Verification highlights

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) includes a definition of a global verification regime to monitor compliance with the Treaty. Establishing this regime, which must be capable of detecting nuclear explosions underground, underwater and in the atmosphere, is the main activity of the Preparatory Commission for the CTBTO. The verification regime must be operational at the Treaty's entry into force. The regime consists of an International Monitoring System (IMS) supported by an International Data Centre (IDC), consultation and clarification, on-site inspections (OSI) and confidence-building measures.

Global IMS station status

The International Monitoring System (IMS) consists of 321 stations and 16 laboratories employing four different technologies (seismic, hydroacoustic, infrasound and radionuclide), located in 89 countries.

Currently, 190 of these stations are installed and are either certified as part of the IMS or substantially meet specifications. Of these 190 installed stations, approximately 140 are sending data to the International Data Centre in Vienna. An additional 78 stations are either already under construction or under contract negotiation, while another 72 stations and two radionuclide laboratories have contracts for operations and maintenance.

Even as the IMS network reaches completion, much work remains to be done. The Provisional Technical Secretariat (PTS) is moving from a development stage to a mature operational and maintenance stage. By the end of 2007, the PTS expects that over 90 per cent of the IMS network will be completed and sending data to Vienna. ■

Challenges of establishing IMS stations: From Patagonia to Baja California

VIEW OF SAN JUAN BAUTISTA, ROBINSON CRUSOE ISLAND, CHILE

The Latin America and the Caribbean (LAC) region is one of the six regions defined under the Comprehensive Nuclear-Test-Ban Treaty (CTBT). It encompasses 33 countries and a population of approximately 535 million. The LAC States host 43 International Monitoring System (IMS) facilities in locations ranging from Ushuaia, the southernmost city in the world in Patagonia, Argentina, to Baja California, Mexico, and from the Caribbean Sea to some of the most remote islands in the South Pacific. The area covers 7° longitude and a huge variety of topographies and climate zones.

The logistical and engineering hurdles facing the installation of facilities in this region can be considerable. The site locations are frequently off the beaten track, making the transport of people and construction materials complicated and time-consuming. Recently, two of the most challenging missions took place on Robinson Crusoe Island, located some 650 kilometres off the Chilean coast, and on Socorro Island, 480 kilometres south of the tip of Baja California, Mexico.

In April 2004, three IMS staff members undertook a four week mission on Robinson Crusoe Island to install infrasound station IS14. Robinson Crusoe Island is the very island where the sailor Alexander Selkirk was marooned for over

CARRYING INFRASOUND EQUIPMENT TO INSTALLATION SITE, ROBINSON CRUSOE ISLAND, CHILE, APRIL 2004

A MULE TRANSPORTING A GENERATOR, ROBINSON CRUSOE ISLAND, CHILE, APRIL 2004

BOAT UNLOADING SEISMIC EQUIPMENT ON PLAYA NORTE, SOCORRO ISLAND, CHILE, MAY 2004

four years. His recollections of the ordeal sparked the imagination of Daniel Defoe for his famous novel 'Robinson Crusoe'. The island which belongs to the Juan Fernández archipelago, rises dramatically from the Pacific to peaks of over 900 metres. It is a protected national park, and a UNESCO World Biosphere Reserve. Robinson Crusoe Island has the archipelago's only permanent population, centred in the town of San Juan Bautista. The 650 islanders' industry focuses largely on deep sea fishing and the harvest of spiny lobsters which are traded over the South American continent, and tourism is very low key.

Infrasound station IS14 is an eight element station divided into two sub-arrays, with array elements spread out on four hills located at distances between 1.5 to 8 kilometres from San Juan Bautista, while the Central Processing Facility (CPF) is located in the town, as is the shore facility for hydroacoustic station HA03. The topography surrounding it is ruggedly volcanic, with steep slopes that can exceed 50 metres altitude difference per kilometre. All the array elements can be reached by mountain trails. However, the island only has a few cars and relies on the mule population, which provide the most effective mode of transport on the steep and narrow mountain trail. The Provisional Technical Secretariat (PTS) team, therefore, had to quickly familiarize themselves with this unusual style of commuter travel. Furthermore, rain immediately turns the trails into mud slides, so the team was highly dependent on weather conditions.

The vaults and station equipment for IS14 were flown to the site by helicopter, but to keep costs down, all pipes, masts, electronic equipment and tools needed for the installation – a total weight of several hundred kilograms – were transported by up to ten mules per day. Depending on the location of the infrasound elements, the mules needed up to four hours to reach the site, and for the installation of a very remote array element it was necessary to camp at the site for four nights.

INFRASOUND ELEMENT H2, ROBINSON CRUSOE ISLAND, CHILE, APRIL 2004

Despite adverse weather conditions and a challenging topography, the PTS team successfully installed IS14 and performed all the necessary certification tests before returning to Vienna.

Another mission to a remote island, in May 2004, provided an IMS team with firsthand experience of how an 'island paradise' can turn within hours into something quite different. The mission to install and test seismic equipment for the T-phase hydroacoustic station HA06 took place on Socorro Island.

Socorro Island is the summit of a massive, predominately submarine volcano, covered with dense vegetation and black lava rocks. In the scuba diving community it is considered a heavenly playground for manta rays and other underwater species, including whale sharks and humpback whales. It is, however, only accessible between December and early June. A small Mexican naval base of about 45 people is located on the island during these months. The rest of the year the island is uninhabited due to its location on the hurricane path.

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Verification highlights

OSI Strategic Plan

On-site inspections (OSI) are considered to be the final verification measure of the Comprehensive Nuclear-Test-Ban Treaty (CTBT). The major elements of an OSI are the operational manual, inspectors, equipment and infrastructure. These elements were developed at the beginning somewhat independently of each other, but have now matured enough to be mutually integrated to establish the OSI regime. In order to achieve OSI readiness at entry into force of the Treaty, a comprehensive OSI Strategic Plan has been developed.

Three strategic goals have been defined in order to fulfil this plan. The first goal is to conduct a near full scale OSI field experiment in 2007 (FE07); the second goal is to achieve operational readiness for the conduct of one OSI, confirmed by a mock OSI in 2009 (OR09); the final goal is to establish the capability to conduct two simultaneous OSIs after entry into force. The time lines for achieving these goals are essential to allow completion of the build-up of all components of the overall CTBT verification regime in parallel, and of the OSI regime in particular.

The OSI Strategic Plan will be used as an internal reference for drafting programmes and budgets for the coming years. ■

OSI aviation communication exercise

In June 2004, the On-Site Inspection (OSI) Division conducted an aviation communication exercise in Stockerau, Austria, with the goal to find a solution which enables a team of inspectors to communicate freely with each other inside a helicopter and, at the same time, keep a record of all the communications that take place during the entire flight. The solution had to be totally independent from the helicopter's internal intercom system and wireless in order to provide the maximum flexibility for the team to move around inside the cabin. In addition, the solution had to concur with the aviation rules and regulations, and with the telecommunications authorities. Other equipment was also tested, such as, a GPS/GIS (Global Positioning System/ Geographic Information System), a camera and a satellite phone.

Two-way personal radios showed significant advantages over other systems, specifically because due to their low output power, the interference with other headsets and the aircraft electronic equipment turned out to be minimal. The noise level inside a helicopter usually ranges between 90-100 decibels, therefore headsets with two-way radios and a special boom microphone with a large noise attenuation to transmit voice and minimize the surrounding noise were necessary. For this reason, a model was adapted where the transmitter circuit is embedded in the headset and as a result there is no need for any additional equipment or cables. The PTT (Push To Talk) button is fitted on the left earphone and the antenna is mounted on the right earphone, thus providing true mobility for the users in the cabin. ■

NAVIGATING ON-BOARD A HELICOPTER USING THE MOBILE GEOGRAPHIC INFORMATION SYSTEM

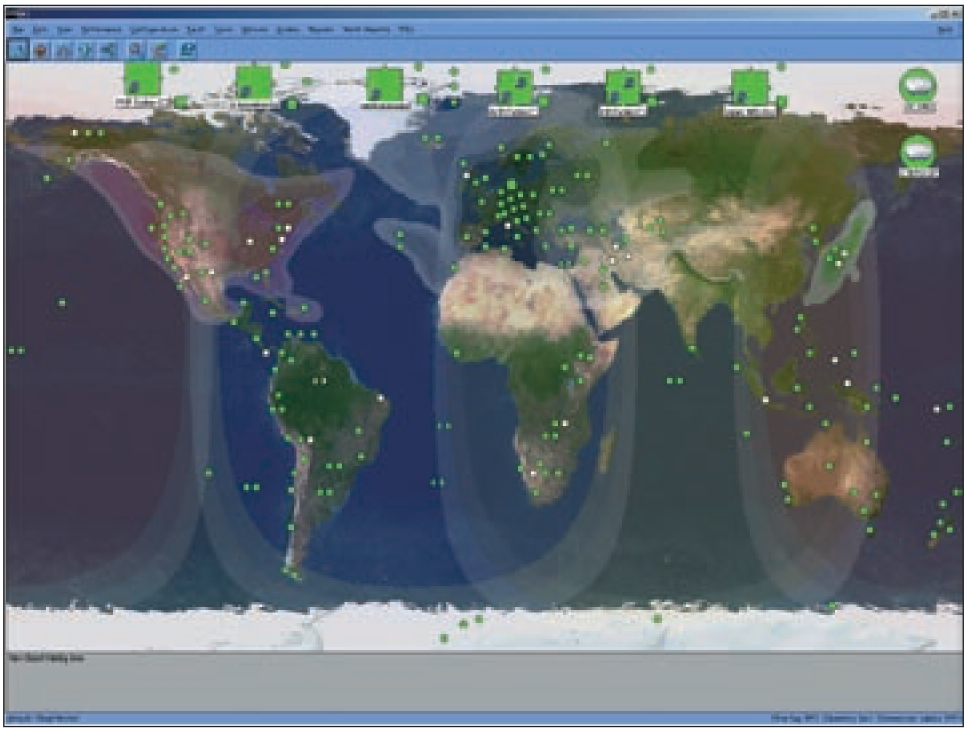
Global Communications Network Management System upgraded

The Network Management System (NMS) of the Global Communications Infrastructure (GCI) received a much-needed upgrade in April this year, just in time for the System-Wide Performance Test. The upgrade improves significantly the monitoring capabilities of the NMS. It provides a web portal from which the Provisional Technical Secretariat staff, network operators and National Data Centres' operators can check the status of their GCI link. Users can spot if a link is up or down, read the start and end time of an outage, and generate reports on historical response time and carried traffic. Interested GCI users can access the NMS web portal at: http://nmsweb.gci.ctbto.org.

WEB PORTAL FOR NETWORK MANAGEMENT SYSTEM USERS

In 2002, the International Data Centre/GCI Section, in conjunction with the GCI subcontractor, identified a need to upgrade and enhance the NMS for the GCI. The existing system had been in place for around five years and was running out of capacity to deal with an ever expanding and increasingly complex network.

The upgraded system was carefully designed over the next year. In order to have the enhanced monitoring capabilities in place for the System-Wide Performance Test, the Secretariat worked closely with the developer to implement the project in record time. The project commenced on 5 February 2004 and the new system replaced the old one on 24 April, with only six minutes downtime on the Network Management Systems. This caused no network downtime at all.



VIEW OF THE NEAR REAL-TIME GCI WORLD MAP USED BY GCI NETWORK OPERATORS

The system achieved a number of technical firsts. The most significant features of the NMS II are: enhanced monitoring resolution (down from 30 minutes to 60 seconds); migration of all data; warehousing and storage. The upgrade also involved a complete hardware replacement project. Furthermore, in order to meet the specific requirements of one of the most complex global networks anywhere, a number of specific tools had to be built and – most importantly – integrated into the existing system. As a result, the GCI NMS II is a seamless fusion of over 20 different component systems, some off the shelf, many bespoke, but all working together to provide some of the most advanced network management ever built. ■