UKRAINE	27 SEP. 1996	23 FEB. 2001
UNITED KINGDOM	24 SEP. 1996	6 APR. 1998
UNITED STATES OF AMERICA	24 SEP. 1996	
VIET NAM	24 SEP. 1996	10 MAR. 2006

SIGNATURE AND RATIFICATION OF THE TREATY BY GEOGRAPHICAL REGION

AFRICA

54 STATES

- 45 RATIFIED
- 6 SIGNED BUT NOT RATIFIED
- 3 NOT SIGNED

STATE	DATE OF SIGNATURE	DATE OF RATIFICATION
ALGERIA	15 OCT. 1996	11 JUL. 2003
ANGOLA	27 SEP. 1996	20 MAR. 2015
BENIN	27 SEP. 1996	6 MAR. 2001
BOTSWANA	16 SEP. 2002	28 OCT. 2002
BURKINA FASO	27 SEP. 1996	17 APR. 2002
BURUNDI	24 SEP. 1996	24 SEP. 2008
CABO VERDE	1 OCT. 1996	1 MAR. 2006
CAMEROON	16 NOV. 2001	6 FEB. 2006
CENTRAL AFRICAN REPUBLIC	19 DEC. 2001	26 MAY 2010
CHAD	8 OCT. 1996	8 FEB. 2013
COMOROS	12 DEC. 1996	
CONGO	11 FEB. 1997	2 SEP. 2014
CÔTE D'IVOIRE	25 SEP. 1996	11 MAR. 2003
DEMOCRATIC REPUBLIC OF THE CONGO	4 OCT. 1996	28 SEP. 2004
DJIBOUTI	21 OCT. 1996	15 JUL. 2005
EGYPT	14 OCT. 1996	
EQUATORIAL GUINEA	9 OCT. 1996	
ERITREA	11 NOV. 2003	11 NOV. 2003
ETHIOPIA	25 SEP. 1996	8 AUG. 2006
GABON	7 OCT. 1996	20 SEP. 2000
GAMBIA	9 APR. 2003	
GHANA	3 OCT. 1996	14 JUN. 2011
GUINEA	3 OCT. 1996	20 SEP. 2011
GUINEA-BISSAU	11 APR. 1997	24 SEP. 2013
KENYA	14 NOV. 1996	30 NOV. 2000
LESOTHO	30 SEP. 1996	14 SEP. 1999
LIBERIA	1 OCT. 1996	17 AUG. 2009
LIBYA	13 NOV. 2001	6 JAN. 2004
MADAGASCAR	9 OCT. 1996	15 SEP. 2005
MALAWI	9 OCT. 1996	21 NOV. 2008
MALI	18 FEB. 1997	4 AUG. 1999
MAURITANIA	24 SEP. 1996	30 APR. 2003
MAURITIUS		
MOROCCO	24 SEP. 1996	17 APR. 2000
MOZAMBIQUE	26 SEP. 1996	4 NOV. 2008
NAMIBIA	24 SEP. 1996	29 JUN. 2001
NIGER	3 OCT. 1996	9 SEP. 2002
NIGERIA	8 SEP. 2000	27 SEP. 2001
RWANDA	30 NOV. 2004	30 NOV. 2004
SAO TOME AND PRINCIPE	26 SEP. 1996	
SENEGAL	26 SEP. 1996	9 JUN. 1999
SEYCHELLES	24 SEP. 1996	13 APR. 2004
SIERRA LEONE	8 SEP. 2000	17 SEP. 2001
SOMALIA		
SOUTH AFRICA	24 SEP. 1996	30 MAR. 1999
SOUTH SUDAN		
SUDAN	10 JUN. 2004	10 JUN. 2004
SWAZILAND	24 SEP. 1996	21 SEP. 2016
TOGO	2 OCT. 1996	2 JUL. 2004
TUNISIA	16 OCT. 1996	23 SEP. 2004
UGANDA	7 NOV. 1996	14 MAR. 2001
UNITED REPUBLIC OF TANZANIA	30 SEP. 2004	30 SEP. 2004
ZAMBIA	3 DEC. 1996	23 FEB. 2006
ZIMBABWE	13 OCT. 1999	

EASTERN EUROPE

23 STATES

● 23 RATIFIED

STATE	DATE OF SIGNATURE	DATE OF RATIFICATION
ALBANIA	27 SEP. 1996	23 APR. 2003
ARMENIA	1 OCT. 1996	12 JUL. 2006
AZERBAIJAN	28 JUL. 1997	2 FEB. 1999
BELARUS	24 SEP. 1996	13 SEP. 2000
BOSNIA AND HERZEGOVINA	24 SEP. 1996	26 OCT. 2006
BULGARIA	24 SEP. 1996	29 SEP. 1999
CROATIA	24 SEP. 1996	2 MAR. 2001
CZECH REPUBLIC	12 NOV. 1996	11 SEP. 1997
ESTONIA	20 NOV. 1996	13 AUG. 1999
GEORGIA	24 SEP. 1996	27 SEP. 2002
HUNGARY	25 SEP. 1996	13 JUL. 1999
LATVIA	24 SEP. 1996	20 NOV. 2001
LITHUANIA	7 OCT. 1996	7 FEB. 2000
MONTENEGRO	23 OCT. 2006	23 OCT. 2006
POLAND	24 SEP. 1996	25 MAY 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
SERBIA	8 JUN. 2001	19 MAY 2004
SLOVAKIA	30 SEP. 1996	3 MAR. 1998
SLOVENIA	24 SEP. 1996	31 AUG. 1999
THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA	29 OCT. 1998	14 MAR. 2000
UKRAINE	27 SEP. 1996	23 FEB. 2001

LATIN AMERICA AND THE CARIBBEAN

33 STATES

● 31 RATIFIED

● 2 NOT SIGNED

STATE	DATE OF SIGNATURE	DATE OF RATIFICATION
ANTIGUA AND BARBUDA	16 APR. 1997	11 JAN. 2006
ARGENTINA	24 SEP. 1996	4 DEC. 1998
BAHAMAS	4 FEB. 2005	30 NOV. 2007
BARBADOS	14 JAN. 2008	14 JAN. 2008
BELIZE	14 NOV. 2001	26 MAR. 2004
BOLIVIA (PLURINATIONAL STATE OF)	24 SEP. 1996	4 OCT. 1999
BRAZIL	24 SEP. 1996	24 JUL. 1998
CHILE	24 SEP. 1996	12 JUL. 2000
COLOMBIA	24 SEP. 1996	29 JAN. 2008
COSTA RICA	24 SEP. 1996	25 SEP. 2001
CUBA		
DOMINICA		
DOMINICAN REPUBLIC	3 OCT. 1996	4 SEP. 2007
ECUADOR	24 SEP. 1996	12 NOV. 2001
EL SALVADOR	24. SEP 1996	11 SEP. 1998
GRENADA	10 OCT. 1996	19 AUG. 1998
GUATEMALA	20 SEP. 1999	12 JAN. 2012
GUYANA	7 SEP. 2000	7 MAR. 2001
HAITI	24 SEP. 1996	1 DEC. 2005
HONDURAS	25 SEP. 1996	30 OCT. 2003
JAMAICA	11 NOV. 1996	13 NOV. 2001
MEXICO	24 SEP. 1996	5 OCT. 1999
NICARAGUA	24 SEP. 1996	5 DEC. 2000
PANAMA	24 SEP. 1996	23 MAR. 1999
PARAGUAY	25 SEP. 1996	4 OCT. 2001
PERU	25 SEP. 1996	12 NOV. 1997
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
SURINAME	14 JAN. 1997	7 FEB. 2006
TRINIDAD AND TOBAGO	8 OCT. 2009	26 MAY 2010
URUGUAY	24 SEP. 1996	21 SEP. 2001
VENEZUELA (BOLIVARIAN REPUBLIC OF)	3 OCT. 1996	13 MAY 2002

MIDDLE EAST AND SOUTH ASIA

26 STATES

- 16 RATIFIED
- 5 SIGNED BUT NOT RATIFIED
- 5 NOT SIGNED

STATE	DATEOF SIGNATURE	DATEOF RATIFICATION
AFGHANISTAN	24 SEP. 2003	24 SEP. 2003
BAHRAIN	24 SEP. 1996	12 APR. 2004
BANGLADESH	24 OCT. 1996	8 MAR. 2000
BHUTAN		
INDIA		
IRAN (ISLAMIC REPUBLIC OF)	24 SEP. 1996	
IRAQ	19 AUG. 2008	26 SEP. 2013
ISRAEL	25 SEP. 1996	
JORDAN	26 SEP. 1996	25 AUG. 1998
KAZAKHSTAN	30 SEP. 1996	14 MAY 2002
KUWAIT	24 SEP. 1996	6 MAY 2003
KYRGYZSTAN	8 OCT. 1996	2 OCT. 2003
LEBANON	16 SEP. 2005	21 NOV. 2008
MALDIVES	1 OCT. 1997	7 SEP. 2000
NEPAL	8 OCT. 1996	
OMAN	23 SEP. 1999	13 JUN. 2003
PAKISTAN		
QATAR	24 SEP. 1996	3 MAR. 1997
SAUDI ARABIA		
SRI LANKA	24 OCT. 1996	
SYRIAN ARAB REPUBLIC		
TAJIKISTAN	7 OCT. 1996	10 JUN. 1998
TURKMENISTAN	24 SEP. 1996	20 FEB. 1998
UNITED ARAB EMIRATES	25 SEP. 1996	18 SEP. 2000
UZBEKISTAN	3 OCT. 1996	29 MAY 1997
YEMEN	30 SEP. 1996	

NORTH AMERICA AND WESTERN EUROPE

28 STATES

- 27 RATIFIED
- 1 SIGNED BUT NOT RATIFIED

STATE	DATE OF SIGNATURE	DATE OF RATIFICATION
ANDORRA	24 SEP. 1996	12 JUL. 2006
AUSTRIA	24 SEP. 1996	13 MAR. 1998
BELGIUM	24 SEP. 1996	29 JUN. 1999
CANADA	24 SEP. 1996	18 DEC. 1998
CYPRUS	24 SEP. 1996	18 JUL. 2003
DENMARK	24 SEP. 1996	21 DEC. 1998
FINLAND	24 SEP. 1996	15 JAN. 1999
FRANCE	24 SEP. 1996	6 APR. 1998
GERMANY	24 SEP. 1996	20 AUG. 1998
GREECE	24 SEP. 1996	21 APR. 1999
HOLY SEE	24 SEP. 1996	18 JUL. 2001
ICELAND	24 SEP. 1996	26 JUN. 2000
IRELAND	24 SEP. 1996	15 JUL. 1999
ITALY	24 SEP. 1996	1 FEB. 1999
LIECHTENSTEIN	27 SEP. 1996	21 SEP. 2004
LUXEMBOURG	24 SEP. 1996	26 MAY 1999
MALTA	24 SEP. 1996	23 JUL. 2001
MONACO	1 OCT. 1996	18 DEC. 1998
NETHERLANDS	24 SEP. 1996	23 MAR. 1999
NORWAY	24 SEP. 1996	15 JUL. 1999
PORTUGAL	24 SEP. 1996	26 JUN. 2000
SAN MARINO	7 OCT. 1996	12 MAR. 2002
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
UNITED KINGDOM	24 SEP. 1996	6 APR. 1998
UNITED STATES OF AMERICA	24 SEP. 1996	

SOUTH EAST ASIA, THE PACIFIC AND THE FAR EAST

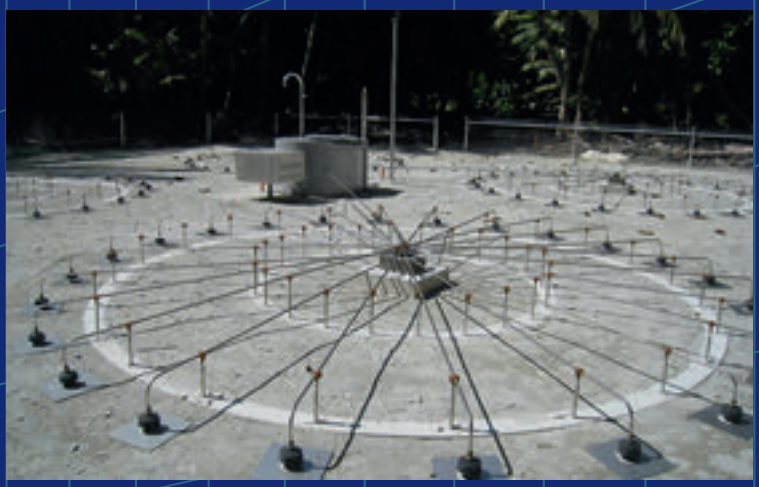
32 STATES

- 24 RATIFIED
- 5 SIGNED BUT NOT RATIFIED
- 3 NOT SIGNED

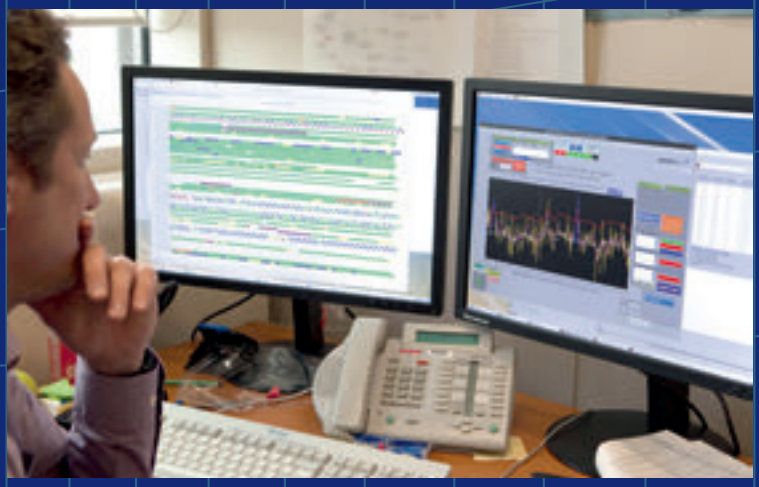
STATE	DATE OF SIGNATURE	DATE OF RATIFICATION
AUSTRALIA	24 SEP. 1996	9 JUL. 1998
BRUNEI DARUSSALAM	22 JAN. 1997	10 JAN. 2013
CAMBODIA	26 SEP. 1996	10 NOV. 2000
CHINA	24 SEP. 1996	
COOK ISLANDS	5 DEC. 1997	6 SEP. 2005
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA		
FIJI	24 SEP. 1996	10 OCT. 1996
INDONESIA	24 SEP. 1996	6 FEB. 2012
JAPAN	24 SEP. 1996	8 JUL. 1997
KIRIBATI	7 SEP. 2000	7 SEP. 2000
LAO PEOPLE'S DEMOCRATIC REPUBLIC	30 JUL. 1997	5 OCT. 2000

STATE (CONT.)	DATE OF SIGNATURE	DATE OF RATIFICATION
MALAYSIA	23 JUL. 1998	17 JAN. 2008
MARSHALL ISLANDS	24 SEP. 1996	28 OCT. 2009
MICRONESIA (FEDERATED STATES OF)	24 SEP. 1996	25 JUL. 1997
MONGOLIA	1 OCT. 1996	8 AUG. 1997
MYANMAR	25 NOV. 1996	21 SEP. 2016
NAURU	8 SEP. 2000	12 NOV. 2001
NEW ZEALAND	27 SEP. 1996	19 MAR. 1999
NIUE	9 APR. 2012	4 MAR. 2014
PALAU	12 AUG. 2003	1 AUG. 2007
PAPUA NEW GUINEA	25 SEP. 1996	
PHILIPPINES	24 SEP. 1996	23 FEB. 2001
REPUBLIC OF KOREA	24 SEP. 1996	24 SEP. 1999
SAMOA	9 OCT. 1996	27 SEP. 2002
SINGAPORE	14 JAN. 1999	10 NOV. 2001
SOLOMON ISLANDS	3 OCT. 1996	
THAILAND	12 NOV. 1996	
TIMOR-LESTE	26 SEP. 2008	
TONGA		
TUVALU		
VANUATU	24 SEP. 1996	16 SEP. 2005
VIET NAM	24 SEP. 1996	10 MAR. 2006

Verification Regime of the Treaty



International Monitoring System



International Data Centre

On-Site Inspection