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BACKGROUND DOCUMENT BY THE PROVISIONAL TECHNICAL SECRETARIAT OF THE PREPARATORY COMMISSION FOR THE COMPREHENSIVE NUCLEAR-TEST-BAN TREATY ORGANIZATION PREPARED FOR THE CONFERENCE ON FACILITATING THE ENTRY INTO FORCE OF THE CTBT (NEW YORK, 2021)

TREATY

1. The Comprehensive Nuclear-Test-Ban Treaty (CTBT) prohibits all nuclear test explosions, whether for a military or any other purpose. It covers all environments and does not set a threshold from which the prohibitions should apply. The preamble of the Treaty states that its objective is "to contribute effectively to the prevention of the proliferation of nuclear weapons in all its aspects" and "to the process of nuclear disarmament".

2. The CTBT, and the international norm of non-nuclear testing, have grown in strength since the adoption of the Treaty in 1996. In order to enter into force, the CTBT must be ratified by all 44 States listed in Annex 2 to the Treaty. These are the States which formally participated in the work of the 1996 session of the Conference on Disarmament, thus having contributed to the final stage of the negotiations on the CTBT, and which appear in the lists, compiled by the International Atomic Energy Agency (IAEA), of States with either nuclear power reactors (as of April 1996) or nuclear research reactors (as of December 1995).

3. Significant progress has been made towards the goal of entry into force and universalization of the Treaty. To date, the CTBT has been signed by 185 States and ratified by 170 States, including 36 of the 44 States listed in Annex 2. Since the 2019 Article XIV conference, Cuba and the Union of the Comoros completed their ratification procedures on 4 February 2021 and 19 February 2021, respectively.

2019 ARTICLE XIV CONFERENCE

4. Under Article XIV, if the Treaty has not entered into force three years after the date of the anniversary of its opening for signature, a conference of those States that have already ratified it may be held to decide by consensus what measures consistent with international law may be taken to accelerate the ratification process and to facilitate entry into force. States Signatories will also be invited to attend the conference.

5. The eleventh Article XIV conference[1] was held on 25 September 2019 in New York with more than 82 States participating. In addition, several international and regional organizations as well as non-governmental organizations attended. The conference adopted a Final Declaration calling upon all States which had not yet done so to sign and/or ratify the Treaty (CTBT-Art.XIV/2019/6, Annex). The declaration includes a number of measures to promote the entry into force of the CTBT.

6. In the course of the follow-up to the 2019 Article XIV conference, and in accordance with paragraph 10 (k) of the Final Declaration, Algeria and Germany, which served as the Presidency of the conference, were selected as coordinators of the process "to promote cooperation aimed at promoting further signatures and ratifications". Through a silence procedure which ended at close of business on 13 August 2021, Italy and South Africa were appointed to serve as Presidents-designate in preparing for the 2021 Article XIV conference in New York.

PREPARATORY COMMISSION

7. In advance of the entry into force of the Treaty and the establishment of the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), a Preparatory Commission was established by States Signatories on 19 November 1996. Its purpose is to carry out the necessary preparations for the effective implementation of the CTBT and to prepare for the first session of the Conference of the States Parties to the Treaty. Altogether 185 States are members of the Commission.

8. The Commission has two main activities. The first consists of undertaking all necessary preparations to ensure that the verification regime foreseen by the CTBT is capable of fulfilling its operational mission at entry into force. The second is the promotion of signature and ratification of the Treaty to achieve entry into force. The Commission is made up of a plenary body responsible for directing policy and composed of all States Signatories, as well as a Provisional Technical Secretariat (PTS) which assists the Commission in its duties and carries out such functions as the Commission determines.

PROVISIONAL TECHNICAL SECRETARIAT

9. As of 31 July 2021, the PTS comprised 281 staff members from 90 countries. The number of staff at the Professional level was 185. The PTS is committed to a policy of equal employment opportunity, with a particular emphasis on improving the

[1] Previous Article XIV conferences were held in Vienna (in 1999, 2003 and 2007) and in New York (in 2001, 2005, 2009, 2011, 2013, 2015, 2017 and 2019).

representation of women, especially in the scientific and technical areas within the Professional category. Sixty-six women held Professional positions as of 31 July 2021, corresponding to 35.68% of the Professional staff.

10. The approved Budget of the Commission for 2021 amounts to US$125.10 million. From 1997 up to and including the financial year 2021, the total budgetary resources amounted to $1464.98 million and €954.91 million. In equivalent US dollars this corresponds to a total of $2635.21 million calculated using the budgetary rate of exchange of $1 = €0.816. Of this total, 79.8% has been dedicated to verification related programmes, including $494.38 million (around 19%) for the Capital Investment Fund for the installation and upgrade of International Monitoring System (IMS) stations.

VERIFICATION REGIME

11. The CTBT provides for the establishment of a unique global verification regime that consists of an IMS, a consultation and clarification process, on-site inspections (OSIs) and confidence building measures. Data from IMS stations are to be sent via a secure global network (the Global Communications Infrastructure (GCI)) to an International Data Centre (IDC) for processing and analysis, and IMS data and IDC products are to be made available to States.

International Monitoring System

12. The IMS is to consist of a network of 321 monitoring stations and 16 radionuclide laboratories. The mission of these facilities is to produce data for the detection of nuclear explosions. These data are to be provided to States Parties for verification of compliance with the Treaty after entry into force.

13. The momentum to complete the IMS network continues at a moderate pace. As of 30 June 2021, 297 (92.5%) IMS stations had been installed, of which 288 had been officially certified as meeting the specifications of the Commission. In addition, since mid-2019, one more radionuclide laboratory (RL14, South Africa) was certified, bringing the total number of certified laboratories to 14. As a result of political agreements and successful outreach activities, progress is being made in the establishment of stations in a number of States where there had been no or little progress. This will lead to additional IMS facility certifications in the coming years. Installation of additional noble gas systems will be a particular focus in the next few years. As of 30 June 2021, of the 40 noble gas detection systems envisaged by the Treaty, 31 had been installed, of which 25 systems have been certified (62.5%).

14. In addition, the continued political support from a number of countries hosting IMS facilities brings the prospect of a complete IMS network closer.

International Data Centre

15. The mission of the IDC is to support the verification responsibilities of States by providing data, products and services necessary for effective global monitoring after the entry into force of the Treaty.

16. The IDC continues in its provisional mode of operation and supports States Signatories by acquiring and forwarding continuous real time data, selected data segments and radionuclide spectra from the IMS. The IDC processes the IMS data along with compiled meteorological data and distributes the resulting products to support the verification responsibilities of States as well as their civil and scientific efforts. On average 13 terabytes of data and products are distributed every year. States are supported through an online help desk, data retrieval services, training courses, workshops and the provision of software and equipment.

17. The GCI receives and distributes IMS data and IDC products. Using a combination of satellite, terrestrial and Internet technologies, this communications infrastructure now spans over 100 countries and territories. Subnetworks are being operated in eight States Signatories to complement the GCI. Adjustments to the physical infrastructure and procedures are made from time to time to ensure that the GCI continues to transmit data and products securely with 99.5% availability every year.

18. Through the International Noble Gas Experiment, support from European Union Council Decision funds, contributions in kind from the United States of America (USA), and voluntary contributions from Japan, the PTS has been optimizing the capability of detecting signals from nuclear explosions against the global background of natural and man-made radionuclides. The overall goal is to enhance the detection capability of the IMS noble gas systems in order to make them as sensitive as possible to nuclear explosions.

19. The third phase of IDC seismic, hydroacoustic and infrasound (SHI) software re-engineering commenced in December 2018. This IDC-led effort to make the SHI processing platform modern, flexible, maintainable, updatable, and traceable will include a new pipeline, improved analyst interface and state of health (SOH) capabilities. The new system will integrate contributions from several States Signatories. The US government has donated two initial releases, including SOH capabilities, of their Geophysical Monitoring Software which comes from the modernization effort of the US National Data Centre (NDC), with much of the software fully compatible with PTS requirements. This software will be integrated with contributions from other States Signatories and PTS development, and thoroughly tested.

20. The PTS made significant progress preparing for the automatic processing of data from the next generation noble gas systems and in the modernization of interactive analysis software tools. Radionuclide data processing software is being developed and enhanced in a coordinated approach to improve analysis algorithms, provide single software platforms to handle both particulate and noble gas processing, and unify the software used at the IDC and in NDCs.

21. Since 2019, the PTS released major upgrades of both the radionuclide and the SHI data analysis software provided to NDCs. In addition, the release process was modernized to enable NDCs to install and update their software more easily. The project was supported financially through EU Council Decision V, VI, VII and VIII. The new version of the software enables NDCs to combine IMS data and IDC products more easily with data from local and regional stations and from other global networks. The PTS continuously enhances and extends the capabilities of software for NDCs.

Sustaining and Maintaining the International Monitoring System

22. In accordance with Article IV of the Treaty, the PTS supervises, coordinates and ensures the operation of the IMS and its component elements. Preparing a global verification regime is not just about building stations. It is about taking a holistic approach to establishing and sustaining a system that meets the verification requirements of the Treaty and ensures minimal downtime of IMS facilities. Operational experience with the system has increased over time, leading to the establishment of an IMS sustainment structure and concerted efforts for more effective operations, preventive maintenance, logistical and engineering strategies and programmes. These sustainment activities are essential to preserve the investment already made by States Signatories.

23. The PTS has continued its activities in configuration management, supportability analysis, establishment of equipment support contracts, shipping and customs clearance, and equipment sparing in support of improving IMS station operability and uptime. It has also continued to recapitalize IMS facility components reaching the end of their operational lives and to address unscheduled maintenance in a timely fashion. Furthermore, owing to the central role played by station operators in resolving problems on site and hence contributing to high levels of data availability, the PTS has continued to invest in training courses for station operators that are tailored to their needs. Monitoring and tracking software has been enhanced to further facilitate the tasks of monitoring, detecting and resolving incidents in the IMS network.

24. As the IMS network grows, the costs associated with its sustainment also rise. Provisions are in place to address peaks in obsolescence of IMS equipment in the medium term. The PTS is continuing its efforts in life cycle modelling of IMS stations to enhance the sustainment of the IMS, including its cost.

25. Operation and maintenance of IMS auxiliary seismic stations are the responsibility of the host countries. While some progress has been made over the last two years, resulting in maintained levels of data availability and a better understanding of roles and responsibilities for sustainment, further efforts involving close collaboration with States Signatories are required. The European Union provides financial support for IMS auxiliary seismic stations that do not belong to parent networks and are hosted by developing countries or countries in transition.

26. Increasing the number of facility agreements and arrangements between the Commission and the States hosting IMS facilities is important for providing the required support for the functioning and sustainment of the IMS. As of 31 July 2021, facility agreements had been signed with 49 of the 89 host States, and 41 of these

agreements had entered into force. The development and implementation of mechanisms such as timely customs clearance and tax exemption for equipment brought into an IMS host State has proven to be highly relevant.

27. The PTS has continued to focus on engineering and development activities with the aim of improving the robustness of IMS monitoring facilities and enhancing the performance and capabilities of associated technologies. This is being achieved through designing, validating and implementing solutions throughout the life cycle of IMS stations. Notably, grounding and lightning standards that were updated to international standards are being progressively implemented throughout the IMS, and new guidelines for power at IMS stations and type approval procedures for critical equipment used at IMS installations are under development.

28. Significant progress has been made in the quality assurance/quality control (QA/QC) programme of the IMS network. Calibration of primary and auxiliary seismic, T phase stations and infrasound stations are scheduled and performed on an annual basis with the support of station operators. Similarly, a comprehensive QA/QC programme is in place for all radionuclide stations. In addition, testing and implementation of pilot QA/QC procedures for radionuclide stations with noble gas capability has continued with good results and in 2021 the first noble gas Proficiency Test Exercise was held with the participation of six IMS laboratories.

29. 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. The PTS continues to make progress populating its Quality Management System (QMS) with station specific documentation.

30. There are currently two major technological developments in progress: (i) the next generation of noble gas systems that have improved sensitivity and enhanced reliability are under development, testing and implementation. One type of noble gas system has completed all testing and the first of its kind is now being installed at radionuclide station RN63 (Sweden); (ii) a hybrid modular design concept was identified as the optimal approach to enable reparability of individual nodes and underwater system subcomponents of hydroacoustic hydrophone stations. A first prototype modular cable latch that enables the disconnection of a node from the trunk or internode cable any time after deployment without disturbing the other elements of the underwater triplet is complete and is ready for testing.

31. Significant efforts and re-engineering of the information technology infrastructure has ensured high availability of all information technology equipment and systems in use. For instance, the availability of infrastructure supporting critical IDC verification capabilities was 99.9% for the period January to June 2021. Through a combination of different approaches, including redundancy, secure storage and clustering, the effects of hardware failure and human error have been minimized.

32. High levels of data availability from IMS stations are being achieved. This has been achieved through the PTS' operation and sustainment strategy and the joint efforts with delegations, national governments, station operators and national institutions. In 2020, the data availability levels remained high for certified IMS stations with average data

availability of 93.4% for the primary seismic station network, 98.6% for the infrasound station network, 88.3% for the hydroacoustic station network, 87.8% for the auxiliary seismic station network. The radionuclide network performed at a level of 95.4% (particulate stations) data availability and 89.6% (noble gas systems) in 2020.

33. Post-certification activity (PCA) contracts, agreements and arrangements support station operators in operating and maintaining primary IMS stations after certification. There are PCA contracts in place for 167 certified primary IMS stations. The PTS has developed standardized operation and maintenance plans, which by the end of 2020 had been implemented by 135 stations. This approach helps to keep operational costs at a reasonable level while ensuring sufficient funding to keep the stations well maintained. Keeping the operational costs of IMS stations at a reasonable level is a joint responsibility of the PTS and the host country.

On-Site Inspections

34. On-site inspections represent the ultimate verification measure of the CTBT in order to address possible compliance concerns with the Treaty. An OSI can only be invoked after the entry into force of the Treaty. The sole purpose of OSI is to clarify whether a nuclear weapon test explosion or any other nuclear explosion has been carried out in violation of the Treaty and to gather facts which might assist in identifying any possible violator.

35. The Commission has continued to build up the OSI verification regime in accordance with Treaty requirements. Considerable progress has been made with the completion of the OSI action plan and of the third training cycle for inspectors.

On-Site Inspections Programme of Work

36. The completion of the previous OSI action plan 2016-2019 has seen the Division focused on analysis and reporting of results from the action plan primarily through the issue of information papers and technical reports. A new programme of work is under development for the period 2022-2023 to build on the significant progress made since 2016. The programme of work is being designed and developed in the context of the OSI Strategic Plan and the Programme and Budget for 2022-2023. The programme consists of four parts:

- Development of the OSI Training Programme and Integrated Capacity Building and Training;
- Policy, Planning and Operations;
- Documentation;
- Inspection Techniques and Deployment.

Third Training Cycle for Inspectors

37. The third training cycle as a further development of the OSI training programme builds upon the two previous training cycles. Its basic model originates in the long range plan for the OSI training and exercise programme (CTBT/PTS/INF.475) and draws on the

evaluations, recommendations, lessons and experience from the first and second training cycles leading up to the integrated field exercise in 2014 as well as from the integrated field exercise itself.

38. WGB agreed with the proposed training cycle and its implementation at its Forty-Sixth Session. Subsequently, the PTS circulated a note verbale calling upon all States Signatories to nominate suitable candidates for participation in the third OSI training cycle for surrogate inspectors through their Permanent Missions, in accordance with the announcement which included a description of requirements and qualifications.

39. The cycle commenced in October 2016 and finally concluded after some COVID-19 related delays in May 2021. The training curricula were to be validated in 2020 as part of a series of two field exercises, however, these were unable to take place due to the COVID-19 pandemic. An expert meeting to review the training cycle outcomes will be held virtually on 21-25 June 2021.

SIX ANNOUNCED NUCLEAR TESTS BY THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

40. The accuracy of the location identified by the IDC based on primary and auxiliary seismic stations of the IMS depends on the number of detections contributing to it. For the nuclear tests announced by the Democratic People's Republic of Korea , this number increased from 22 for the DPRK-1, conducted on 12 October 2006 with mb (IDC)=4.08, to 189 stations for the DPRK-6, conducted on 3 September 2017 with mb (IDC)=6.07. This increase is due to both a larger number of certified stations in 2017 and to the higher magnitude of the DPRK-6 test. Correspondingly, the confidence ellipse area decreases from 880 square kilometres for DPRK-1 to 109 square kilometres for DPRK-6.

41. The aftershock sequence of the Democratic People's Republic of Korea tests has unusual properties for underground explosions with body wave magnitude 5 to 6. The most recent aftershocks were detected by IMS stations in July 2021.

42. The performance of the verification system was timely and effective and proved the value of the investment made in its establishment.

43. The announced tests were detected by the IMS facilities and the data were shared with States Signatories in near real time. The States Signatories received the reviewed data products within the defined time lines. The Commission also held briefings to discuss the findings of the verification system.

44. The response of the IMS and the IDC to the announced tests established that their capabilities are nearing full maturity. In addition, the tests underlined the significance of the OSI mechanism as a complementary element of the verification regime and the need for constant testing and validation of the regime.

45. The international reaction to the announced tests was swift and strong. Many countries condemned the nuclear tests and considered such actions to seriously threaten

international peace and security. They called on the Democratic People's Republic of Korea to cease any further tests and to immediately sign and ratify the Treaty.

QUALITY ASSURANCE AND PERFORMANCE MONITORING

46. The PTS undertakes to continuously enhance effectiveness and efficiency through its QMS, which encompasses all contributing PTS processes and work products. One of the functions of the QMS is to identify and implement key performance indicators for evaluating these processes and products and assure the development of a continual improvement process in the PTS with focus on the verification regime. The overall aim of the QMS is to support the objective of consistently meeting verification system requirements.

47. The performance monitoring and testing framework was established by the PTS to create a culture in which quality is monitored as part of normal activities so that stakeholders, such as States Signatories and NDCs, have assurance that the Commission is in compliance with the requirements set forth in the Treaty and its Protocol. As part of this process, NDCs, which use the products and services of the IDC, meet in annual workshops to provide their feedback, and representatives from States Signatories are invited to participate in activities organized by the PTS, such as OSI exercises or experiments conducted by the IDC.

48. Exchanges of experience and knowledge have been reached through a series of NDC Preparedness Exercises (NPEs) conducted by the NDCs and will continue in the future. NPEs represent a further advance along the learning curve for NDCs to perform their verification duties, enhancing the dialogue and cooperation between experts in the various CTBT monitoring technologies and the PTS.

CTBT: SCIENCE AND TECHNOLOGY CONFERENCES

49. Mindful of the obligation under Article IV of the Treaty that States Parties cooperate with the CTBTO "in the improvement of the verification regime, and in the examination of the verification potential of additional monitoring technologies", the CTBT: Science and Technology (SnT) process was established in 2006 to engage with the global scientific and technological research community.

50. This process continued in June 2019 with the fifth in a series of biennial SnT conferences hosted by the Commission in the Hofburg Palace, Vienna, with support from the European Union. Attendance was over 1000, with 128 oral presentations, over 575 research posters, 19 panel discussions and an opening session with high level invitees providing a political and diplomatic context. The conference provided a forum for the Commission to maintain awareness of emerging technologies relevant to CTBT verification. It explored methodologies for monitoring the performance of the verification regime and considered topics related to capacity development and the education and training of those who contribute to the installation and maintenance of relevant monitoring facilities and to data processing and analysis. It also highlighted monitoring for nuclear explosions in a global context and put special emphasis on the

active participation of the CTBTO Youth Group (CYG). The event was an opportunity for the Group of Eminent Persons (GEM) to meet and discuss ways and means of advancing the universality of the treaty and its entry into force. The SnT2019 conference report "Scientific Advances in CTBT Monitoring and Verification 2019" can be read and downloaded from: https://events.ctbto.org/sites/default/files/2020-08/SnT2019report_published.pdf.

51. SnT2021 took place from 28 June to 2 July 2021. As a result of the COVID-19 pandemic, SnT2021 was different from previous SnT conferences in terms of its hybrid-virtual format. The high level opening day (28 June 2021) took place in the Hofburg Palace, Vienna, with live video streaming to all participants worldwide. The technological sessions and scientific panels on the following days (29 June - 2 July) were conducted fully online.

52. More than 1600 registered participants attended the sessions. The conference programme contained over 600 oral and e-poster presentations. In addition, a series of highlight and invited talks were included.

53. The conference had two important themes that were unique for 2021. These included the 25th anniversary of the opening for signature of the CTBT and the COVID-19 pandemic that has influenced all our lives.

54. The 25th anniversary was marked by a series of invited talks and panels that addressed various aspects of the developments in the past 25 years and the challenges and prospects for the Treaty in the future. The topics of the panels included sensors, data analysis, regional data, lessons from historical data, preparedness for OSI, scientific and civil applications. The global nature of the COVID-19 pandemic produced a resilience test for many, and in particular for a global monitoring system such as the CTBTO's, which relies on continuous data gathering, transmission and analysis. This experience and the lessons that can be learnt from it were discussed in a dedicated panel and a series of oral presentations distributed over several sessions.

INTEGRATED CAPACITY BUILDING AND TRAINING

55. The Commission accords high importance to training and capacity building to improve the capacity of States Signatories to effectively fulfil their verification responsibilities under the Treaty and to benefit fully from their participation in the verification regime, in particular through the use of IMS data and IDC products (for verification as well as for their own civil and scientific applications).

56. In addition to traditional training methods, information and communication technologies such as e-learning offer broader possibilities to expand and further enhance capacity building. Training and capacity building are provided to States Signatories that have access to IMS data and IDC products (around 1980 authorized users from 141 States) as well as to those that do not have access (43 States) and those that do have access but make limited use of the information. Owing to the COVID-19 pandemic, online training was introduced in April 2020 to address the inability of having in-person training sessions.

57. The training targets a variety of audiences, namely IMS station operators, technical staff of NDCs, OSI inspectors, officials, diplomats and PTS staff. Currently, 51 e-learning modules, in the official languages of the United Nations, are available. Since 1999, more than 11 000 NDC technical staff and IMS station operators from 185 States Signatories were trained. The current training programme includes around 30 NDC and station operator events annually, for all four technologies.

58. The need to invest in the next generation of nuclear non-proliferation and disarmament specialists is a key driver of the education activities of the Commission. These aim to broaden knowledge of the Treaty and to develop capacities in States Signatories to effectively confront the political, legal, technical and scientific challenges facing the Treaty and its verification regime. To achieve this objective, the Commission continued to develop its Knowledge and Training Portal, complete with issue specific training modules, a database of CTBT related resources and materials, and an archive of lectures on the Treaty and the science and technology that underpin its verification regime. The Commission is also the first security based international organization to create a free and open educational platform on iTunes U, which allows users to access and download lectures, documents and presentation files on the policy, legal, technical and scientific aspects of the CTBT.

59. The Commission also continued to update and to modernize its publicly available CTBT e-learning modules and introductory CTBT tutorial using a modern and interactive e-learning framework. This set of newly developed modules will help to prepare stakeholders for the CTBTO educational initiatives, support outreach activities, and improve the CYG induction mechanism on its portal. The modules will also be utilized for awareness raising and outreach to the general public, and can be made available for incorporation into academic curricula.

OUTREACH ACTIVITIES

60. The outreach activities of the PTS 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.

61. Most interaction with States to raise awareness about the Treaty and promote signature and ratification takes place in the context of bilateral consultations and correspondence. While special emphasis has been placed on those States listed in Annex 2 to the Treaty and those hosting IMS facilities, virtually all States have been approached in the Commission’s outreach efforts since September 2019. In addition to regular dialogue with Permanent Missions in Vienna and those representations based in Berlin, Geneva and New York, visits by PTS staff were conducted in a number of capitals. Consultations were also held, at all levels, on the margins of global, regional and subregional conferences and other gatherings.

62. A number of events and activities are organized by the PTS which allow for bilateral consultations with participants from both signatory and non-signatory States. A series of international science and diplomacy workshops in Havana, Cuba, organized in October 2019 with Cuba's Ministry of Science, Technology and Environment, were part of the CTBTO's outreach to Cuba.

63. 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 e.g. the IAEA, the Inter-Parliamentary Union, the Organization for the Prohibition of Chemical Weapons, the United Nations Industrial Development Organization (UNIDO), the United Nations General Assembly and its First Committee, the United Nations Office on Drugs and Crime (UNODC), the African Commission on Nuclear Energy (AFCONE), the International Organization of the Francophonie and the Parliamentary Assembly of the Francophonie (APF).

64. 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 High Representative for Disarmament Affairs of the United Nations, the President-Designate of the Tenth Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, the Director-General of the IAEA, the Director-General of UNIDO, the Director-General of the United Nations Office at Vienna/Executive Director of UNODC, the Chairperson and the Executive Secretary of AFCONE, the Secretary General of the Organisation internationale de la Francophonie, the Vice-President and the Parliamentary Secretary General of the Parliamentary Assembly of the Francophonie.

65. Participation by the Executive Secretary in major events and high level bilateral talks constitutes a key element of PTS outreach efforts. These included the following: Munich Security Conference 2020 (Munich, Germany, February 2020); 75th Anniversary of the Atomic Bombings of Hiroshima and Nagasaki (video message, August 2020); address to the United Nations General Assembly in the context of the International Day against Nuclear Tests (virtually, August 2020); European Forum Alpbach (virtually, August 2020); Armenia's Summit of Minds (virtually, October 2020); the Friends of the CTBT Group's global call to end nuclear testing (video message, October 2020); Halifax International Security Forum (virtually, November 2020); Astana Club Meeting (virtually, November 2020); 75th session of the United Nations General Assembly, under the agenda sub-item "Cooperation between the United Nations and the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization" (virtually, November 2020); Vienna Center for Disarmament and Non-proliferation (virtually, February 2021); Student/Young Pugwash – UK Branch (virtually, March 2021); International Conference co-organized with Turkmenistan on "Ensuring peace, stability and security: Strengthening international and regional cooperation in the field of disarmament" (virtually, April 2021); Conference on Disarmament (virtually, May 2021).

66. The Executive Secretary also attended several other conferences, meetings and seminars where he gave keynote speeches or participated in panels or discussions on the Treaty. During these conferences, meetings and seminars around the world and at meetings in

Vienna, the Executive Secretary met with a number of prominent figures from academia, leading think tanks and other non-governmental entities. He also attended events related to nuclear non-proliferation and disarmament convened by individual governments.

67. The PTS has continued to promote preparations for national implementation of the CTBT through its programme of legislative assistance to States on the measures to be taken in accordance with Article III of the CTBT. Model legislation and commentary have been widely distributed by the PTS and are available on the CTBTO public web site.

68. As part of its outreach programme, the CTBTO holds a Science Diplomacy Symposium every other year to raise public awareness of the contribution of the CTBT to international peace and security, and to inspire cooperative and collaborative research and innovation on nuclear test monitoring science and technology. Due to COVID-19 restrictions, the third Science Diplomacy Symposium (2020) had to be postponed.

69. The PTS has also continued to promote the Treaty and its verification regime through interaction with States, media, civil society, educational and scientific institutions, think tanks and the general public. Using a proactive and targeted approach, public information activities generated considerable media coverage for key events, including the CTBT: Science and Technology 2021 conference. Film, photography, interactive features and animations are notable characteristics of CTBTO outreach activities. The public web site and social media platforms have been further developed to reach new audiences, including the young generation, in particular in the remaining Annex 2 States. This has led to increased visibility for the Treaty and its verification regime in print, online and broadcast media worldwide. Media outreach and other public information activities have continued in the form of articles, op-eds, interviews, briefings, publications, special events, exhibitions and presentations.

70. A significant portion of the outreach activities of the Commission is carried out using voluntary contributions provided by States Signatories. Among the activities conducted by the PTS on the basis of such contributions was the project facilitating the participation of experts from developing countries in technical meetings of the Commission, funding the maintenance and operation of auxiliary seismic stations in developing countries, thus enhancing the data processing capabilities and data availability for States Signatories. Voluntary contributions have also been provided for training to build capacity in developing countries and to enhance understanding of the work of the Commission with a particular focus on the young generation including the expanding CYG, applications and development of the CTBT verification technologies and the benefits accruing from membership of the Commission, including the potential benefits derived from the civil and scientific applications of the verification technologies.

CIVIL AND SCIENTIFIC BENEFITS OF THE TREATY

71. There are a range of civil and scientific applications for the verification technologies of the Treaty that can benefit States Signatories. The abundance of data and products

available to States Signatories can facilitate their civil and scientific activities, including, for example, natural disaster warning and preparedness, sustainable development, climate change research, knowledge expansion and human welfare. Since 2011 a total of 156 contracts have been signed, providing researchers from 27 countries free access to IMS data through the virtual Data Exploitation Centre.

72. As an example of the civil and scientific applications of the verification technologies, the Commission has agreed on terms under which IMS seismic and hydroacoustic data can be made available to recognized tsunami warning organizations. Eighteen such agreements or arrangements with seventeen countries are currently in place for which data from approximately 100 IMS stations are being sent. Tsunami warning organizations have confirmed that the use of IMS data, which are timelier and more reliable than data from other sources, increases their ability to identify potentially tsunamigenic earthquakes and to issue more rapid warnings. Another example is the membership of the Commission in the Inter-Agency Committee on Radiological and Nuclear Emergencies which has 19 member organizations as well as observer organizations. The Commission is a co-sponsor of the Joint Radiation Emergency Management Plan of the international organizations. According to the plan, in case of a radiological or nuclear emergency IMS data and IDC products may be shared through the secure IAEA Unified System for Information Exchange in Incidents and Emergencies. The Practical Arrangements between the Commission and the IAEA in this regard was signed in 2016.

CONCLUSION

73. Since the 2019 Article XIV conference, considerable progress has been achieved in the promotion of the Treaty and the advancement of its verification regime. The call for early entry into force has continued to feature prominently in the agenda of the international campaign for nuclear non-proliferation and disarmament. The verification regime of the Treaty has moved closer to completion, further improving its operational readiness and thereby increasing the confidence in its capability to detect any nuclear explosion test in any environment.