CTBTO
PREPARATORY COMMISSION

5TH WORKSHOP ON

OPERATION AND MAINTENANCE OF THE IMS

5 TO 9 OCT 2015

VIENNA INTERNATIONAL CENTRE
VIENNA, AUSTRIA

BOOK OF ABSTRACTS

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CTBT:
5th WORKSHOP ON
OPERATION AND MAINTENANCE
OF THE IMS
2015
BOOK OF ABSTRACTS

Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization
Vienna International Centre
PO Box 1200
1400 Vienna
Austria

September 2015

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Keynote Speaker

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THEME 1: Data Availability

T1-O1. 5th workshop on the operations and maintenance (O&M) of the IMS

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DATA AVAILABILITY I - Ensuring high levels of DA 1- Daily checking of Snow White - Volume, air flow on data logger 2- Daily checking of auxiliary generator status - Tank refuel, display panel controller, oil change 3- Daily checking of detector status - High voltage on DSPEC Jr, temperature on RSS 4- Daily checking of air conditioners - Operation mode, their lifetime, room temperature II – interaction with operations, maintenance and engineering - Lubrication of snow white bearing, replacement of bearing - V-links replacement, impact of thunder strike on power generator then warm up of detector - Position of installation of lightning protector - The lifetime of devices according by the voltage of RN13, measure of the voltage at RN13 station III – Best practices including standardization of report and maintenance plans. - CMP13 Checking and maintenance devices - CMX13 Checking and maintenance devices, electronics board IV – planed upgrades - Improvement of acquisition system - Connection of rooftops in the ground - Installation of auto transformer to lower the voltage at around 230V,mesure of the new voltage, ground - Reception of Dspec Jr - Resolution concerning the appropriate air conditioner to be install at the station.

T1-O2. Challenges For Ensuring High Levels of Data Availability of BRTR-PS43, Turkey.

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BRTR-PS43 is located in Turkey and composed of two arrays, SP and MP, including borehole type seismometers. The depth of the sensors are approximately 30 meters and 60 meters for SP array and MP array, respectively. There are indeed advantages of receiving seismic data from borehole sensors for analysis but maintenance and troubleshooting of borehole stations are crucial. Recently, BRTR-PS43 experienced some issues such as bent borehole, water in the borehole and data with spiking which directly affects the data availability, negatively. Bent borehole can block the faulty sensor during its replacement and cause of increasing the downtime. Spiking is a data quality issue that needs to be fixed immediately. Intrasite communication problems related with antennas were the other main issue which hinders receiving timely data that BRTR-PS43 was exposed. Keeping the antenna alignments constantly is the main point of receiving timely data. Efforts and troubleshooting actions of fixing these issues will be explained and discussed. Future upgrade plans of BRTR-PS43 will also be mentioned.

T1-O3. Ensuring data availability at IMS stations

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Station equipment is powered by electricity. Loss of the main and backup power supply is areason of unavailability of data from the stations. This presentation contains causes of the problem and proposals for their elimination.

T1-O4. Failure Trends at the IMS RN

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This presentation provides a detailed recording of the failures of particulate and noble gas systems of IMS radionuclide stations and describes the results of the investigation into the causes of these failures. Data from 63 certified radionuclide particulate systems and 22 certified noble gas systems of the network of IMS radionuclide stations were analyzed. Performance Reporting, daily state-of-health monitoring of stations, and incident tracking through the IMS Reporting System (IRS) provides the basis for classifying and analyzing different types of failures of radionuclide systems. Failure Mode and Effect Analysis (FMEA) enables the PTS to develop engineering solutions and systematic strategies for the network to increase data availability and its robustness. An overview of FMEA and the failure categories used for the IMS radionuclide network is provided. The analysis of particulate and noble gas systems is presented separately in order to take into account the different technologies of the stations. On the station equipment level an in-depth analysis is provided for failures related to HPGe (High Purity Germanium) detector systems installed at IMS radionuclide stations, since failures of HPGe are the most dominant cause of system downtime.

T1-O5. IMS Stations BDFB and I09BR working status in the last two years.

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Over the last two years (2013/2014), the IMS stations BDFB and I09BR have been operating with high data availability (BDFB: UDA.6/99.6 and MCU.0/99.0 and I09BR UDA.8/98.7; MCU.9/96.7). However, recent indications are showing that the stations are deteriorating (e.g. power problems) due to the long raining season associated with unnecessary loads (DC/DCs converters) and inappropriate shorter life time battery. The other important indicator is the high rate of equipment failure (radios and digitizers), probably due to the high rate of lightning strikes (not uncommon to this area) associated with the degraded grounding/lightning protection systems. The infrasound station Wind Noise Reducing System was installed about 13 years ago and so far no major maintenance was done. A visual inspection showed that the inlet ports initially covered by gravel are now filled with soil and probably with leaks. As a conclusion the stations might experience a drop to their DA if no actions are taken to bring them to their installation standard as well as some improvement done to the associated infra-structure. The CF backup power is not working fully and since the commercial power grid increased the interruption rates in frequency and duration it is advisable to have it assessed shortly.

T1-O6. IMS/IDC Operational Manuals – Part of the Framework Governing the O&M Activity in the IMS network

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The International Monitoring System (IMS) and International Data Centre (IDC) Operational Manuals, which govern the functioning of all stations/laboratories in the IMS network and of the IDC, are documents required by the Comprehensive Nuclear-Test-Ban Treaty (CTBT). The manuals include the technical and operational requirements needed to ensure the effective operation of these components of the monitoring and verification system. They also present the interactions among these components, and the responsibilities of the entities that perform the O&M activities. The Operational Manuals also specify performance requirements for IMS and IDC components, e.g. data availability, timeliness, and quality for the stations in the IMS networks, and product availability, timeliness, and quality for the IDC. The paper presents the status of the IMS/IDC Operational Manuals and the way several technical/operational requirements included in these documents are met.

T1-O7. Implementation of Optimized Sparing for IMS Stations

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All International Monitoring System (IMS) stations must meet very high Data Availability (DA) requirements, equivalent to only a few days down-time per year at each station. One way to reduce the amount of down-time at a station is to ensure that the correct spares are available to replace failed parts in an acceptable amount of time. As part of an Integrated Logistics Support approach, the Monitoring Facilities Support (MFS) Section is using an optimized sparing analysis method to model the IMS network, identify probable equipment failures, and calculate the number and location of spare parts needed to maximise Data Availability at a station (or a set of stations) in the most cost effective way. In this presentation we demonstrate our method of analysis; explore some potential benefits; repeat our request for your feedback on our primary input data; and envision a possible implementation process for budget forecasting and annual spares planning.

T1-O8. Maintaining High Data Availability: The Australian Network

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High data availability is of upmost importance to the IMS network and is crucial to its ongoing success. Historically, the operators of the Australian stations that form part of the IMS network have maintained a high level of data availability across their network. During the 12 months from May 2014 to April 2015, the average unauthenticated Data Availability for the Australian stations was above 95% for Radionuclide and 97% for Waveform. This is well above the IMS network average which sits at around 85% for Radionuclide and 92% for Waveform. The Australian station operators apply a variety of methods to maximise the data availability across both waveform and radionuclide stations. These methods fall into three main areas; Technology; Maintenance; and Relationships; and include items such as: • SoH Monitoring Software. • Data Latencies. • Easily Deployable Spares. • Preventative Maintenance. • Early detection of emerging problems. • Fast response to Unscheduled Maintenance. • Ongoing Training of Local and Station Operators. • Station Operator Availability. • Good Local Operator relationships. During this presentation these areas will be discussed in detail in order to demonstrate what we do to ensure that a high level of data availability is maintained.

T1-O9. Maintaining high DA: The NACT view

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This presentation will give an overview of the data availability for all of the US IMS stations operated under the NACT program, and will review trends in data availability across these stations in recent years. Efforts to maintain and improve data availability across these stations and best operating practices will also be discussed. Additionally, the data availabilities of a radionuclide, infrasound, and auxiliary seismic station will be presented in greater detail to review specific applications of best practices for maximizing data availability and enhancing operations at these stations.

T1-O10. Monitoring System of Auxiliary Station in Indonesia

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Indonesia, in these case BMKG, are the institution which competent to do development, maintenance, and dissemination information relating to Earthquake and Tsunami, in addition to other task such as weather and climate and others. Especially Earthquake and Tsunami monitoring, currently BMKG has 160 of seismic station in the network. And part of it, 6 stations are cooperation between CTBTO and BMKG. 5 station are direct

cooperation between BMKG headquarters and CTBTO, 1 station are collaboration between UCSD and BMKG Regional IV and CTBTO. The biggest challenge is to keeping the system fully running, so that it can contribute to the observation of earthquakes and also determination of the earthquake parameters. Therefore, the monitoring carried out continuously, by utilizing tools from Nanometrics such as rbfsum and naqsview, to monitor the instruments condition. And also by do visual monitoring of waveform from the station as first indication of problem detection.

T1-O11. Monitoring and troubleshooting of RN stations in operations – challenges and importance of timely response from Station Operators

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At present there are almost 120,000 problem reports in the IRS database. The administration of the IMS network, troubleshooting and resource allocation are primarily handled through writing and updating problem reports. For the RN network the 95% Data Availability requirement is not met yet, and it is a major challenge to improve the RN performance. This presentation aims to show the importance of quick and accurate handling of problem reports as a means to minimize downtime.

T1-O12. Moving Stations in and Out of Operations (12 month view)

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Problems in stations, station upgrades or equipment changes may make necessary the removal of data from the IDC Pipeline. The presentations focuses on how the process is being streamlined in order to avoid delays from the time a station is operationally ready, therefore minimizing effects on Data Availability.

T1-O13. Preparatory Work on Refurbishing the Canadian National Seismograph Network

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Natural Resources Canada has started a 5 year project to refresh the Canadian National Seismograph Network, including weak and strong motion monitoring, and to co-locate GPS sensors at some of the seismic stations. Preliminary work has begun for determining the station, equipment and data centre requirements. A market survey of digitizers, seismometers, and accelerometers was conducted to compare features and capabilities of different instruments. An assessment was made of using posthole sensors instead of surface sensors. Digitizer data formats and telemetry protocols were studied, including the pros and cons of using proprietary versus standard protocols. Telecommunications options and digitizer protocols were investigated to gauge the bandwidth required to send data to two independent data centres. Finally, the impact on data centre processing was reviewed, with a focus on data acquisition software. The results of this preparatory work will be presented.

T1-O14. The role of Seismic Hydroacoustic Infrasound (SHI) analysts

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The Comprehensive Nuclear-Test-Ban Treaty (CTBT) bans all nuclear explosions. Compliance to the CTBT is monitored through analysis of data from the IMS network of stations whose results are published in the Reviewed Event Bulletin (REB. Thus, the information contained in the REB forms the basis for the verification of the CTBT. As such, it is important that information in the REB must be accurate, of high quality, and

delivered in a timely manner enabling member states to make informed decisions. Despite the use of automatic processing within CTBTO, SHI analysts play an important role in ensuring that the organisation delivers data products of high quality to member states. Analysts refine and/or re-estimate automatic event solutions by checking the correctness of the associated phase identity, phase arrival time, azimuth and slowness using raw waveform data. They also scan for events that might have been missed by the automatic system. This is done using unassociated signal detections and the raw waveform data. In addition, analysts do perform tests to verify the integrity of data from stations or performance of software packages before they are used for operational purposes to ensure that there are no disruptions to routine production of the REB.

THEME 2: Calibration

T2-O1. Data quality considerations for IMS radionuclide stations

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A quality control program is performed to assess the performances of the IMS radionuclide network in terms of data quality, i.e. to ensure that data produced are of acceptable quality and that the station is working within its certified operational specifications, and to initiate corrective action if non-conformities are found and take preventive action to avoid nonconformities. The station quality control is carried out by the station operator and includes the following elements: management of technical documentation, including operation and maintenance procedures and equipment manuals; daily station state of health monitoring in collaboration with the Technical Secretariat; and periodic calibration checks. A network quality control program is run by the Technical Secretariat on a periodic and ongoing basis: randomly selected samples collected during normal operations are dispatched regularly from stations to certified laboratories for reanalysis to verify system calibrations as part of this program. On the basis of the laboratory results, the Technical Secretariat may initiate a request for corrective actions. An overview of the current status of the quality control program will be presented.

T2-O2. How pre-calibrated HPGe detectors can enhance dramatically the TCOi of CTBT stations

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For 50 years CANBERRA has been the leading provider of innovative solutions in the domain of high resolution spectroscopy with a particular focus on Hyper Pure Germanium detector applications. Since the introduction of commercial mathematical efficiency calibration software 20 years ago, the industry has changed dramatically. CANBERRA has been and remains the undisputed leader in the development, use, and furtherance of mathematical efficiency calibrations by enhancing the usability and applications of the ISOCSTM and LabSOCSTM methodology in the domain of mid and high resolution gamma spectroscopy. After a discussion of the philosophy and technology behind ISOCSTM and LabSOCSTM, this presentation will focus on the proposed approach for the CTBT specific needs. Working with pre-calibrated detectors, performed by the supplier in a rigorous, traceable, and proven process, will simplify high quality measurements as deployed in the field. To be successful, certain aspects of QA/QC and validity of the data must be taken into account. Some of those aspects will be highlighted during this presentation.

T2-O3. Seismic Station Calibration

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The purpose of the station calibration project is the implementation of the calibration requirements defined in the IMS Operational Manual towards IMS primary and auxiliary seismic stations. Calibration is a measurement assurance process that contributes to the PTS quality control programme. The Calibration project was initiated in 2010 for the IMS Seismic network. Since 2012, every year all operating IMS seismic stations are scheduled for electrical calibration. To this date, this is not a straightforward task. Calibration is labour-intensive and requires careful planning, development and implementation of procedures and extensive cooperation with the external parties. In this work, we present the main achievements and lessons learnt since the initiation of the project, as well as the way forward, including the development of software tools that support the scheduling, implementation, evaluation and reporting of calibration activities. This includes the development of a platform to share calibration related information (schedule and reports) that will be available to the Station Operators via CTBTO Web Portal.

THEME 3: Security

T3-O1. Data Surety in IMS

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In 2013 PTS bootstrapped data surety activities in IMS network. First functioning of tamper switches was tested through IMS and later in 2014 PKI was bootstrapped. By the end of 2014 number of stations sending signed data passing authentication check in IDC reached around 20%. Results of these activities are summarized and challenges in the process are analysed. Further requirements on reporting related to data surety are discussed.

THEME 4: Engineering

T4-O1. A Windmill Farm, A Threat or an Opportunity?

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The current trend of the increase of man-made noise is leading the seismological world towards "noisy stations". Every year the area of low noise wilderness is diminishing and it will be less easy to find new good sites for seismograph stations. In the future the world is looking for new alternative energy sources and quite obviously it is leading towards local and smaller energy producing units, like windmills. It means more units in wider areas. In the real world windmills are already there. And there will be even more to come! This means that the problem is not only with the new station sites but also the existing CTBTO/IMS network should be alerted! This presentation tries to give a view on the facts which have been taking place next to the IMS station PS17, FINES, in Finland during the last two years. This is not an attempt in any way to condemn windmills as energy sources, but there is a need for knowledge to understand wind mills as noise sources and to establish regulations for construction of new windmill farms. Let all the flowers bloom, in their own backyards!

T4-O2. CMAR(PS41) Upgrade

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In order to increase the reliable of data availability and maximize the radio signal strength, AFTAC execute the upgrade plan for CMSRS in May 2014 , to bring up the equipment to current standards, to increase backup power time, and to improve the Intrasite communication. The upgrade equipment include changing to new Macintosh station processors, Digitizer firmware, LMR 900 Cable, Radome antenna, and New Power Box with bigger size Batteries. The Network configuration adjustment is done for CM32. The upgrade would not successfully done without the closely cooperation among AFTAC Team from the US., DET415 Team, and CMSRS Maintenance Team of 4 persons from Royal Thai Navy, Electronic Department.

T4-O3. DEVELOPMENTS ON THE IMPLEMENTATION OF AN EARTHQUAKE EARLY WARNING SYSTEM

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Earthquake Early Warning System (EEWS) is one of the most effective approaches in our days to mitigate the effects caused by strong earthquakes. There are two concepts on the implementation of these systems: a regional approach and an onsite approach. For an effective EEWS we will probably apply both concepts. PRESTo is a software platform for regional earthquake early warning, developed in the RISSC-Lab, University of Naples, Italy, that is easily adapted and configured for different networks and seismogenic regions. Starting with Portugal mainland, and specifically bearing in mind the southwest seismogenic region, we configured PRESTo for a network of strong motion accelerometers, and proceed to simulations with some felt events occurred in the last years. We also elected some targets in order to observe the lead time available. About the onsite approach, based on Yamamoto et.al., 2008, we developed a computational tool to estimate the intensity of an earthquake using the first 5 s of the P wave. We then compared the results with other methods of instrumental intensity estimation. The results were very encouraging.

T4-O4. Operation of IMS Stations at Tristan da Cunha

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EnvirOconsult is the operator of the IMS Stations IS49, HA09 & RN68 on the island Tristan da Cunha. This island is famous to be the inhabited world remotest place and this involves a lot of complications in the operation and maintenance of the Stations.

T4-O5. Evolution in HPGe detectors and impact on station performance

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For 50 years CANBERRA has been the leading provider of innovative solutions in the domain of high resolution spectroscopy with a particular focus on Hyper Pure Germanium detector applications. In the last decade, many innovations have been developed and deployed in the field related to the need for service and serviceability of the installed equipment and have resulted in significant improvements to the TCO (Total Cost of Ownership). As an example, the current cooling systems used for HPGe detectors have significantly improved reliability compared to the first generations of cooling systems. Additionally, advanced crystal techniques have allowed a significant increase in performance in terms of resolution, efficiency and energy response of the current generation detectors. CANBERRA has been in close collaboration with CTBTO for many years and is continuously able to demonstrate an enhance system performance of the stations, based on a combination of different factors specifically optimized for CTBTO applications. Some of those aspects will be highlighted during this presentation.

T4-O6. PTS SERVICES, SUPPORT AND THEIR IMPORTANCE TO ZIMBABWE

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The availability of power affects the ability of National Data Centres (NDCs) to carry out their verification activities, including the accessing of IMS data and IDC products. Frequent, unscheduled power cuts and poor internet connection are some of the major constraints we face as we thrive to meet the 98% data availability and fulfilling our verification for our seismic station. This presentation will focus on Zimbabwe's experiences and the challenges we encounter with seismic instrumentation, power utilities, software (Geotool) and communication equipment as well as suggested solutions. The presentation also gives an overview of efforts being made by the PTS to ensure proper functioning of the NDC and the IMS network. The upgrading of the power system from AC to DC at our station MATP (AS120) is some of the effort that was done to ensure continuous uptime of the station.

T4-O7. SAUNA system upgrade for certification of the Takasaki IMS station

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A SAUNA system was installed for monitoring of radioxenon at the Takasaki IMS station (JPX38) in Japan in December, 2006. The test operation had been performed from 2007 to 2014, and valuable monitoring data and operation and maintenance experiences were obtained. Though the CTBTO planned to start system upgrade of the JPX38 SAUNA for certification in April, 2013, the upgrade plan was postponed since JPX38 detected radioxenon isotopes early in April, 2013, which were derived from the third nuclear test announced by North Korea. To prevent missing data during the period of upgrade, the Transportable Xenon Laboratory (TXL) was installed near JPX38 as an alternative measurement system and started to operate in January, 2014. The JPX38 SAUNA upgrade was carried out from January to April, 2014 to replace some parts with new ones and to implement some new functions. Stability and safety of the JPX38 SAUNA are definitely increased by these improvements. A certification visit by the CTBTO was done in June, 2014 and JPX38 got the certification on 19th December, 2014.

T4-O8. Standard Station Interface (SSI)

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The Standard Station Interface (SSI) is a software system designed for supporting the data acquisition at IMS stations and its transmission to the IDC. It is composed by several modules that can be used to manage the data collected by the system. The SSI is designed to meet all requirements for IMS data transmission, including: - CD1.1 protocol - data authentication - 7+ day buffering - Remote Command and Control - secure remote interactive sessions The SSI system is designed, developed and maintained by the PTS (via contractors). It is written in C programming language, and is developed and tested for Linux operating systems. It is provided to authorized users in source code form and in binary installable packages for RedHat Linux (RPMs). Its modular design allows for easy extension of the software system. This SSI documentation consists of unix-style man pages and a Configuration and Installation Manual in PDF format.

T4-O9. Station Operator Support for the GCI

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The Global Communications Infrastructure (GCI) connects every IMS facility to the IDC with a target annual availability of 99.5%. Every GCI component is remotely monitored and controlled by the 24x7 Network Operations Centre in the USA as well as by PTS staff. There are times when local support is necessary to diagnose a failure condition or to restore GCI service in the most expedient way. This presentation will discuss the ways in which Station Operators can assist the PTS and the GCI Contractor in maintaining or restoring GCI service.

T4-O10. The IDC pipeline and IMS

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This presentation gives an overview of IDC processing of IMS data.

T4-O11. The modernization of the seismic array ARCES/PS28

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The ARCES seismic array is currently in a major recapitalization/modernization phase. The array has been operating with more or less the same equipment from 1999 to 2014. In a first stage in September 2014 NORSAR replaced all essential acquisition and recording equipment, in a later stage we will refurbish the central recording facility. Each of the 25 sites is now instrumented with a three-component broadband seismometer (Guralp CMG-3T hybrid) and a Guralp EAM digitizer. The central site has a very-broadband instrument (360s -50Hz), whereas the other sites have sensors with a bandwidth from 120s - 50Hz. In the central recording facility we replaced the central timing system, the fibre optic modems for intra-array communication and the acquisition computers. We also established two new communication solutions (broadband over satellite and GSM) additional to the existing VSAT communication in order to accommodate higher data transmission volumes. During the upgrade we have been operating the old and new system as much as possible in parallel and accomplished a smooth migration. It took a total of 3 days (18.9. - 20.9.2014) from the installation of the first new instrument to the shutdown of the last old instrument.

T4-O12. Updates on the Performance Evaluation of CANBERRA® Cryo-Cycle™ Hybrid Cryostat as Cooling System for the High-Purity Germanium (HPGe) Detector in PHP52 Radionuclide Monitoring Station in Tanay, Philippines

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The PHP52 Radionuclide Monitoring Station in Tanay, Philippines installed one (1) unit of CANBERRA® Cryo-Cycle™ Hybrid Cryostat last 15 April 2012 as cooling system for the High-Purity Germanium (HPGe) Detector used at the station for the analysis of air-borne radionuclides. The Cryo-Cycle™ hybrid cryostat holds an initial supply of twenty-two (22) liters of liquid nitrogen (LN2) and regenerates LN2 from boil-off produced during normal operation, thereby reducing operational costs and occupational safety hazards brought by the purchase and delivery of additional liquid nitrogen to the station. In 22 November 2014, two and a half years since installation and initial supply of liquid nitrogen, the Cryo-Cycle™ required replenishment of liquid nitrogen after reaching a nominal LN2 level of 11 to 18 liters based on the provided user's manual. This presentation aims to present observations on the technical and economical performance of the CANBERRA® Cryo-Cycle™ hybrid cryostat in PHP52 station from its installation until its first replenishment of liquid nitrogen supply.

T4-O13. Upgrade of infrasound stations of IMS segment in the Russian Federation

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Long-term experience in IMS stations operation alowed us to make a number of conclusions about the need for infrasound stations upgrade. Proposals for infrasound stations upgrade aimed at improving data availability are included in this presentation.

T4-P1. ARP03 Station GE Detector, second and deep review of the Behavior of the Canberra Cryo-Cycle Cryostat after 6 years of performance

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The Canberra Cryo-Cycle Cryostat Germanium detector was installed in ARP03 station on Bariloche city, Argentina in 2009 as an experimental idea to test the behavior in a IMS station. This idea rise to check this new (2009) kind of mixed cooling systems in remote stations without the need of a weekly refiling, taking into account the provision or mayor storage of the LN2. The poster shows the behavior of the Cryo-Cycle since the installation, LN2 consuming (6 years) and what were the changes which the manufacture took into account since our last review of this old equipment to develop a new better mixed cooling system. Finally it would show the advantages and disadvantages that were taken account when it was thought to replace the old station detector. This decision became the solution to all the detector cooling difficulties/failures that are some of the biggest and most common problems that IMS stations has in the network.

T4-P2. Auxiliary Costa Rica Station on our local processing system

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One of the mainly activities of OVSICORI-UNA(Costa Rica) is the seismic researching and civilians communications by the monitoring of the earthquakes on our country. For transmission, processing, archiving and distribution we start using since 2010 the Antelope BRTT processing system. We successfully include the Costa Rica Auxiliary Seismic Station; Juntas de Abangares, Guanacaste (JTS) from the IMS Seismic Network into our local processing system and other regional IMS stations for regional earthquake location. In this work, we show the interaction between the Antelope and the Auxiliary Station.

T4-P3. Contributions of FSOs in the operation and availability of the national data centers and IMS stations

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. Free Space Optics (FSO) systems can provide high data bite rates up to 5 GB/s. They are also easy to install and low cost compared to wired optical fiber. In that regard, FSO can play a key role in link back-up for the infrastructure of the CTBTO in the field and even for the infrastructure at the headquarters in Vienna in terms of rapid deployment for securing link and data rate transmission. A special focus on IDC-IMS stations whose link halls are less than 15 km are investigated in terms of availability and access improvement when coupling FSO with the normal link.

T4-P4. Establishment of an On-Line Radiation Monitoring System as a Complement to the CTBTO IMS Network in Strengthening National Capabilities for Radiological Emergency Preparedness in the Philippines

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The widespread release of radioactive materials caused by the Fukushima Daiichi Nuclear Power Plant Accident that occurred on 11 March 2011 was detected by the IMS Radionuclide Station PHP52 Station in Tanay, Philippines on 24 March 2011. This accident not only provided evidence of the capability of the IMS Station PHP52 to detect minute amounts of suspended radionuclide particulates in air, but it also raised further concerns on the radiation monitoring capabilities of the Philippines in the event of another widespread radiological accident. The Philippine Nuclear Research Institute (PNRI), through the support of the International Atomic Energy Agency (IAEA), is establishing an on-line environmental radiation monitoring system that can provide real-time environmental radiation dose rate measurements from different monitoring stations around the Philippines. Together with CTBTO's PHP52 station in Tanay, this monitoring system aims to strengthen capabilities for radiological emergency monitoring and response in the Philippines.

T4-P5. Mexican National Seismological Service Networks

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The Servicio Sismologico Nacional (SSN) is the institution in charge of providing seismic information in Mexico. For this purpose, it has a network of 60 stations that constitutes to the Broadband Network (RBA); 32 stations, the Valley of Mexico Network (RSVM); 6 stations, the Conventional Network and GPS network of 24 stations that allows us to add displacement as a reported parameter. Thanks to the instrumentation used and the response of the sensors has high capacity seismic stations for detecting seismic events. Stations of the RBA have both velocity and acceleration sensors. Stations of the RSVM have only velocity sensors. The Conventional Network have short period seismometers. This work focuses on describing the construction and installation standards followed by the SSN in order to obtain efficient and reliable seismic information, as well as the different networks and instruments that SSN operates. A Standard Seismological Observatory of the Mexican Seismological Network has been established. This standard ensures temperature control inside the station, good seismic noise levels and safety. It contemplates procedures to select the proper site, construction details and installation protocols for electrical protection, power, backup and communication in order to guarantee in the continuity and quality of the data.

T4-P6. Modernization of the Yellowknife Seismic Array, (PS09)

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In late 2011, an agreement was made between the Department of Natural Resources Canada (NRCan) and the Provisional Technical Secretariat (PTS) of the Comprehensive Nuclear-Test-Ban Treaty Organisation (CTBTO) to invest in the recapitalization of the aging infrastructure of the Yellowknife Seismic Array (YKA) in Yellowknife, Northwest Territory, Canada. Originally constructed in 1962, YKA is currently one of the primary seismic arrays of the International Monitoring System (PS09). The recapitalization and modernization of the seismic array was extensive, requiring replacement of remote power systems, seismometer vaults, digitization systems and radio communications to all 18 elements of the short period array. In addition, new sensors replaced aging broadband sensors along with a complete replacement of the Central facility's acquisition computers. Significant challenges were overcome in the process of the reinvestment, since much of the array's infrastructure is scattered across ~125 km2 of northern Canadian muskeg. To ensure data quality of the new array, both the new YKA and its predecessor were run simultaneously for nearly a year for side-by-side comparison. Details of the process and new infrastructure will be discussed along with array comparisons.

T4-P7. Planning upgrade, communications troubleshooting and reliability of primary IMS station on example of PS45 (AKASG), Ukraine

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The Malin seismic array (AKASG), PS45, was certified in December 2002. It consists of 24 seismic sites and a central recording facility CF-AKASG (CRF). For AKASG are important all of the workshop's themes. I want to focus on communications troubleshooting and reliability of IMS stations. Share experiences and best practices on the example AKASG. This is interesting because, nowadays AKASG presents a unique mixed system that includes Nanometrics, SAIC and Guralp technologies. Regardless of the technology, the site's sensor data can be transmitted to the CRF via radio, underground low-frequency cables or underground fibre optic cables. And surely, in my report I want to present the basics aspects of planned upgrade of AKASG. Describe stages of modernization, complications process and how they solved.

T4-P8. Utilization of NDC_LK facility in the monitoring of micro seismic activities in Sri Lanka

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Sri Lanka is located well within the Indo-Australian plate, and hence it is believed that the Sri Lanka is safe from disastrous earthquakes. However, recent records indicates that the country experiences micro earth tremors from time to time. As Sri Lanka was considered to be an aseismic country, earthquake monitoring had been an insignificant subject until recent years. The National Data Center (NDC) of the Geological Survey and Mines Bureau was established in the year 2005. Earthquake data analyzing capability of the NDC was considerably improved with the installation of the data analyzing software package, GEOTOOL; and the establishment of a data storage facility by the CTBTO at the GSMB premises. In addition to the seismic data input from the International Monitoring System, data from two other local seismic stations are also being fed into this data storage facility. The GEOTOOL software is mainly used at the NDC_LK for calculation of earthquake locations. It is also used to differentiate seismic signals of natural origin from those generated by man-made explosions. It is our experience that such data analyses are found to be beneficial in the understanding of the seismicity and the general structural features within the Sri Lankan landmass.

THEME 5: Operations and Maintenance

T5-O1. Station Operator specific reporting requirements as per IMS Operational Manuals

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A series of reports are specified in the Operational Manuals with the objective of ensuring a streamlined operation and maintenanceo f the IMS stations. The presentation provides an overview of the different types of reports avaialable in the system and how the information on them is used to maximize Data Availability by the PTS.

T5-O2. A Perspective on the Management of CTBTO Stations in the Philippines: PHP52 and NDC-PH

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The annual Operation and Maintenance (O&M) budget under the Post-Certification Activities (PCA) of CTBTO Station PHP52 was amended effective 06 December 2012 to align with the increase in cost of products and services since the first Certification in 2006. However, the timely release of O&M funds is still marred with difficulties due to the intricacies of bureaucracy in the Philippine government, resulting in significant delays in procurement of supplies and services and payment of dues. The Philippine Nuclear Research Institute, in its relentless effort to manage the CTBTO stations PHP52 and NDC-PH, is continuously seeking for solutions to ensure that all of the stations' requirements are met in a timely manner despite all the challenges. This report will show a perspective in the management of CTBTO stations being operated by the PNRI in the Philippines, its past and current challenges and its view into the future.

T5-O3. IMS Configuration Management Case Study

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In an interactive session, a case study on Configuration Management daily life will be conducted allowing station managers and operators to understand the importance of timely and accurate reporting while simultaneously affording them the opportunity to see PTS challenges and comprehend the relevance of data provision for other PTS products, such as the Logistics Support Analysis.

T5-O4. CHALLENGES,PERFORMANCE OF IMS STATIONS IN KENYA

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Kenya hosts two IMS stations as part of the verification regime of the CTBTO. I32KE is a seven element infra sound station situated about 6km NNE of the city of Nairobi,and can be visited on a daily basis. PS24 is a broad band three channel primary seismic station located 70 km west of the city. This remote station is visited at least once a month. These two IMS station have faced similar logistical and security challenges which include cable vandalism,powers supply,communication,longer supply periods among others. As a result,these station underwent a major upgrade in 2013. Whereas I32KE has maintained 98% data availability,PS24 is still facing the same problems ,although data availability has since improved.

T5-O5. Challenges and Strategies for Maintaining High Data Availability in Canada

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Abstract: Natural Resources Canada operates 11 International Monitoring System waveform stations (3 primary seismic, 6 auxiliary seismic, 1 hydroacoustic, 1 infrasound), as well as over 130 weak-motion seismographs for national earthquake monitoring. Over the decades, many difficulties have arisen that challenge our ability to maintain high data availability. The challenges include: maintaining unmanned, remote stations from distant offices; supporting a variety of telecommunications technologies; maintaining aging equipment and infrastructure; refreshing and life-cycling equipment and systems; operating and modernizing data centres; etc. Numerous strategies have evolved over the years to address these issues and sustain high data availability. Hardening remote stations and power systems, installing redundant communications links, operating robust data centres at multiple locations, monitoring data flow throughout the pipeline, and adhering to defined procedures for modifying and troubleshooting the system are examples of these solutions. Details regarding these and other challenges and strategies employed in Canada will be presented.

T5-O6. Challenges of operating an Infrasound station in a Papua New Guinea

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Station Operators are commonly faced with many challenges in operating and maintaining a station, but at IS40 in Papua New Guinea (PNG), as in other remote locations, these challenges can be compounded by the station’s location itself. In the case of PNG, maintenance visits to the station begin with an hour’s drive over poorly paved roads. Once to the station, access roads are commonly unpassable and often trap vehicles in mud, flood washes or holes. If maintenance actions are required, parts that are not supplied directly by CTBTO may not easily accessible in the host country. In these cases they have to be sourced from abroad with the process taking weeks to months, rendering many immediate to short term restoration efforts extremely difficult. IS40 also experiences power blackouts regularly and the length of blackouts can vary from several hours to several days. Mitigating outages and striving to keep Data Availability and Timely Data Availability statistics is a high priority. These situations are not constrained to only IS40 and can be found at many other IMS station throughout the Network. The operation and maintenance of infrasound stations provides different challenges for station operators at various locations throughout the world. By sharing our daily routine plus the methods used to circumvent difficulties presented by our station location can serve to benefit the entire IMS Network.

T5-O7. Correct Documentation is Fundamental to Developing and Optimized Sustainment Strategy for Your System - You can’t manage and sustain what you can’t document!

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AFTAC

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AFTAC Engineering has performed a comprehensive engineering analysis review of the entire geophysical field system in order to correct gaps in system knowledge stemming from a failed system acquisition a decade ago. Over 80,000 system parts were reviewed across 387 equipment locations, creating our first ever master parts lists for the geophysical field system. Approximately 2,200 unique components and over 6,000 documentation discrepancies were identified. This initiative provides the ability to update our inventory management system allowing for 100% part accountability. Through effective management of our complete inventory we can now implement accurate logistic support models yielding substantial sustainment cost savings and increase overall system availability.

T5-O8. Enabling remote access to the APG station

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The remote location of the APG station has difficulted it's maintenance. With the implementation of a remote access, we expect to monitor the station's sensor from anywhere. To provide this access a very secure schema is implemented, using the RSA public key cryptosystem. In the future a two factor authentication is planned with a one-time password token or challenge-response authentication.

T5-O9. Evaluation of station operator performance – criteria and tools.

S. Nikolova, K. Aktas, K. Elmgren, M. Lee, M. Malakhova, S. Mickevicius, E. Nava, R. Otsuka
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Evaluation of Station Operator performance is considered to be part of the PCA management and will further contribute to the transparency of the fund expenditures. Proposed evaluation criteria are based on the performance and reporting on the tasks of the O&M plan as well as on timeliness and completeness of IRS reporting. Performance of the IMS station is additional information available to the evaluator. Presentation provides an overview of proposed criteria and developed tools used for Station Operator performance evaluation (SOPET - Station Operator Performance Evaluation Tool)

T5-O10. Feedback on LCC issues

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Life Cycle Cost (LCC) is the total cost of acquisition and ownership of a system over its full life, including the cost of planning, development, acquisition, operation, support, and disposal. Operation and Maintenance, can potentially contribute as much as 90% to the total life cycle cost. Reliability and maintainability greatly influence the life-cycle cost of complex systems. Through dedicated examples, we will give a feedback on predicting reliability and observed data obtained on equipment installed on station.

T5-O11. Global Communications Infrastructure on the State of Health

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The focus of the presentation is the use of SOH (State of Health) with regards to GCI (Global Communications Infrastructure) monitoring and troubleshooting. SOH collects data from various sources including the GCI Network Monitoring System and makes this data available to the user community. SOH is an important tool for the Station Operators in getting an accurate view in the GCI status and performance. SOH is also supporting their troubleshooting efforts.

T5-O12. How to resolve a barcode out of sync problem at a RASA station

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An event happened at the RN15 (Resolute Bay, Canada) station presents an opportunity to analyse the discarding of the spectra for three samples due to a filter advance failure and the deficiency in the RASA

software in resolving a barcode out of sync problem. Additional barcode scans by the software could have minimized the impact of this problem.

T5-O13. IMS Configuration Management Reporting: CCN and CCR

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Certified IMS facilities undergo modifications over time for several reasons. Configuration management ensures that IMS facilities continue to meet IMS specifications and other requirements for certification and that the stations remain mission capable and can be operated and maintained sustainably. Configuration management also aims to ensure that changes are justified and implementation of approved changes is efficient and effective. During the certification process, an initial baseline station configuration is established and recorded in the PTS configuration management database (DOTS). Reporting is essential for configuration management, as it ensures that accurate and up to date information is available on an IMS station and its equipment. Station operators are required by the draft IMS Operational Manuals to provide the inventory of all equipment at the stations. There are two forms for reporting changes to a configuration item: Configuration Change Request (CCR) and Configuration Change Notification (CCN). The presentation will summarize the requirements and responsibilities of the PTS and the station operator for requesting, approving and reporting changes to IMS facilities. Timelines, content for reporting, the impact of proposed changes, good and bad practice as well the role of the station operator will be covered.

T5-O14. IS42-Graciosa 2011-2015 O&M and interaction with the PTS: Implications in Station Data Availability (DA) and Performance Over Time (POT)

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Installed in August and certified in December, 2010, the IS42 station only had its infrastructures completely built on June 2012. Despite the initial difficulties, the Station Operator (SO), could count with a comprehensive support from the PTS staff. The attendance of a training courses on O&M for IMS Wave station managers and on Technical Training Programme on Nanometrics Equipment, in 2011 and 2012, allowed us to prepare the O&M Plan and the PCA proposal and to consolidate the team capabilities to operate the station. We present, for the operation period since the station certification, between January 2011 and March 2015, the progression of DA, POT and signal quality. We also describe the difficulties felt by SO in trying to maintain the excellent DA of the first 14 months. For that we identified the main occurrences submitted in 72 Problem Reports (PR), including some severe signal to noise ratio problems not reflected in the DA and POT. The interaction with the PTS over time was also analysed, by presenting the effective time responses to the PRs and to other requests to support the station operation and its implications in the DA, POT and effective Mission Capability.

T5-O15. Integrated Capacity Building, CBT Training Strategy

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Integrated Capacity Building is one of the key enablers that support the strategic goals of the CTBTO/PTS Midterm Strategy MTS (2014-2017). The capacity building and training for Station Operators of the International Monitoring System IMS and National Data Centres NDCs is delivered through different means: technical and infrastructure support, training events, workshops and conferences. The objectives and strategy for the training are presented and discussed in this presentation.

T5-O16. Introduction to Life Cycle Costs Analysis for IMS Stations

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Monitoring Facilities Support (MFS) Section is currently in the early stages of introducing a new Life Cycle Costs (LCC) analysis method for the IMS network. This will complement our other modelling and analysis tools and techniques, many of which are also applicable to other station operators and networks, as well as to other divisions within the PTS. These tools and techniques are part of an Integrated Logistics Support (ILS) approach to ensure that IMS facilities continue providing data in accordance with availability, timeliness and other requirements as specified in the draft IMS Operational Manuals, at optimal cost. In this presentation we introduce some of these tools and techniques, and their potential benefits, and describe some of the key milestones and challenges of the project. We also seek constructive feedback, including lessons learned and suggestions for improvement.

T5-O17. Operations and Maintenance of KSRS in Wonju, Korea

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1. Introduction of KSRS
KSRS that consists of 26 seismic stations in Wonju, Korea, is one of 50 primary seismic stations among 321 CT BT IMS, called PS31.
2. Ownership of KSRS
On March 10, 2014, KSRS entered into ROK-exclusive period after 5-year joint-use period between AFTAC an d KIGAM.
3. Operators of KSRS
Currently, 7 KIGAM staffs are dispatched to Wonju City from KIGAM HQs in Daejeon City to run O&M of K SRS with 2 AFTAC liaisons.
4. Upgradation of KSRS
Central Recording Building of KSRS will be renovated by about two-year reconstruction. Ground-breaking cere mony for new Central Recording Building was held on September 1st, 2015.
5. Communication of KSRS
Fiber-optic communication will be applied after full test for replacing current intra-site communication by radio from 26 sites to Central Recording Building.

T5-O18. Monitoring and troubleshooting of SHI stations in operations – challenges and importance of timely response for Station Operators.

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The administration of the IMS network, troubleshooting and resource allocation is primarily handled through writing and updating problem reports. For the SHI network the 98% Data Availability requirement has not been met yet completely, but in 2014 Primary and Infrasound network reached 96% and 97.72 % level respectively, while Hydroacoustic network (HA) – 88.78%, Auxiliary Seismic – 86.07%. Major challenge is to improve the performance and keep it at the required level 98%. This presentation aims to show the importance of quick and accurate handling of problem reports as a means to minimize stations downtime as a result of the incidents and problems.

T5-O19. NDC Roles and Functions

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CTBTO

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An NDC is an organization with technical expertise in the verification technologies that works under the guidance of a National Authority. An NDC is operated and maintained by a State Signatory. Its functions may include sending International Monitoring System (IMS) data to the International Data Centre (IDC) and/or receiving data and products from the IDC. The roles and functions of NDCs are presented and discussed in this presentation.

T5-O20. O&M of PS22, Japan's Primary Seismic Station

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The Japan Weather Association (JWA) has been maintaining and operating PS22/MJAR since 2004. PS22 is an array seismic station consisting of 14 elements out of which 8 are co-located at JMA's existing observation network (JMA: Japan Meteorological Agency). At the co-located site, the IMS sensor of PS22 is jointly installed together with the JMA's sensor in the same and narrow borehole. This circumstance sometimes induces difficulties when either IMS or JMA sensor needs to be removed for repair. So far we have abundant experience in removing/re-installing of IMS seismometer at co-located site by ourselves as many as ten times or more regardless of the season. On the other hand, the main cause of data interruption or sensor failure is lightning. But the frequency of lightning-induced trouble has drastically decreased compared to that of few years ago since surge protectors for communication line were installed at lightning-prone sites. I would like to share your experience against lightning in this workshop. Note: JWA is in charge of not only Station Operator but National Data Centre (NDC-1). The Government of Japan has designated the JWA and the Japan Atomic Energy Agency as the NDCs dealing with waveform (NDC-1) and radionuclide data (NDC-2).

T5-O21. O&M provisions in current IMS Operational Manuals

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Effective operation of the IMS network is ensured by providing the necessary technical and operational details. The IMS Operational Manuals contain a set of Operations and Maintenance Provisions for IMS stations and laboratories. Responsibilities of the teams involved in operating the IMS are also defined in the manuals.

T5-O22. Overview of Facility Agreements: Video and short presentation

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· The Resolution Establishing the Preparatory Commission for the CTBTO provides: o The Commission was established to carry out the preparations for entry into force of the CTBT. o It shall develop standard model agreements to be concluded by the CTBTO, including facility agreements. o It shall undertake all necessary preparations to ensure operationalisation of the verification regime. · The Model Facility Agreement was approved by the Preparatory Commission in 1998 . It is negotiated with each Host State. Its scope is based on CTBT requirements. · As of August 2015, 47 Facility Agreements/Arrangements have been concluded, out of which 38 have entered into force.

T5-O23. PARAGUAY IMS STATIONS PS30-CPUP AND IS41 ANNUAL OPERATIONAL PERFORMANCE REPORT 2014

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PARAGUAY IMS STATIONS PS30-CPUP AND IS41 ANNUAL OPERATIONAL PERFORMANCE REPORT 2014 JUAN CARLOS VELAZQUEZ Universidad Nacional de Asunción Paraguay operates two of the IMS monitoring technologies. Primary Seismic station PS30/CPUP and Infrasound station IS41PY installed in 2001. In this presentation, an annual summary operational report analysis from both stations reveals total data availability bellow the 98% CTBT expected goal during 2014. Main data loss are due to factors such as weather inclemency (lightning strike) causing equipments malfunctioning affecting power system, communication system, data acquisition; lack of spare parts in stock, equipments which are in final phase of their operating lives that requires replacement and others. To reverse this problems, with the PTS support, upgrading plans are being carried out during 2015 and updated data availability will be presented. Last but no least the lesson learned to keep the system running at high performance levels it is important to maintain an open fluid communication and reporting between PTS and station operator.

T5-O24. PERFOMANCE AND SUSTAINMENT OF IMS NETWORK IN ZIMBABWE

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The presentation discusses the means to improve the performance and viability of the IMS network. In Zimbabwe we have a fair distribution of a sustainable station network. I have outlined the problems we encounter with seismic instrumentation, power utilities and communication equipment as well as suggested solutions. The following presentation explains how we carry out maintenance procedures on a regular basis in accordance to GCI standards.

T5-O25. Performance, Challenges and Operation of Radio-nuclides Monitoring Station, Tanzania

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Tanzania Atomic Energy Commission

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The radionuclide monitoring stations utilize complex and sophisticated equipment. The good performance of these Radio-nuclides monitoring stations is achieved by the qualified and skilled manpower in adherence to the standard operational procedures, Equipments' preventive maintenance and corrective maintenance culture. The magnitudes and extents of challenges influencing station performance differ among member states depending on technological advances and geographical locations. Tanzania being one of developing Member State located at tropical weather experienced some challenges at RN64 station caused by high humidity and power fluctuations. Frequent power failures contributed to some faults or intermittent behavior of equipment so far experienced. Recorded phase reversal to air sampler unit after power cut and workings at mains however the use of a standby generator is a remedy. The limited number and locations of production firms made the unreliable production and supply of cooling LN2 for HPGe detectors. Some operational procedures are not user friends such as procedures for re-sending spectral data. Usage of IDC data is minimal although some research institutions have shown interest in accessing some radioactivity data for environmental research. The highlights of some challenges and possible solutions are presented.

T5-O26. Power backup Infrastructure to Support Sensors and Data Communication at Zimbabwe NDC

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• Power availability is the backbone of the operation of the station and the National Data Centre (NDC). Power outages in developing countries reduce the uptime of most stations. The detection capability of the seismic network and data availability of the International Monitoring System (IMS) stations in order to satisfy the strict data and network availability requirements of the IMS Network depends on power availability. Power availability at MATP, AS 120) and the National Data Centre (NDC) would enable the continuous monitoring of the stations' state of health, data quality, troubleshooting of incidents and reporting. The use of the new technologies to ensure an improved and reliable power supply enable the meeting of uptime expectations thus improving on service to the country, the region and the International community that require data for scientific and civil application. The upgrading of the power system from AC to DC at AS 120 station has improved continuous uptime of the station and the installation of UPS at the NDC has also contributed to the uptime. Battery bank in the NDC server was replaced and the UPS now provides backup in the event of a power outage thus GCI equipment would remain operational most times.

T5-O27. Preventative Maintenance for Sustaining the International Monitoring System

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Note: This abstract has been changed to Poster and it can be found now as T5-P21

T5-O28. Preventative Maintenance, Maintenance Planning and Maintenance Oversight of the IMS Network

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The International Monitoring System (IMS) Network of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) is to consist of 337 monitoring facilities located around the globe with four different technologies. Effective sustainment of the network can be achieved through proper planning and execution. The IMS Monitoring Facilities Support maintenance team provides maintenance oversight for these facilities. We will present an overview of our maintenance activities; discuss the importance of preventative maintenance, maintenance planning and maintenance oversight. We will highlight some important lessons learned.

T5-O29. Radionuclide Analysis in the MDA

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The radionuclide technology is one of the four technologies the Preparatory Commission for the Comprehensive Nuclear Test-Ban Treaty Organisation (CTBTO) has for the verification regime of the Nuclear Test-Ban Treaty (CTBT). This complementary technology is the only one that is able to confirm whether an explosion detected is indicative of a nuclear test. A network of 80 globally distributed radionuclide monitoring stations enable a continuous worldwide observation of aerosol samples. And as part of an experiment to increase the efficiency of radionuclide monitoring, half of these stations are equipped with noble gas monitoring technology to measure radioactive noble gases generated by nuclear explosions. Data on radionuclide observations are sent to the International Data Centre (IDC) Division, where they undergo an analysis process. The radionuclide analysts in

the Monitoring Data Analysis (MDA) Section of the IDC refine the automatic results during interactive review and issue the Reviewed Radionuclide Reports (RRR). The reports are then made available to the Member States.

T5-O30. Recurring Themes in the Operation and Maintenance of the Palau IMS Infrasound Array

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Infrasound array IS39PW, Palau, is in a remote, tropical forest with minimal cultural and wind noise. Each element consists of one MB-2000 pressure sensor, a Geotech Smart-24 digitizer, power regulation and surge suppression electronics, and a GPS timing system. The elements and communications to the Central Facility (CF) are powered by 48V photovoltaic systems. At the CF, the data is transferred via satellite to Vienna, Austria. The primary O&M challenge is to provide steady power the CF site. The intermittent grid power and backup power system to the CF site are suboptimal. Due to the instability of the power grid, a photovoltaic system is being considered to power the CF through longer outage periods. Typhoons are also a recurrent seasonal problem, and they have caused extended impact to the national power grid, damaged the array elements with fallen trees, and limited access to the sites by washing out roads. Palau's slow internet connection can hinder O&M tasks, such as accessing the CTBTO PKI portal to submit authentication certificate requests. Despite all these challenges, IS39PW has maintained mission capability through the support of the CTBTO and the Site Operator.

T5-O31. Review of Station Operator reporting

R. Otsuka, M. Malakhova, K. Aktas, K. Elmgren, M. Lee, S. Mickevicius, E. Nava, S. Nikolova
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In the second half of 2013 PTS performed review of Station Operator reporting. Timeliness and completeness of report required by the OM were assessed for the period 1 July 2013 – 15 Dec 2013. Results show that majority of the monthly reports, problem reports and outage requests were submitted in time with complete information. Further improvement in CCN and CCR timely and complete submission was also sought. The PTS is working actively with SO to improve content of Monthly Reports systematically requiring reporting on the tasks of the O&M plans as well as IMS Operational Manual tasks. For effectiveness of the evaluation process and standardization purposes it is necessary that all station operators submit O&M plans in the standard format and provide complete information in Monthly Reports for the tasks performed at the stations. Criteria for timeliness and completeness of the reports submitted by the Station Operators are also used for assessing performance of the station operators.

T5-O32. Roles and Responsibilities of the Host Country

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The presentation will provide an overview of the roles and responsibilities of the Host Country within the framework of the CTBT, among others: · the measures required under Article III to implement each State Party's obligations under the Treaty, which includes prohibiting and preventing nuclear explosions and establishing a National Authority; · the duty to facilitate the verification of compliance with the Treaty; and · for States hosting IMS facilities, the requirements for cooperation and modalities of cooperation with the Organization for the operation, financing and maintenance of IMS facilities.

T5-O33. STATUS OF BOLIVIA (ESTADO PLURINACIONAL DE) IMS NETWORK

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This presentation is to share the status of Bolivia (Estado Plurinacional de) IMS Network (PS06, IS08 and AS08 stations), based on a collective effort in which each participant (OSC-AFTAC and OSC-DASE) knows and exercises its responsibility, seeking a reliable, available and maintained (RAM) sustainability monitoring of IMS. Dependent aspects besides several challenges, appropriate national measures, availability of skilled human resources and the achievement of a feedback between the OSC (as OS) and the host of Bolivia (Estado Plurinacional de). Strategies needed to implement the Operations and Maintenance Manual in the IMS Network.

T5-O34. Some problems of IMS auxiliary seismic stations maintenance in Kazakhstan

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There are 3 auxiliary seismic station operated in Kazakhstan, constructed using PTS CTBTO funds – seismic arrays in Borovoe (AS-057) and Kurchatov (AS-058), 3-component station in Aktyubinsk (AS-059). Station in Borovoe was installed in 2002, in Aktyubinsk – in 2004, so their age exceed standard live period of geophysical equipment, equal to 10 years. Outdated equipment (borehole seismometers, digitizers etc.) little by little collapsing. According to the Article IV p.20 of CTBT, Organization "…shall meet the costs…", including, "(c) Upgrading stations…". The problem of auxiliary stations equipment maintenance and replacement and necessity for PTS CTBTO to be involved in this process is discussed in the presentation.

T5-O35. Sources of support for Station Operators

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Various entities support the operation and sustainment of the IMS facilities: (a) In-house resources: PTS technical, administrative and legal resources; (b) Station Operators; (c) Regional depots, workshops or stores; (d) Support contracts and (e) Host States (facility agreements) – This presentation will aim at explaining to the audience how to use them in an efficient manner and how they complement each other. It will also seek for feedback, lessons learnt and suggestions for improvement.

T5-O36. State of Health (SOH) Monitoring Sysytem

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The goal of the CTBTO SOH project is to collect and manage State of Health information from ALL components of the CTBTO International Monitoring System, including IMS Stations, GCI links, IDC programs, servers and any other source of data that may be relevant to the Operation of the Monitoring System. The overall design principle of the CTBTO SOH system is that it is a 'System Wide SOH', it collects data from other systems and acts like a "top-level SOH system", integrating heterogeneous data into one single view. This integrated view focuses on metrics to directly support the Operation and Maintenance of the IMS system. The system is also available for external PTS users.

T5-O37. Station Specific Documentation project

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The Station Specific Documentation Project is a PTS project to manage the development of up to date, validated, maintainable, reusable Station Specific Documentation (as required by IMS Operational Manuals) that can be published in different formats and made available to the Station Operators and the PTS. Attachment III of the IMS Operational Manuals defines the Information items required by the Station Operator and the PTS to sustain the IMS facilities. This project provides a long term solution to the station information

T5-O38. Station Summary Reports

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According to Annex A of the Model PCA Contract and the Draft Operational Manual, a Station Summary Report (SSR) will provide the Commission with an overview of relevant technical matters related to the Services. The Station Operator should submit an SSR three months prior to the end of the Budget Term or every twelve months. The level of detail of the information provided by the Station Operator shall be such as to facilitate planning the operation and maintenance of the station. The SSR should include: • status and length of the land lease • a copy of the current inventory of the Station Equipment • a description of maintenance of the Station Equipment and status of any vehicles • a current list of O&M personnel and any changes during the relevant period • requested changes to the operations and maintenance, if any • the Operator’s assessment on the technical status of the Station • a brief summary of the most important events from the past year’s Monthly Reports • plans for the coming years During the workshop we will discuss reporting contents, timelines, common issues, and strategies to facilitate workload on both Station Operators and the PTS.

T5-O39. Status Operation and Maintenance of IMS Monitoring Facilities, Uganda

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Uganda is a State Signatory to CTBTO and signed the CTBT Treaty on 7th November 1996, shortly after its opening for signature, and ratified it on 14th March 2001.Uganda hosts an IMS auxiliary seismic station, MBAR (AS103) located at Kyahi forest near Mbarara and operates a NDC (NDC-UG N180) located at the Directorate of Geological Survey and Mines, Entebbe, established in 2003. MBAR seismic station is part of IRI-IDA Global Seismographic Network of University of California San Diego, USA. The station was installed in 1999 and later in 2006 upgraded to International Monitoring Systems standards of the CTBTO. Since then, data recorded at MBAR station is transmitted to IDC Vienna and made available to NDC-UG via a modern Global Communications Infrastructure (GCI) facility installed at the station. MBAR received its IMS certification in November 2007, becoming one of the CTBTO’s 120 auxiliary seismic stations contributing data to the detection of clandestine nuclear weapons testing. In June 2012, Uganda became the 43rd host country to have concluded the signing of facility agreement with CTBTO, formalizing cooperation between a host country of a monitoring facility and the CTBTO, in regulating all technical aspects involved in maintenance and operation of IMS facilities.

T5-O40. Testing and Evaluation/Post Certification Activities (T&E-PCA) contracts - Existing contractual mechanisms and procurement process as governed by the Financial Regulations and Rules

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The presentation will provide an overview of the Commission's legal framework for the operation and maintenance activities and transactional strategic goal. It will also cover, in more detail, the structure and features of the Testing and Evaluation and/or Post-Certification Activities (T&E/PCA) contracts and the Commission's procurement process applicable to the establishment of T&E/PCA contracts, including its budget (re)negotiations and unscheduled maintenance activities.

T5-O41. The Australian IMS Network

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Responsibility for the operation and maintenance of Australia's IMS network is largely separated by the different technologies involved, waveform and radionuclide. Geoscience Australia (GA) operates and maintains 10 seismo-acoustic stations while the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) operate and maintain 7 radionuclide stations including 2 noble gas systems and 1 laboratory. The ten waveform stations operated by GA are comprised of 3 infrasound stations, 3 primary seismic stations (1 array), 1 hydroacoustic station and 3 auxiliary seismic stations. Work is currently underway to build Australia's final station for the IMS which is an infrasound station to be located at Davis Station in Antarctica. In addition to these sites The Australian National University operate two IMS arrays in central Australia, one seismic and one infrasound. The majority of the waveform sites are unmanned due to their remote locations and therefore high reliability is essential.

T5-O42. The CTBTO new Integrated E-Learning Platform

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The CTBTO's new Integrated eLearning platform has been completed. The online training programme offers, among others, training for potential On-site Inspectors, National Data Centers NDCs, Station Operators, etc. The new platform also provides a wide range of easy to use online services, such as recruitment tools for applicants to the CTBTO, live chat rooms in support of real-time events and others. A quick introduction demo will be presented.

T5-O43. The France IMS network

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CEA

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CEA is in charge of operating and maintenance of several RN, infrasound and seismic stations for CTBTO that represent several thousands of equipment worldwide deployed. The presentation will explain the quality management system dedicated for CTBTO equipement.

T5-O44. The Independent subnetwork of the Israeli NDC

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Israeli NDC

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Two IMS auxiliary seismic stations (EIL and MMAI) are located in Israel. The Independent Sub Network (ISN) configuration was chosen as the method to connect the stations to the IMS in Vienna. In this talk we will present the challenges in operating and maintaining the ISN. The main constrains are the high criteria of the IMS network like; timely data availability and the data authentication. We will demonstrate that by correct planning it is possible to meet these criteria.

T5-O45. The Norway IMS Network segment

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Norway hosts 6 IMS stations. The 42-sites large aperture teleseismic array PS27-NOA, the 25-sites regional seismic array PS28-ARCES, the 9-sites small aperture seismic array AS72-SPITS, the three-component seismic station AS73-JMIC, the 10-sites infrasound array IS37 and the radionuclide stations RN49 with both particulate and noble gas technology. We will present some details of the installed equipment and operations, maintenance and communication concepts. All NORSAR's seismic installations went through significant modernization within the last 4 years in order to ensure high reliability and data quality and to facilitate remote operation. All processes for data collection, transmission, quality checks, storage and processing are monitored automatically and continuously.

T5-O46. The O&M plans in standard format and IMS station Operations and Maintenance

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Presentation will give an overview of the development in management of the PCA contracts since 2011 until now. In October 2011 all the Station Operators of the IMS stations were requested to operate their stations according to the Draft Operational Manual, Rev. 5 2009 (for SHI stations) and 2010 (for RN stations). This step allowed changing of the content of Monthly Reports and focusing it on the performance of the tasks included in the respective O&M plans. Further major effort was done to standardize the format of O&M plans and move towards standardizing the O&M task in the plans but accounting for specifics of every station. Currently, 95 stations have O&M plans in a standard format and initial analysis of these plans will be presented.

T5-O47. The South African/CTBTO waveform networks

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South Africa is involved in the maintenance and operation of four waveform stations namely BOSA (PS39), Infrasound station (I47ZA) situated to the south of the town Boshof almost in the center of South Africa and Auxiliary Seismic stations AS35 (Sutherland) and the Antarctic Station (AS099). The latter is operated in cooperation with the GFZ. Maintenance activities include work on the satellite systems, for which ULTISAT is the service provider for both PS39 and I47ZA, down to intensive detailed maintenance on the Infrasound System. The seismic station, PS39, is maintained and run by the Station Operator in cooperation with the American Air Force Technical Application Center (AFTAC). Exchange equipment for both the Boshof stations are sourced from the CTBTO and AFTAC. For both these stations, a reasonable amount of redundant equipment is held at the station's Central Recording Facility (CRF) and the Pretoria offices (CRB) for exchange purposes.

This allows for the stations to maintain a uptown of 98%, as is mandated by the station agreement contracts existing between the CTBTO and the Republic of South Africa, which is represented by the Council for Geoscience.

T5-O48. The USA IMS Network segment

J. Mattila
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This presentation will give an overview of the US IMS network segment and the associated monitoring stations. The Nuclear Arms Control Technology (NACT) program operates over thirty IMS stations: 11 radionuclide particulate stations, 4 of which have collocated noble gas samplers, 7 infrasound stations, 12 auxiliary seismic stations, one primary seismic station, and 1 radionuclide laboratory. Additionally, the US Air Force operates one hydroacoustic IMS station and four primary seismic IMS stations. The US IMS stations are located across a wide range of geographic locations including the United States, US controlled Pacific Ocean territories, and Antarctica. The presentation will also summarize the operational challenges posed by the varied and remote locations, and other factors influencing operation and maintenance of these stations.

T5-O49. Tunisian contribution to Operations & Maintenance Improvement

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Since the installation of its seismic and infrasound stations, the Tunisian operators have carried out several tasks in order to enhance the achievement of its IMS operations and maintenance. Some constrains have been met while progressing with those tasks. The following are the conducted tasks with feed back to the PTS about encountered problems with some proposals of solutions if needed : 1- A daily monitoring which continue to make progress with the idea to develop a software to implement it, 2- A Public Key Infrastructure (PKI): developed by the PTS and being implemented by Tunisian side and meeting some constrains, 3- Contribution of the Tunisian side to the improvement of better communication between PTS and Tunisian Operators (SSR, SOPET ....) 4- Other issues related to the maintenance (IS48 WNRS upgrade, access and road maintenance, internet connection ......) 5- Calibration evolution and encountered problems

T5-O50. Wadi Sarin (AS074), CTBTO Auxiliary seismic station in Oman

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Senior Engineer

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Wadi Sarin (AS074), CTBTO Auxiliary seismic station in Oman Salam Al-Hashmi1 1Earthquake Monitoring Center, Sultan Qaboos University, Oman. Abstract Sultanate of Oman unique location on the southeast corner of the Arabian Plate makes it susceptible to felt earthquakes over the years. Wadi Sarin (AS074) is one of the CTBTO Auxiliary seismic stations enhances the coverage of Oman Seismological Network that consists of twenty broadband stations. AS074 is a seismic three components borehole station established in 2004. Earthquake Monitoring Center (EMC) at Sultan Qaboos University supervised the establishment of this station with the cooperation of CTBTO. The verticality of the borehole had been verified successfully. The station is operated and maintained well by EMC since its establishments. The data is transferred directly from the station via satellite to CTBTO headquarter in Vienna. The unique location and the quietness of the station makes it one of the most important CTBTO auxiliary seismic stations that can be converted to a primary station in the future.

T5-O51. Wadi Sarin (AS074), CTBTO Auxiliary seismic station in Oman

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Earthquake Monitoring Center

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Sultanate of Oman unique location on the southeast corner of the Arabian Plate makes it susceptible to felt earthquakes over the years. Wadi Sarin (AS074) is one of the CTBTO Auxiliary seismic stations enhances the coverage of Oman Seismological Network that consists of twenty broadband stations. AS074 is a seismic three components borehole station established in 2004. Earthquake Monitoring Center (EMC) at Sultan Qaboos University supervised the establishment of this station with the cooperation of CTBTO. The verticality of the borehole had been verified successfully. The station is operated and maintained well by EMC since its establishments. The data is transferred directly from the station via satellite to CTBTO headquarter in Vienna. The unique location and the quietness of the station makes it one of the most important CTBTO auxiliary seismic stations that can be converted to a primary station in the future.

T5-O52. Ways to improve efficiency of SO : tools & procedure

T. Philippe, V. Flavin, O. Flament
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Operations and maintenance typically includes on-site visits that require substantial resources and time even if well prepared and based on procedure and O&M manual. During maintenance operation, unexpected events could be faced and be handled by staff on site. In this context, we have identify that improvement could be made on the way we proceed. We will illustrate the way we proceed to perform on site activity using a set of new tools to support improved operations and preventative maintenance at station.

T5-O53. Overview of Treaty (Provisional O&M guidelines)

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In accordance with the CTBT the functions of the Technical Secretariat with regards to verification of compliance with the Treaty include supervising and coordinating the operations of the International Monitoring System as well as providing technical assistance in, and support for, the installation and operation of monitoring facilities. Specifically, CTBT Article IV para 14 (c) and (j) states that: "… the Technical Secretariat shall, for the purpose of this Treaty; *(c) supervise, coordinate and ensure the operation of the IMS...; ... and (j) provide technical assistance,... where such assistance and support are required by the State concerned." In addition to that, CTBT Article IV para 17 also states that: "The IMS shall be placed under the authority of the Technical Secretariat. All monitoring facilities of the International Monitoring System shall be owned and operated by the States hosting or otherwise taking responsibility for them in accordance with the Protocol.*

Prior to Entry Into Force (EIF), CTBT/PC-19/1/Annex II, details in para 13 to 19 the Prep Com adopted WGB recommendations regarding general guidelines for technical testing and provisional operation and maintenance of certified IMS stations, the GCI and IDC. These Provisional Operational Guidelines are reviewed by WGB on a yearly basis.

T5-O54. PTS support to Auxiliary Seismic network

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CTBTO

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The International Monitoring System (IMS) Network of the Comprehensive Nuclear Test-Ban Treaty (CTBT) is to consist of 50 Primary Seismic (PS), 11 Hydro-acoustic (HA), 60 Infra-sound (IS), 80 Radionuclide (RN) and 120 Auxiliary Seismic (AS) stations. However for the AS network is unique, due to the fact that the treaty specifies that Host Countries are responsible in providing support to these stations after they have been certified. This presentation will show support which can be provided by the PTS to these AS stations.

T5-O55. Integrated Global CTBT Education Network

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The education and outreach efforts of the CTBTO aim to educate and inspire the next generation of CTBT experts, particularly in the developing world and amongst women. These efforts consist of three components: Live lecture courses, presented by CTBTO staff and internationally-renowned experts; E-Learning, including extensive online modules, video tutorials, and the CTBTO iTunes U channel; and, Partnerships with universities, aiming to expand CTBT related curricula across the globe. These efforts are supported by the online CTBT Education Portal consisting of two elements: an online course platform and an online CTBT education community. Through this platform, members are able to complete a profile to indicate CTBT related interests and dynamically search for other community members who share the same interests. The CTBTO's education and outreach efforts aim at engaging the scientific and technical academic communities with the objective of raising awareness of the Treaty, its verification regime, and the civil and scientific applications of monitoring technologies, with a view to advancing the Treaty's entry into force. In this regard, the landmark event for 2015 was the 2015 CTBT Academic Forum, which was held on 26 June 2015 as a part of the Science and Technology 2015 Conference (SnT2015). The Academic Forum was a results-oriented, interactive event for academics already engaged in, or interested in, CTBT education. The next major education event will be a policy course held in January 2016.

T5-O54. Progressive Commissioning of the IMS, GCI and IDC

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A plan for progressive commissioning of the IMS, the Global Communications Infrastructure (GCI), and the IDC that included seven phases each for the IMS, GCI and IDC was established early in the history of the Preparatory Commission (PrepCom). The plan was modified at PrepCom 15 to reorganize phase 5 of the IDC's commissioning into two parts, phases 5a (preparation for full-scale testing) and 5b (full-scale testing). The IMS and the GCI are both in phase 5, and the IDC has recently completed the requirements established for Phase 5a. Many of the requirements for phase 5b have already been met by the IDC, some have substantial progress made, and some require significant effort. Completing the Validation and Acceptance Test Plan; carrying out specific experiments as required to ensure that the functionalities of the IMS, GCI and IDC meet the requirements set forth in the Treaty and the operational manuals; and conducting experiments and tests of the IDC full-time operational capabilities are the main activities leading up to phase 6, which is validation and acceptance of the IMS, GCI and IDC. The final step in commissioning (phase 7) is being available for full CTBTO operations while waiting for entry-into-force.

T5-P1. A simple tool developed to investigate from outside the borehole interior

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This job presents a simple procedure carried out during the annual inspection of the IMS station BDFB in order to have a preliminary inspection of the initial portion of the borehole interior (100 meters deep, implanted 23 years ago, lined with metallic tubes welded). This job was motivated by: the borehole age; the location be in a sensitive and protected environmental area and observations done during the last seismometer maintenance, when rusted metallic pieces were collected, indicating possible deterioration of the borehole. For this preliminary inspection it was used a simple video camera (VC) connected to a DVR equipment. The VC was fixed in the end of a robust plastic tube, allowing some direction control. The lighting was provided across LEDs tied around the VC. The images gotten were recorded in a notebook while they were being sights in real time. The images were saved to be analyzed in the future. This partial assessment of the borehole showed the presence of corrosions scattered along the examined portion, getting worse with the depth. Based on the images we conclude that it is strongly advised a more detailed assessment including the whole borehole to be done in the next seismometer maintenance.

T5-P2. AS001/CFA seismic station overhauling and long-term sustainability

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It is known that the operation and maintenance (O&M) of a seismic station are tasks of singular complexity depending not only on the technology involved, but also on the geographical location, accessibility to the site by the operator, urban planning conditions, traditions and customs of the neighbors. In practice, not taking these last aspects into account in the design stage of station or, ignoring the changing of conditions over time, makes its long term sustainability a very difficult task to perform. That is why it is necessary to determine particular mechanisms to ensure long term operation. Due to changes on conditions of near urban settlements, the CFA station has suffered regular bouts of vandalism, stolen the power lines and goods of facilities, what have seriously affected the data availability and, that came to light the wrong estimations on O&M budget. This work is aimed to find alternatives on overhaul the facilities, active/passive security measures and, planning guards schedules to ensure operation sustainability. For the above purpose, assessments on civil works and security systems will be made, in order to find the cost-effective solution to provide continuity to the seismic monitoring program in Argentina.

T5-P3. CTBTO objectives & Station operators

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To carry out its defined objective of nuclear test monitoring mission in the world. The CTBTO has installed a network of more than 300 stations worldwide, with the aim of detecting, identifying and locating all natural and human caused events. Each station of the monitoring network has to respect a ratio of 98% data validation per month, in order to comply with the rules and requirements of the Treaty. To achieve this requirement, the stations operators play an important role, and responsibility that all equipment must work perfectly and stoppage time must be as short as possible. CTBTO often provides material and technical training to all station operators so as to be able to interviews all problems that occur at any given time. Also, the operator has to provide detailed report on the causes of the problem as well as the solutions and under no circumstances hesitate to seek technical support or advice from PTS. The CTBTO has several departments, and the stations operators are part of this chain. Their presence at remote part of the country is essential because they provide important and highly needed crude information (data).

T5-P4. Contribution of Malian's national data center (NDC) to run Kowa Station

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This poster show you the effort made by our national data center to update Kowa station for IMS system.

T5-P5. Development of Seismic Monitoring System in Sri Lanka

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Sri Lanka is believed to be safe from disastrous earthquakes due to its location far away from active plate boundaries, thus, seismic monitoring was not an urgent necessity until the 26th December 2004 tsunami struck the island. Seismicity in and around Sri Lanka originates in (a) the Sundra trench to the East, (b) a diffused zone to the South, (c) the mid-oceanic ridge to the West (d) Peninsular India to the North and (e) intra-plate locations on land and in the ocean. Presently, seismic monitoring is carried-out in Sri Lanka with the help of three broadband seismic stations at Pallekelle (PALK), Mahakanadarawa (MALK) and Hakmana (HALK) and seismic data received from International Data Centers. The earthquake data analyzing capability of the Data Center was improved with the installation of two data analyzing software Seiscomp3 by GFZ, Germany and GEOTOOL from Comprehensive Nuclear Test Ban Treaty Organization (CTBTO). In addition to that, relevant personnel are being continuously trained through in house and foreign training programs mainly offered by CTBTO, IRIS and GFZ. With the support of these foreign agencies, the GSMB is now having the capacity to identify and describe the seismic activities in and around Sri Lanka.

T5-P6. Future development of a daily operational report through web interface.

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In order to improve the performance of the IMS stations in the network this poster in going to expose the developing of a new kind of standard report sheet for manual radionuclide and infrasound stations. The idea we are developing is to create an "experimental" web portal of daily operations for all Argentinian stations, to have a database of all daily operational reports, to have the possibility of generate statistics for data availability, to identify deviations and indicators for quality assurance. Our primary goal will be that all Station Operators in IMS Argentinian Stations be able to enter to this webpage through a PC, Tablet or Smartphone, complete the mandatory fields of the daily operational form and submit it. The system will automatically create a report of operation, a feedback form, storage the data in the database and updated the quality indicators diagrams.

T5-P7. GCI II Network Architecture, Monitoring and Control

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High availability network designed to transport measurement and application data from International Monitoring System (IMS) and National Data Center (NDC) facilities to the International Data Center (IDC) in

Vienna, Austria and from the IDC to all CTBTO State Signatories. The entire network is operated and maintained 24x7x365 by UltiSat using the integrated Network Management System (NMS) from its network operations center (NOC) and expert help desk (EHD) located in Gaithersburg, Maryland (USA). UltiSat manages the network as a bi-directional end-to-end IP network comprising satellite and terrestrial communications services to interconnect IMS, NDC, and independent sub-network (ISN) remote locations to the IDC in Vienna, Austria. Satellite connections are implemented for most remote. The network is designed to be "transparent" between the monitoring stations and the national data centers. The Network Management System (NMS) design is based on measuring, monitoring, reporting selected information and providing easy-to-understand summary status displays. Key abilities of the NMS are to measure and report on delay, packet loss and various device statistics available via SNMP and then display up/down status via icons on a map of the world. With such information, UltiSat is pro-actively monitoring the network, minimizing station maintenance and recovery time, maximizing station uptime.

T5-P8. IS42-Graciosa: Procedures of Operations and Maintenance (O&M)

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IS42 is located in Graciosa Island, one of the nine islands of the Azores. The station is installed in a dense forested area. The array is composed by eight elements with small aperture wind noise reducing systems (WNRS) and a Central Recording Facility (CF). The geometry of the array is arranged in a 1km aperture main array, shaped as a pentagon, complemented by a 200m aperture triangular sub-array. Each array element has 230V independent power supply from the public grid and all the elements are linked to the CF by optical fiber, in order to guarantee reliability, robustness and high performance. The daily O&M procedures are performed in the SO headquarters, located in S. Miguel Island, at a travel distance of 2 connected flights of 1 hour of total flight-time from Graciosa Island. A Local Operator (LO) established in Graciosa island, with a 24/7 contact availability, assures the fast response and support for the local maintenance by visiting the station every two weeks. Bimonthly preventive maintenance visits are performed by the SO. Once a year, before winter, an annual preventive maintenance visit is performed by SO, LO and subcontracted companies, mainly focused on energy, intrasite communications infrastructures and other equipment.

T5-P9. Monitoring Radionuclides in Indonesia

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Natural radionuclides essentially a lot of in the environment and along with the use of nuclear technology in various fields would increase the concentration of radionuclides in nature that can causing environmental contamination and it is necessary for monitoring radionuclides in the environment. Natural radionuclides particulate monitoring in Indonesia is aimed determining the ambient concentrations of radionuclides and monitoring of radioactive substances in case of contamination either in Indonesia or coming from outside Indonesia such as the impact of Fukushima accident or nuclear experiments from other countries. In Indonesia has installed some radionuclides stations, one of them is in the Metrology Center Safety and radiation technology, besides that Indonesia is appointed by the CTBTO as a nobel gas station SAUNA which this year placed in Manado

T5-P10. OPERATION , MAINTENANCE AND IMPROVEMENTS at Auxiliary Station JTS (AS025)

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The station JTS(AS025)was installed in the year 1995 and provides data from 2001 in real-time to network CTBTO. The station is located in Juntas of Abangares,Guanacaste,Costa Rica.Coordinates station are 10,2908°N,84,9525°W. In August of 2009 was upgrade data storage system data,system power consumption,lightning protection,satellite communication. Station JTS was upgraded to a Quanterra Q330HR system.seismometers include STS-1,STS2,Episensor strong motion sensor.The station JTS have two main communication systems:satellite system and wireless broadband system . In September 2010,the Volcanological and Seismological Observatory of Costa Rica- National University(OVSICORI-UNA), began operating Data Acquisition and interface to the CTBTO Capacity Building Systems of National Data Centre,a tool that is intended to increase the capacity to receive, analyze and report all information recorded by the International Monitoring System (IMS).In May 2011 the station was rebuilt the recording room and new pier. On the benefits it will bring the country to be a member of the Treaty, have access to a single database on the planet's history, which may be used to study seismic events, seismic hazard assessment of the country and build capacity to assess the potential some have local or regional earthquakes.

T5-P11. OPERATIONS AND MAINTENANCE ACTIVITIES OF THE INTERNATIONAL MONITORING SYSTEM (IMS) PRIMARY STATION AT SONSECA, SPAIN, (PS-40).

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The PS-40 Array, located at Sonseca (Spain), was upgraded in November 2001 by the station operator, the Instituto Geografico Nacional (IGN), under contract to the International Monitoring System (IMS) of the Comprehensive Nuclear Test Ban Treaty Organization(CTBTO). The Station was certified on 21 December 2001 and a Post Certification Activities (PCA) contract was signed between IGN and CTBTO on 18 December 2003. The Array consists of 19 Short Period (SP) elements, one component and 2 BroadBand (BB) elements with three components. In Central Facility there are two computers Pryosys , one is running SSI software and sending data in CD1.1 protocol to the International Data Centre (IDC) in Vienna, Austria and the second is sending data to the National Data Center (NDC) in Madrid in CD1.0. In order to ensure Data Availability (DA) and the optimum operational conditions for all station equipments, there are scheduled 30 Periodic Maintenance Routines (PMR'S). PS-40 as a primary seismological station uses six reports in its communications with IMS and IDC according with the CTBTO Operational Manual: Monthly Reports (MR), Problems Report(PR), Outage Request (OR), Configuration Change Request (CCR), Configuration Change Notification (CCN) and Station Summary Reports (SSR). Annually calibration of elements is done.

T5-P12. Operation and maintenance of PS44, characteristics and the operational experience of station operator

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The IMS includes dozens of stations that are located in different countries of the world. Each of these stations technically is unique. However, the specialists who work at these stations have a common trait. The operators and managers are passionate about their job and do their best for the proper functioning of the station. In my presentation, I will discuss about my first steps in the process of operation and maintenance of the station as well as the challenges I faced during that period. Also, I will note about the long-term procedure of custom clearance of the station's equipment and the ways of solution of the mentioned issue. I will discuss about the reasons of the duration of customs clearance procedure of the equipment and how to address this issue. I will

also talk about the support of the PTS to accelerate the process and to implement the planned activities at the station as well as the replacement of the equipment. Plans to address the problem of power supply elements of the station, considering their strengths and weaknesses will also be included in the discussion. We offer of uninterrupted power supply equipment which is installed in the institute.

T5-P13. Operations of IMS

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The IMS is a globally distributed network of monitoring facilities using sensors from four technologies: seismic, hydroacoustic, infrasound and radionuclide. Monitoring stations transmit data to the IDC in Vienna, Austria, over a global communication network known as the GCI. Since 2013, the data availability (DA) requirements for IMS stations account for quality of the data. At the core of the IMS Network operations are a series of tools for: monitoring the stations' state of health and data quality, troubleshooting incidents, communicating with internal and external stakeholders, and reporting. The new requirements for data availability increased the importance of the raw data quality monitoring. This task is addressed by development of additional tools for easy and fast identification of problems in data acquisition, regular activities to check the compliance of the station characteristics with the requirements of the IMS Operational Manuals by performing scheduled calibration of the IMS seismic network, review of the RN samples by certified radionuclide laboratories. The DA for the IMS network for different technologies in 2014 is: Primary seismic (PS) network – 95.70%, Infrasound network (IS) – 97.72%, Hydroacoustic network (HA) – 88.78%, Auxiliary Seismic – 86.07%; Radionuclide Particulate – 85.42% and Radionuclide Noble Gas -80.29%. PTS strategy for further improving operations and management of the stations and meeting DA requirements is discussed.

T5-P14. Operator experiences and impact on operation during volcanic eruptions

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Since 2008 the Argentinian particle station ARP03 has been witness of the eruptions of three volcanoes. Chaiten volcano in 2008 and 2011, Puyehue volcano in 2010 and Calbuco volcano in 2015, all three in Chilean territory nearby the station location unleashed a huge amount of volcanic ashes to the atmosphere that affected all the area of San Carlos de Bariloche and surroundings and even reached ARP01 station in Buenos Aires, 1600 km away. This work describes how the local operator has managed his own health and safety issues, how to continue the daily sampling, and how the volcanic ashes affected station equipment and infrastructure of the station.

T5-P15. Performance of Albanian VSAT, National Seismological Network, and its observed issues

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Previous experience of telemetric seismological network configuration, conditioned by local topography and costs, lead to VSAT solution, which was found most appropriate due to topography, remotes-hub position and the inability of the newly established mobile and internet networks to support that issue, at the time. Actual configuration of ASN comprises a set of 7 remote VSAT (BB) seismological stations, as well a MEDNED station, installed in Tirana (ex-central station), equipped by a VBB sensor and transmitting through VSAT to the INGV, in Rome. Data are received in our National Data Center through InterNAQS (Naqs plugging) using secure internet connection. Libra system (Nanometrics), taking the advantage of the TDMA carrier access, dual

transmission of raw and SOH data at 112 kbps/ 32 kbps modulation (QPSK/BPSK), and time synchronization accuracy < 100 µs (GPS), have resulted in plain performance for twelve years of ASN experience. Nevertheless, several issues have been addressed, despite the robustness of the selected networking solution. Main problems are interference causing GPS distortion and lightening influence. Cases of Vlora (VLO), Korça (KBN) and Tirana (TIR), are discussed here in detail along with found practical solutions.

T5-P16. Technology Trends And Future Developments In Seismic Stations

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By Grace Musonda: gracemusonda48@yahoo.com Zambian seismic network is responsible for the scientific study of earthquakes and the propagation of elastic waves through the Earth or through other planet-like bodies. The field also includes studies of earthquake effects, such as tsunamis as well as diverse seismic sources such as volcanic, tectonic, oceanic, atmospheric, and artificial processes- such as explosions. The Zambian seismic network has indicated results in the data produced and circulated regionally and in some other parts of the world. With regards to the Zambian seismic network, performance optimisations can help by accelerating application delivery and thereby improving end user experience. These technology solutions include WAN optimisation, application delivery and network performance management strategies. The primary objectives are speed and availability, irrespective of where the applications reside or the users connect from. The Government of the Republic of Zambia, through Geological Survey Department operates and maintains a network of five seismic stations. These comprises of Lusaka (LSZ), Kitwe (KTWE), Itezhi-tezhi (TEZI),Mongu (MONG) and Kasama (KASM). Lusaka through the CTBTO is the main station and it’s the one which is on real time. Real time will enable us make timely interventions and plan for disasters in case of any.

T5-P17. The Importance of Training Engineers and Scientist from Developing Countries On the Operation and Maintenace of the IMS

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The CTBT International monitoring system (IMS) is a world wide Network of observational technology that would help and helps to verify compliance with and detect and confirm violations of the CTBTO.When completed the IMS will consist of 337 monitoring facilities. When these facilities becomes operational and running there should be available manpower program to ensure the facilities are up and running effectively, theses would require experts in areas of facility maintenance, Data security, standardization of reports and operation and maintenance plans to mention a few. In other for people from developing countries to participate effectively in the operations the Provisional Technical Secretariat of the CTBTO would need to invest in the training of Engineers and Scientist from developing countries in these areas so that there would be large pool of experts and regional balancing and equal representation in the operation and maintenance of the IMS. Most Engineers from these regions have never seen such equipments and Technologies and how to operate and maintain. These poster presentation would be looking and discussing ways in which Engineers from developing countries can participate actively and effectively in the operation and maintenance of the IMS and

T5-P18. The Problems Faced in Geophysics Station of Parapat.

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Geophysics Station of Parapat is one of the station operator of CTBT. Since 2003, nuclear detection sensors was built . In addition, Geophysics Stasion of Parapat has given computers to analyze the signals from these sensors. But over time, there are some obstacles faced by the station operator. Including damage to the computer analysis. So that the data signal can not be processed. This has been reported to the technicians of CTBT, but we didn’t received the response. Besides that, the geographical Geophysics Station of Parapat which is a mountainous area, difficult to get sunlight. This resulted in the solar panels didn’t work properly and the battery was quickly broken. Network communication is also difficult to access. This made it difficult to communicate with the CTBT technician if a problem was occurs. There was also frequent power outages in the Station. As a result, UPS is also damaged, and only reaches a few minutes. It has also been reported to give us a replacement but has not received a response. With this training, we greatly except that technician at the station operator get knowledge to solve the problems above.

T5-P19. Uninterruptible Power Supply Deterioration and its Incidence on the Interruption of the Data Transfer to the APG station (AS037) Between 2014 and 2015

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One of the main causes behind the interruption of the seismic records' transmission at the auxiliary APG station has been the deterioration of the uninterruptible power supply (UPS) system, both that of the seismic station as well as the one backing up the equipment in charge of the data transmission towards the International Data Center (IDC). The problem related to the batteries in charge of powering the sensor, GPS, etc. has already been solved, as they are now being powered themselves by a solar panel. At the data transmission site, however, is still pending the replacement of the batteries powering the data transmission and authentication backup equipment, which are still being supplied electrical power by commercial electric energy. Given how unreliable this later source of energy has proven to be in the past, the possibility has been raised of installing a battery bank (powered also by a solar panel) at such site. An in depth analysis of the data transmission interruption, its causes and the possible solution previously mentioned is presented.

T5-P20. Zambia's Challenges and Experiences in the Establishment of a National Data Centre

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The Government of Zambia in a bilateral agreement with the Preparatory Commission for the Comprehensive Nuclear Test - Ban Treaty Organisation established a National Data Centre in Zambia with the aim of monitoring of nuclear explosions.The National Data Centre was commissioned in February, 2006 at Zambia Geological Survey Department. At the moment Zambian NDC does not have any operational, centralized data (seismic, Hydroacoustic, radionuclide and infrasound) acquisition system with the capability of accessing data from other international stations. Hence, the importance of setting up the National Data Centre which would enable us constantly monitor, manage and coordinate both natural and man-made seismic activities in the country and around the globe , upload data to the International Data Centre (IDC) as well as receive and use International Monitoring System(IMS) data and IDC products for treaty verification and compliance. Apart from these, the Centre also accesses and analyzes seismic waveforms relevant to its needs from the International Data Centre and make data available to its stakeholder Institutions for earthquake disaster mitigation; reports on all aspects of disasters related to seismic to relevant government agencies that deal with disasters.

T5-P21. Preventative Maintenance for Sustaining the International Monitoring System

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The International Monitoring System (IMS) Network of the Comprehensive Nuclear-Test Ban Treaty (CTBT), is to consist of 337 monitoring facilities, scattered around the globe, of four different technologies. One of the mandates of the Provisional Technical Secretariat (PTS), in cooperation with the Station Operator and Host Country is to ensure that the global network remains operational and reliable. The entire system life cycle starts with conceptual design, followed by fabrication and installation/ to operation and maintenance until it is disposed of and replaced. This is referred to as through life sustainment. Optimal and cost effective sustainment of the network can be achievable only through proper planning and execution. The IMS Monitoring Facilities Support, maintenance team is responsible for the oversight associated with maintenance of the monitoring facilities. Regular tasks consist of planned & scheduled maintenance, unscheduled maintenance, repair and replacement (out of lifecycle). This paper details how sustaining the facilities through preventative maintenance and adopting practices such as maintenance planning and document management can have important long term benefits and can ensure that the CTBT network remains operational, reliable and credible.

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