CTBTO PREPARATORY COMMISSION | preparatory commission for the comprehensive nuclear-test-ban treaty organization

CTBTO Spectrum

CTBTO NEWSLETTER ISSUE 9 | JANUARY 2007

Who we are

The Comprehensive Nuclear-Test-Ban Treaty bans all nuclear weapon test explosions. It opened for signature in New York on 24 September 1996 and enjoys worldwide support.

The CTBTO Preparatory Commission was established to carry out the necessary arrangements for the implementation of the Treaty and to prepare for the first session of the Conference of the State Parties to the Treaty after its entry into force. It consists of all States Signatories and the Provisional Technical Secretariat.

Inside this issue

Forensic seismology and CTBT verification

By Professor Paul G. Richards
Lamont-Doherty Earth Observatory of Columbia University

The word 'forensic' means the application of scientific methods and techniques to the investigation of a crime. Various courts of law have developed standards of what it means to present objective technical evidence, derived from forensic studies. Such courts provide a framework, developed over decades, in which others will evaluate that evidence, to see if indeed a crime has been committed, and perhaps to identify the perpetrators.

In the context of Comprehensive Nuclear-Test-Ban Treaty (CTBT) verification, for a Treaty that is not yet in effect, it is not yet clear what will constitute persuasive evidence of a Treaty violation, nor how in practice such evidence will be prepared, or presented, or assessed. An underlying question here is: who will need to be persuaded? But with more than 2000 nuclear weapon test explosions conducted from 1945 to 1996, there are plenty of examples of what signals might be expected from a CTBT violation – that is, from a nuclear explosion conducted by a Signatory State – if a test explosion were conducted in the same fashion as most tests to date, that is, without attempts at concealment. And we can reasonably speculate what are the challenges to monitoring, if a test were to be conducted with an effort at evading the attention of monitoring systems.

continued on page 6

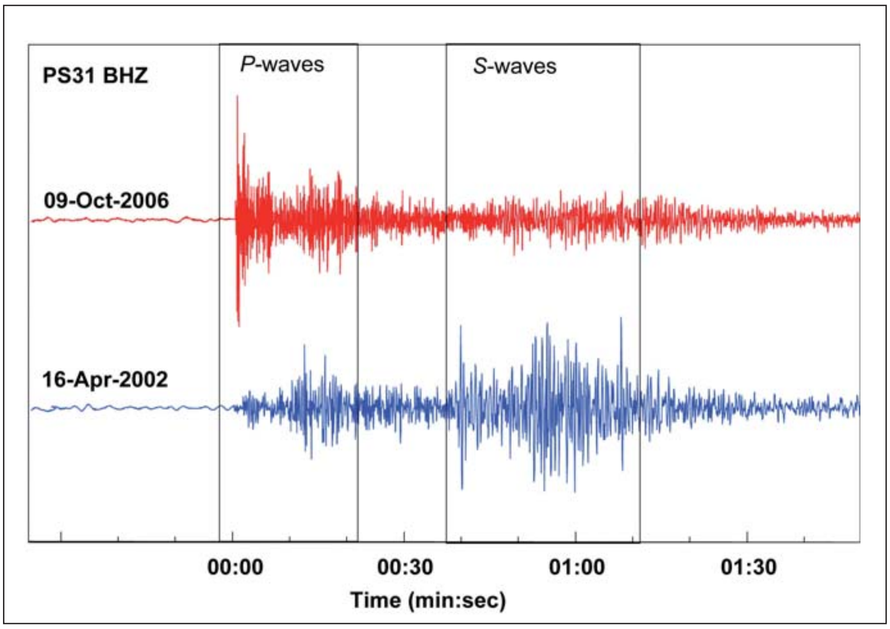


FIGURE 1: SEISMOGRAMS FROM PRIMARY SEISMIC STATION PS31, REPUBLIC OF KOREA. THE UPPER TRACE SHOWS THE WAVEFORM FOR THE ANNOUNCED NUCLEAR EXPLOSION IN THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA ON 09-OCT-2006, MB=4.1. THE LOWER TRACE IS FOR A CLOSE-BY SHALLOW EARTHQUAKE, MAGNITUDE MB=3.9. THE EXPLOSION GENERATES A LARGE P-WAVE AND PRODUCES LITTLE S-WAVE ENERGY RELATIVE TO THE EARTHQUAKE.

Editorial

In its ten years of existence, the Comprehensive Nuclear-Test-Ban Treaty (CTBT) has contributed significantly to international nuclear non-proliferation and disarmament efforts by creating an international norm against nuclear testing. This norm has been challenged by the announcement of the Democratic People's Republic of Korea (DPRK) that it had conducted a nuclear test on 9 October 2006.

The event represented a test for our organization, our technical capabilities, our own procedures and the potential value that the global verification system can bring to Member States. Within hours, States Signatories received reliable data and data products of the event, which was well-recorded throughout the world by the International Monitoring System (IMS) network. The delivery of the Provisional Technical Secretariat (PTS) showed that the verification system works in real life, with less than 60% of IMS stations contributing to provisional operations. At the same time, the event also underscored the need for a steady continuation of the build-up of the verification regime, including on-site inspections, as the ultimate means of verifying whether or not a nuclear test has taken place.

On 13 October 2006, the Member States held a Special Session of the Preparatory Commission, where they expressed their deep concern over the nuclear test announced by the DPRK and reinforced the commitment of the international community to establish a universal and verifiable comprehensive nuclear test ban.

Ultimately, the work of the Preparatory Commission and its Secretariat will only prove their worth once the CTBT has entered into force. With 177 signatures and 138 ratifications, the CTBT family is gradually and steadily growing towards universalization. All European countries have signed and ratified the Treaty. With the ratification of Moldova, the Eastern European Group is the first region to achieve full ratification. Also, all countries of the Treaty defined North American and Western Europe (NAWE) region, with one exception, have ratified the CTBT.

This issue of CTBTO Spectrum looks at the many interactions between the NAWE region and the CTBT, at the anniversary activities marking the adoption of the Treaty ten years ago, as well as at the achievements of the CTBTO Preparatory Commission and future challenges. Several hundred participants listened to presentations of world-renowned scientists in the first scientific symposium organized by the PTS, which was held from 31 August to 1 September 2006 at the Hofburg in Vienna. Delegations and scientists engaged in a multi-disciplinary exchange of ideas and explored synergies between the global scientific community and the CTBTO Preparatory Commission.

The symposium was followed by a two-day long experts meeting on civil and scientific applications of the CTBT verification technologies in Budapest, Hungary. Participants at this meeting discussed additional benefits deriving from the verification technologies and the need to validate the Member States' investment in the IMS network against the wider scientific community. In this context, I am particularly encouraged that the Commission, in its last session, has mandated the PTS to provide real time and continuous IMS data to relevant tsunami warning centres.

Besides providing an overview over the work of the Commission in the past half year, this issue of CTBTO Spectrum presents articles by internationally acclaimed public figures and scientists. The PTS is particularly honoured to publish a brief statement by the new United Nations Secretary-General, Mr Ban Ki-moon, an editorial by the European Union High Representative Javier Solana, an interview with the British Minister of State at the Foreign and Commonwealth Office H.E. Kim Howells and a cover article by Professor Paul Richards, a prominent seismologist at Columbia University.

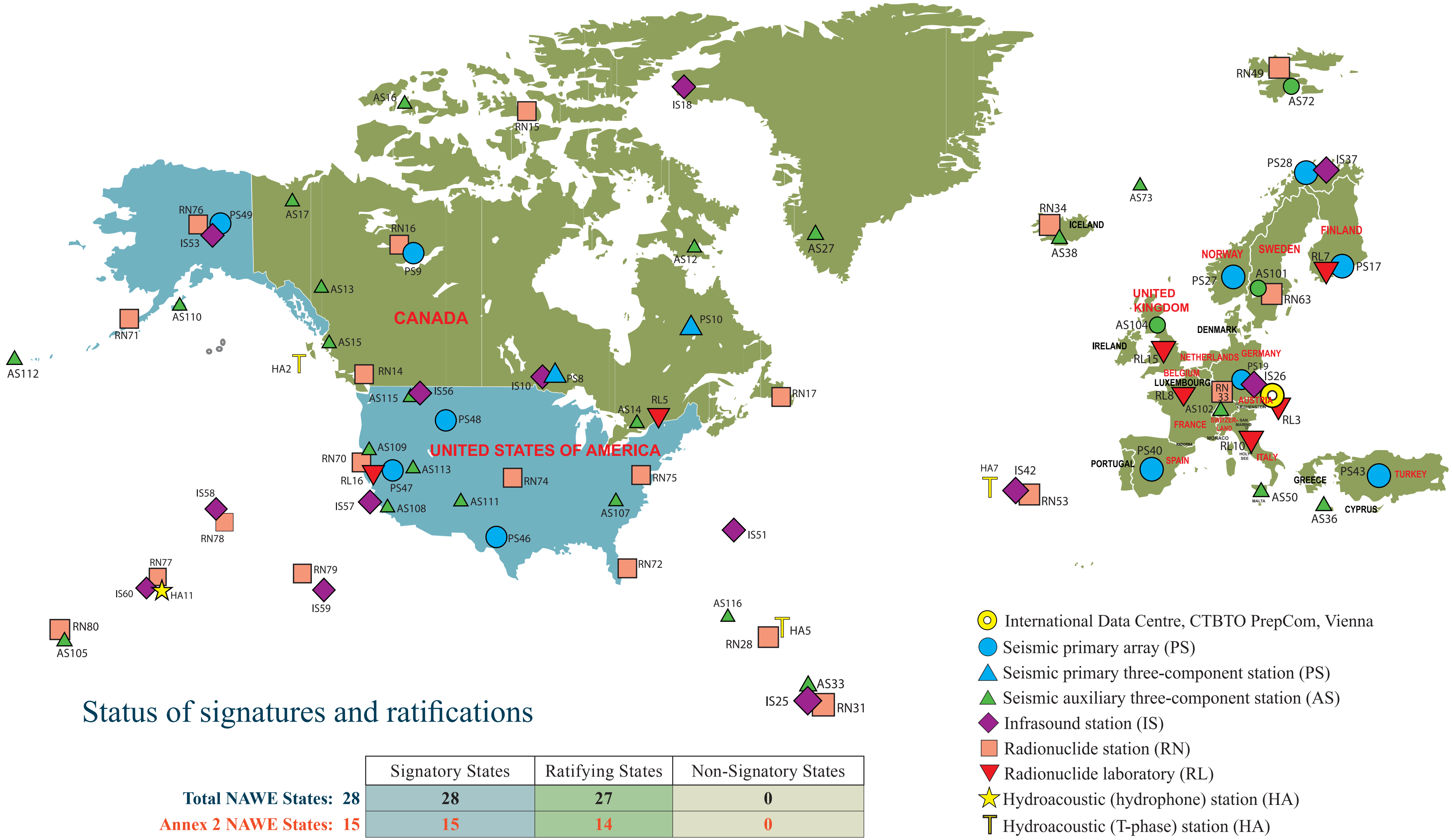
In the field of potential civil and scientific applications of verification technologies, Mr Patricio Bernal, Executive Secretary of the Intergovernmental Oceanographic Commission of UNESCO, reports about the importance of PTS data for tsunami warning centres and Mr Yosef Bartov, Director of the Earth Science Research Administration in Israel, looks at nuclear explosion phenomenology from an on-site inspection perspective. Finally, the special feature article by the Executive Director of VERTIC, Mr Michael Crowley, provides an interesting analysis of ten years of CTBT, the achievements of the Commission and its Secretariat, as well as the challenges ahead.

The 9 October event has challanged the international nuclear disarmament and non-proliferation regime, while at the same time, it has demonstrated the political importance of the Treaty. I hope that the reliable performance of the verification regime and the trend towards universalization will convince 'hold-out' States of the international security value of the CTBT and will encourage them to sign and ratify the Treaty for the benefit of a safer and more secure world.

Tibor Tóth
Executive Secretary
Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization

North America and Western Europe (NAWE region)

IMS facilities as defined by the Treaty (northern hemisphere only)



Status of signatures and ratifications

	Signatory States	Ratifying States	Non-Signatory States
Total NAWE States: 28	**28**	**27**	**0**
Annex 2 NAWE States: 15	**15**	**14**	**0**

Notes & quotes

North America and Western Europe and the CTBT

The North America and Western Europe (NAWE) region is the fourth largest of the six geographical regions defined by the Comprehensive Nuclear-Test-Ban Treaty (CTBT). The signing of the Treaty by all 28 Member States of the region demonstrates the overwhelming support the CTBT enjoys in the NAWE region. Not only have all Member States of the NAWE region signed the CTBT, but nearly all, with the exception of the United States of America, have ratified it.

The NAWE region accounts for a high proportion of signatures and ratifications in relation to its Member States and sets a prime example of a region's furtherance of the CTBT. The NAWE region is also of great significance insomuch as three of the five nuclear weapon States are located in that region; namely France, the United Kingdom and the United States of America. All three States signed the Treaty on the day of its opening for signature in 1996, and France and the United Kingdom ratified the Treaty in 1998. In relation to the 44 States listed in Annex 2 to the Treaty, whose signatures and ratifications are needed for its entry into force, 15 are located in the NAWE region. All 15 of these States have signed, and all, with the exception of one, have ratified the CTBT.

State representatives from the NAWE region have also been actively involved in the administration of the CTBTO Preparatory Commission. Meetings of the Preparatory Commission were chaired by Ambassadors John Freeman of the United Kingdom in 1998, Jaap Ramaker of the Netherlands in 2001 and Thomas Stelzer of Austria in 2003. Furthermore, H.E. Erkki Tuomioja, Minister for Foreign Affairs of Finland, presided over the Conference on Facilitating the Entry into Force of the CTBT (Article XIV Conference) in the year 2003 in Vienna.

Since 1998, States of the NAWE-region have hosted numerous workshops and seminars in order to promote international cooperation with respect to the CTBTO and to raise the general awareness of the CTBT. Such workshops have been held in Austria, Canada, Finland, France, Germany, Italy, Norway, the United Kingdom and the United States. They included Technical Training Programmes, Evaluation Workshops, a National Data Centre Manager Training Course, an On-Site Inspection (OSI) Experimental Advanced Course, an OSI Equipment Field Demonstration and an OSI Inspection Workshop.

The Commission has received valuable voluntary contributions for its workshops from, among others, Austria (2003), Finland (2005), the Netherlands (2001, 2002, 2005 and 2006) and Norway (2002). In addition, the European Union, the Netherlands and the Czech Republic are financing the global e-learning project of the Preparatory Commission, which is currently being set-up. In 2002, the Commission concluded a Host Country Agreement with the Government of Austria that regulates the activities of the Commission in Austria and grants the necessary privileges and immunities for the proper functioning of the organization.

That the CTBT enjoys strong support in the NAWE region should be capitalized on. Full ratification would allow the NAWE region to set an example for all other regions in their pursuit of nuclear non-proliferation and disarmament. States in other regions would sense the urgency of moving towards ratification so that the Treaty can enter into force. ■

Facility Agreements in the NAWE region

Facility agreements are international agreements and arrangements between the CTBTO and a host country regulating the establishment, upgrading, testing, certification and operation and maintenance of monitoring facilities. Facility agreements also ensure that the necessary privileges and immunities are granted to the Commission and its staff. According to the CTBT, States hosting or otherwise taking responsibility for facilities of the International Monitoring System (IMS) shall conclude facility agreements with the Commission pending entry into force of the Treaty.

Of the 28 States in the NAWE region, 17 States host monitoring facilities: Austria, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Italy, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The CTBT envisages the total number of IMS facilities in the NAWE region to be 113, including 7 radionuclide laboratories. All of them have been established.

Eight States in the NAWE region have concluded facility agreements with the Commission. These States are Canada (2000), Finland (2000), Norway (2002), Spain (2003), France (2004), the United Kingdom (2004) and Iceland (2006). All these agreements have entered into force. The trend towards concluding facility agreements continues, with Italy being the latest country to sign in March 2006. Negotiations with other countries are ongoing. ■

The importance of CTBT universalization

By Javier Solana, High Representative for the Common Foreign and Security Policy, Secretary-General of the Council of the European Union

Being the High Representative for the European Union's Common Foreign and Security Policy, I am particularly proud that all European Union (EU) Member States have signed and ratified the Comprehensive Nuclear-Test-Ban Treaty (CTBT). All other European countries are now also party to the Treaty, with Moldova being the latest country in the region to have ratified. This represents a major milestone towards universalization of the CTBT, a key disarmament and non-proliferation instrument.

The CTBT aims to be universal. It is an egalitarian Treaty from the viewpoint of obligations and rights: All States have to comply with the same obligations and all have access, in the same way, to the most extensive global verification regime ever built. While being egalitarian in terms of rights and obligations, the Treaty rightly requires the ratification by those countries, which possess significant nuclear activities, for its entry into force. This is not discrimination but a rather logical provision aimed at ensuring the credibility of the Treaty. Although 177 States have already signed the Treaty and 138 have deposited their ratification, the CTBT is still not nearing its entry into force. This is due to the fact that only 34 of the 44 States whose ratification is required for entry into have so far ratified the Treaty. There are ten so called 'hold-out'-States, among them two permanent Members of the United Nations Security Council.

Since the opening for signature of the CTBT ten years ago, the EU has been a strong supporter of the CTBT. The EU Strategy against Proliferation of Weapons of Mass Destruction, adopted by our Heads of State and Government in December 2003, defines the EU policy as follows: "...to pursue the implementation and universalisation of the existing disarmament and non-proliferation norms … and the early entry into force of the CTBT". Under this strategy, the EU has committed itself to make the best use of the existing multilateral verification systems and seek improvements where possible. This is why we have adopted a Joint Action providing financial support to the CTBTO in the area of training and capacity building in order to enhance the verification system. We are now in the process of preparing future activities for the implementation of the strategy and, among the projects envisaged, there are also new initiatives in support of the CTBT.

On 9 October 2006, the Democratic People's Republic of Korea (DPRK) tested a nuclear explosive device, in disregard of appeals from the international community not to do so. This event underscores how important and urgent it is to bring the Treaty into force and to complete the build-up of the verification system. I hope that the event will facilitate a reconsideration of the ratification of the Treaty by those major States, which so far have stayed outside the regime.

I call on all States, particularly the ones whose signature and/or ratification is necessary for entry into force of the CTBT, to sign and ratify the Treaty without further delay. The CTBT, together with the Nuclear Non-Proliferation Treaty (NPT), the IAEA safeguards system and the implementation of United Nations Security Council Resolution 1540, in particular with regard to export controls, can make a real difference in reducing the risks of nuclear proliferation. The entry into force of the CTBT will also constitute the fulfilment of one of the fundamental steps towards nuclear disarmament that were agreed at the 1995 NPT Review and Extension Conference and again at the 2000 NPT Review Conference and it will testify that we are fully committed to all obligations of the NPT. ■

"It is now as important as ever to work towards the early entry-into-force of the Comprehensive Nuclear-Test-Ban Treaty and achieving the international community's longstanding goal of outlawing all nuclear tests, thereby advancing both nuclear disarmament and non-proliferation. The claim by the Democratic People's Republic of Korea that it conducted the test of a nuclear weapon on 9 October 2006 is a direct challenge to the nuclear non-proliferation regime and has increased tension in the region and beyond. I urge all States to refrain from acts that would defeat the object and purpose of the Comprehensive Nuclear-Test-Ban Treaty pending its entry-into-force."

United Nations Secretary-General Ban Ki-moon for CTBTO Spectrum

Notes & quotes

Promoting the CTBT at the NAM Summit

The CTBTO Preparatory Commission was invited to participate with 'guest status' at the XIV Summit of the Non-Aligned Movement (NAM), held in Havana, Cuba, from 11 to 15 September 2006.

The Non-Aligned Movement has been a staunch supporter of the CTBT. Out of the 118 NAM countries, 102 have signed the Treaty and 69 have ratified it. Facility Agreements have been concluded with 13 countries. The CTBTO Preparatory Commission has sent delegations to all the major NAM meetings.

The CTBTO Executive Secretary, Mr Tibor Tóth, met with high-level representatives from the following countries: Colombia, Cuba, Dominica, Guatemala, Lesotho, Mozambique, the Philippines, and Trinidad and Tobago.

In all of his contacts, Mr Tóth explored ways and means to promote signature and ratification of the Treaty and offered assistance by the Provisional Technical Secretariat. He also underlined the political and technical benefits of the verification regime, including its potential scientific and civil applications. In addition, he reported about the status of ratification and the build-up of the International Monitoring System network, and mentioned the opportunities for training and e-learning for Member States.

In the Final Document of the Summit Meeting, the Heads of State or Government stressed "the significance of achieving universal adherence to the CTBT, including by all nuclear weapon States, which should contribute to the process of nuclear disarmament." They reiterated that "if the objectives of the Treaty were to be fully realized, the continued commitment of all States Signatories, especially the nuclear weapon States, to nuclear disarmament would be essential." ■

Forensic seismology and CTBT verification …

By Professor Paul G. Richards

continued from cover page

Nuclear explosion monitoring entails a series of steps, beginning with detection of signals (did a particular station detect anything?) and association (can we gather all the different signals, recorded by different stations, that originate from the same 'event'?). The next steps involve making a location estimate and an identification (did it have the characteristics of an earthquake, a mining blast, a nuclear weapon test?). Then follow the steps of yield estimation (how big was it?) and attribution (if it was a nuclear test, what country carried it out?).

Many different technologies contribute to nuclear explosion monitoring, with seismology playing a major role in monitoring the underground and underwater environments of a possible nuclear test.

It is intrinsically difficult to do this work because there are so many events generating seismic signals. The International Seismological Centre, located in Berkshire, United Kingdom, provides the most thorough documentation of global seismicity. Its bulletin, published about two years in arrears, now reports several hundred events per day, most of them very small earthquakes occurring in well-monitored regions. Because the CTBT is a comprehensive ban on nuclear testing, all seismic events are potentially suspect and require some level of attention. But though monitoring is difficult, extensive resources are applied to do the work.

The fact that so many events are detected and located should not be seen so much as a problem in monitoring, but rather as a testament to the sensitivity of monitoring networks, which continue to improve in part because of ever-increasing needs to study earthquake hazards. The work of monitoring – for both earthquakes and explosions – is done in practice by hundreds of professionals who process the vast majority of seismic events routinely, and who also look out for the occasional events that in the context of CTBT verification exhibit interesting characteristics, and which may then become the subject of special studies.

These special events have stimulated the development of effective new discrimination techniques and a better appreciation of overall monitoring capability. Examples include a mine collapse in 1989 in Germany and two such collapses in 1995 (in Russia and in the United States); a small earthquake of magnitude 3.5 and its smaller aftershock in 1997 beneath the Kara Sea near Russia's former nuclear test site on Novaya Zemlya; and two underwater explosions in 2000 associated with the loss of a Russian submarine in the Barents Sea; the series of nuclear explosions carried out by India and Pakistan in 1998; and the nuclear test conducted by the Democratic People's Republic of Korea (DPRK) on 9 October 2006.

The mining collapses were seismically detected all over the world, and caused concern because their mix of surface waves and body waves as recorded at great distances from the source appeared explosion-like using the classical Ms: mb discriminant. In this method, the strength of surface waves (Ms) is compared with that of body waves (mb). For seismic sources of a certain size, as determined by their mb value, surface waves are significantly stronger for shallow earthquakes than they are for an underground explosion.

But a careful analysis of regional waves from these events showed that although the surface waves were quite weak, and in this respect seemed explosion-like, they had the wrong sign. Therefore the motion at the source was implosive (the ground had moved inward toward the source), rather than explosive. Indeed, mining collapses are an implosion

continued on page 19

Commission update

Report on the November 2006 session

The Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) held Part II of its Twenty-Seventh Session from 13 to 17 November 2006 in Vienna under the chairmanship of Ambassador Volodymyr Yel'chenko of Ukraine. Ninety-three Member States participated in the session.

The report of the Executive Secretary

Mr Tibor Tóth, Executive Secretary of the CTBTO Preparatory Commission, referred to the announcement of the Democratic People's Republic of Korea (DPRK) to have conducted a nuclear test. He underlined that the Chairman of the Preparatory Commission and he himself had reacted immediately and issued statements sharing the deep concern expressed worldwide about the event. The Provisional Technical Secretariat (PTS) demonstrated that it was capable of meeting this challenge. It recorded and reviewed relevant data, and provided raw data and data products to States Signatories in accordance with the procedures and time lines envisaged under the Treaty.

The Executive Secretary reported on progress made in the build-up of the verification regime as well as on administrative and budgetary matters. He informed delegations that 75% of the International Monitoring System (IMS) network had been installed and 174 stations and seven radionuclide laboratories of the IMS were certified.

Mr Tóth pointed out that the current rate of payments of assessed contributions was lower than in the previous year by about 6 to 7%. As of 10 November 2006, payments of assessed contributions stood at 81.3 % of the $ portion and 78.3% of the € portion.

The Executive Secretary also touched upon the difficult circumstances that the PTS was facing in implementing the programme and budget. This, he reported, was due to the fact that more than 30% of the total number of professional staff would be affected by the implementation of the personnel rotation policy in 2007.

Plenary debate and conclusions

Delegations recalled the Special Session of the Commission on 13 October 2006, when Member States had expressed their deep concern and regret about the DPRK event. They underlined the need for the rapid completion of the establishment of the verification regime, including the noble gas stations, and for the early entry into force of the Treaty. States Signatories thanked the PTS for the timely provision of data and products and for its professionalism in dealing with this event.

States Signatories also expressed their appreciation for PTS training courses, international cooperation and other capacity building activities. They also thanked the PTS for organizing the tenth anniversary scientific symposium, which provided ideas for a wide range of improvements of the verification technologies and their potential civil and scientific applications.

States Signatories welcomed the ratifications of the CTBT since the last session of the Commission by Andorra, Armenia, Bosnia and Herzegovina and Ethiopia, and the succession to the Treaty by Montenegro. They expressed broad support for the convening of the Conference on Facilitating the Entry into Force of the CTBT in 2007.

The Commission agreed to a budget of $48,277,100 and € 48,564,400 for 2007. It endorsed a recommendation by Working Group B to provide real time and continuous data from the IMS network to relevant tsunami warning organizations. ■

Profile of the Chairperson of the CTBTO Preparatory Commission

Ms Ana Teresa Dengo, the new Permanent Representative of Costa Rica to Austria and to the International Organizations in Vienna, is serving as Chairperson of the CTBTO Preparatory Commission for 2007.

Ambassador Dengo holds a bachelor degree in industrial engineering from the Central American Private University, in Costa Rica and a Masters in Public Administration from the John F. Kennedy School of Government, Harvard University, in the United States.

She began her career with her Government at the Ministry of Trade and Exports in 1985 as an Industrial Promotion Officer, after having worked in the private sector for over eight years. Between 1988 and 1990, Ms Dengo worked for UNIDO and later joined the United States Peace Corps in Costa Rica as Associate Director. From 1996 onwards, she worked as an advisor to the Chairman of the Group of 77 and China at the United Nations in New York and subsequently for the Permanent Representative of Costa Rica to the Organization of American States. Ms Dengo has also worked as a consultant for the Interamerican Development Bank (IDB) in Washington DC and the Secretariat of the Organization of American States.

Prior to her appointment as Ambassador, she served for eight years at the Provisional Technical Secretariat of the CTBTO Preparatory Commission. ■

In the spotlight

Hon Kim Howells,
Minister of State at the Foreign and Commonwealth Office, United Kingdom

Q: *The United Kingdom (UK) and France were the first nuclear weapon States to ratify the Comprehensive Nuclear-Test-Ban Treaty (CTBT) on 6 April 1998. According to the then-Foreign Secretary Robin Cook, the ratification of the CTBT signaled Britain's "commitment to the goal of a nuclear-weapons-free world," calling the CTBT "a cornerstone of international efforts to prevent nuclear proliferation."*

How has the United Kingdom supported the CTBT so far?

A: We support the CTBT in a variety of ways. First of all, politically. Pending the Treaty's entry into force, we are continuing to observe a moratorium on nuclear weapon test explosions or any other nuclear explosions, a moratorium we have actually had in place since 1991. We take every opportunity to reiterate our strong political commitment to the Treaty, most recently when I attended the meeting in New York in September 2006 to launch the Joint Ministerial Statement calling for the Treaty's entry into force. The former Foreign Secretary Jack Straw also attended the Article XIV conference in New York in 2005, both under the European Union Presidency which we held at the time and in a national context, and gave a very well received statement calling for early entry into force for the CTBT.

Secondly, we give practical support. We pay our financial contributions in full and on time, and encourage everyone to do the same. We do all that we can to ensure the Treaty's verification regime will work on entry into force, for example by supporting the completion of the International Monitoring System, including the twelve stations we are responsible for, and also by getting involved in the elaboration of the on-site inspection aspects of the Treaty's verification regime, such as the Directed Exercises in 2006 leading to the Integrated Field Exercise in Kazakhstan in 2008. The Atomic Weapons Establishment (AWE) at Aldermaston, for example, provided a mobile laboratory for the 2006 exercise on the base of operations; and has offered equipment and personnel for the Integrated Field Exercise. We also support building links between the CTBTO and the scientific community, so we were pleased that UK scientists took part in the symposium in August 2006 to mark the 10th anniversary of the Treaty.

> "We take every opportunity to reiterate our strong political commitment to the Treaty"

Q: *The CTBT was once described as "the longest sought, hardest fought prize in the history of arms control".*

Why is the CTBT so important for nuclear non-proliferation?

A: We would certainly agree that it was a prize worth fighting for, and it remains so. On entry into force, the CTBT will legally ban testing of nuclear weapons. It is a widely accepted key instrument in the field of disarmament and non-proliferation because it helps prevent the spread of technology and knowledge used for the development of nuclear weapons. The challenges we face in this field are stronger than ever, given the dangers posed to us all from the proliferation of weapons of mass destruction. Thanks to the CTBT, there is a strong international norm against nuclear testing. So while several countries have not yet felt able to ratify the Treaty, they too are nevertheless maintaining moratoria on nuclear weapons testing.

Q: *On the day of the 10th anniversary of CTBT's opening for signature the former United Nations Secretary-General Kofi Annan highlighted the consequences of further delays in the entry into force of the Treaty: "Resumption of nuclear testing by one State could well lead to a single cascade of States seeking to acquire nuclear weapons…and existing nuclear weapon States racing to expand or improve their nuclear capabilities. Avoidance of such a series of events is a mission we must pursue with the utmost urgency." A few days later, North Korea informed the international community that it had tested its first nuclear weapon.*

What measures has the United Kingdom so far undertaken to encourage universalization of the CTBT?

A: First of all, I would say by being one of the first to sign and ratify the Treaty. Also by supporting events designed to promote entry into force,

like the one in New York last September and the one to come later this year under Article XIV of the Treaty. Secondly, by taking every suitable opportunity, both bilaterally and with our European partners, to encourage others to sign and ratify, in particular the remaining ten listed in Annex 2 of the Treaty. But I've been encouraged by the growing breadth and strength of support for the Treaty, particularly amongst developing countries. More countries ratified the Treaty in 2006 than in 2005, including Vietnam, an Annex 2 country. This reflects an understanding that the Treaty is more important than ever, and I expect this trend to continue.

> "More countries ratified the Treaty in 2006 than in 2005, including Vietnam, an Annex 2 country. This reflects an understanding that the Treaty is more important than ever, and I expect this trend to continue."

Q: *For many years it was said that the CTBT, even without having entered into force, contributed to a climate within which a stop to nuclear test explosions was regarded by many as a norm. The recent nuclear weapon test conducted by North Korea represents a direct challenge to the nuclear non-proliferation regime.*

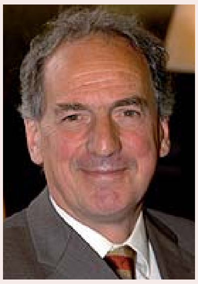
What effect will the testing by North Korea have on the nuclear non-proliferation regime and on the moral norm against nuclear testing?

A: It is true to say that there has been, for a number of years, a moral norm against nuclear testing. This is why North Korea's nuclear test (which, I should add, was in technical terms an unsuccessful one according to all the indications so far) crossed a red line for the international community. United Nations Security Council Resolution 1718 highlighted the deep concern which the test caused; and the 15-0 vote at the Security Council sent a powerful message to North Korea, and any other nation who might consider a nuclear test explosion, that such actions constitute a threat to international peace and security.

The test contravened North Korea's commitments under the Non-Proliferation Treaty (NPT) as a non-nuclear weapon State, breached the 1992 North-South Joint Declaration on the Denuclearization of the Korean Peninsula, and ignored United Nations Security Council Resolution 1695 which was issued in response to its multiple missile tests in July. The nuclear test also runs counter to the spirit of the September 2005 Declaration to which North Korea has signed up. Nevertheless, we continue to call on North Korea to sign and ratify the Comprehensive Nuclear-Test-Ban Treaty, to refrain from conducting any further nuclear tests or missile launches, and to re-establish its commitments to a moratorium on missile launching. ■

This interview was conducted before the publication of the UK Government's White Paper on the future of the nuclear deterrent, on which the UK government has informed us a debate and a decision is not expected in Parliament until March.

Biographical note



Dr Kim Howells was appointed Minister of State at the Foreign and Commonwealth Office in May 2005. He is responsible for the Middle East, Afghanistan and South Asia, Counter Narcotics, Counter Proliferation, Counter Terrorism, United Nations and United Nations Reform.

Dr Howells was previously Minister of State at the Department for Education and Skills. He has also held Ministerial posts at the Department for Transport, the Department for Culture, Media and Sport, and the Department for Trade and Industry.

He is MP for Pontypridd and was educated at Mountain Ash Grammar School; Hornsey College of Art; Cambridge College of Art & Technology and Warwick University. ■

Perspectives

Ten years of CTBT: achievements and challenges ahead

By Michael Crowley, VERTIC Executive Director

Introduction

The two key challenges set to the international community by the United Nations General Assembly's adoption of the Comprehensive Nuclear-Test- Ban Treaty (CTBT) on 10 September 1996 were 1) to ensure that the CTBT is duly ratified by all States Signatories, including the 44 specified States required to do so before the Treaty enters into force, and 2) to support the work of the Provisional Technical Secretariat (PTS) in establishing a verification regime that, by the time of entry into force, is capable of meeting the Treaty's verification requirements. This article will review how far the international community has progressed in meeting these challenges during the past ten years.

International monitoring system: overcoming technical limitations and challenges

Doubts regarding the verifiability of a treaty halting all nuclear explosions were expressed as early as the 1950s, when India's first Prime Minister, Jawaharlal Nehru, and others initially raised the idea of such an agreement. At the time, this was understandable as it was not clear that existing technologies were adequate to detect all underground explosions. In 2001, however, the Independent Commission on the Verifiability of the CTBT, stated that the CTBT could be verified 'with high probability', a conclusion in line with the subsequent US National Academy of Sciences report of 2002.

Indeed, the PTS's progress in overcoming myriad technical, logistical, political and financial hurdles to establish the verification regime has been impressive, with some 75% of stations now installed. Overall the system has proved remarkably accurate, pinpointing seismic events to within 5 kilometers of their epicentres. The system will continue to become more accurate as new stations come on stream, and as the experts learn to exploit the synergies between various types of International Monitoring System (IMS) data, taking advantage of advances in monitoring and communications technologies and of their experience in testing and developing the system.

The democratization of information

One of the unique features of the CTBT verification system among arms control regimes is the real time provision of compliance-relevant information directly to Member States. All CTBT States Signatories are entitled to receive raw data in real time from the International Data Centre (IDC), or if they prefer, filtered information.

It is promising that an increasing number of States – some 780 institutions in 93 countries – now participate in the provisional operation of the verification regime. The PTS facilitates such involvement by providing the necessary hardware and software to interested States, and undertakes intensive capacity building efforts. The aim is to encourage all States Signatories to take full advantage of this unique data sharing arrangement. VERTIC strongly supports such initiatives and believes that all States that do not currently have national data centres should take advantage of the PTS capacity-building programme to maximize the benefit they receive from the system.

While monitoring the test ban is the core function of the PTS, the data collected by the IMS is of considerable use to civilian and government researchers in their analyses of earthquakes, volcanic eruption forecasting, the location of underwater explosions, sea temperature and climate change monitoring. Tsunami-warning centres receiving real time and continuous data from the IDC on a trial basis found that their ability to issue warnings would be significantly increased by using this information. The Commission consequently agreed at its 27th plenary session that the IDC should continue to provide the data to them on a long-term basis.

Completion and maintenance challenges

While considerable progress has been made, the IMS is not yet complete. Logistical difficulties and resource limitations have caused delays. A number of Member States have yet to turn on the data stream from the stations built in their countries, while some countries have elected not to allow the PTS to construct stations on their territories. Paradoxically, perhaps, although the IMS is a 'new' system still under construction, many elements of it are already ageing. The first purpose built stations are now eight years old, while some of the auxiliary seismic stations that pre-date the Treaty are more than 20 years old. Many stations operate in harsh and remote environments which exacerbate the problem of system deterioration. The CTBTO should develop effective means to prevent and remedy system degradation as a matter of priority, and it must address the thorny issue of how to finance such repairs and replacements.

On-site inspections

It has proved difficult for the CTBTO to develop and agree effective procedures for on-site inspections (OSI). A number of States remain concerned that such inspections may compromise their national security. However, Working Group B, tasked with drafting the OSI manual (the key document detailing how such inspections will be undertaken), has made progress in reviewing the draft text. The procedures outlined in the draft

manual will be tested during the Integrated Field Exercise (IFE) scheduled for 2008.

Budgetary challenges

The CTBTO's budget has grown from US$ 27.7 million in 1997 to US$ 112.5 million agreed for 2007. This four-fold growth is primarily due to the steep rise in the first few years of its existence, reflecting the cost of the rapid growth of the new organization and the high establishment costs of the global verification system. Since 1999, the budget has remained relatively steady when corrected for inflation and, in fact, the growth rate fell to zero per cent in 2003. Furthermore, it can be assumed that the costs of maintaining the system are likely to drop when the IMS is operational and its cost-effectiveness is optimized.

Approximately 90-97% of the CTBTO budget is collected annually – an unusually high and encouraging rate for an international organization. However, certain States have on occasion refused to pay their contribution, or have agreed to only fund certain activities, for a variety of reasons. The withholding of funds not only jeopardizes the completion of the IMS on schedule, it also sends a worrying signal that the State withholding funds is less committed to the Treaty and to the organization.

Entry into force: the challenge to the international community

While real and steady progress is being made by the PTS to ensure that the monitoring and verification systems are in place before entry into force, the international community has been less successful in meeting the challenge of bringing the Treaty itself into being. Although 177 States have now signed the Treaty and 138 have ratified it, only 34 of the 44 Annex 2 States required to ratify have done so. Without the ratification of the ten 'hold-out' States – China, Colombia, Egypt, India, Indonesia, Iran, Israel, North Korea, Pakistan and the United States – the CTBT will continue to be a Treaty left in limbo.

Nonetheless, it is important to acknowledge that even in its suspended state, the mere existence of the CTBT has usefully contributed to international nuclear non-proliferation and disarmament efforts by strengthening an effective international norm against nuclear testing. If anyone doubts the importance of the CTBT in this regard, they should consider the situation prior to its development. In the fifty years after the first atomic bomb was detonated some two thousand nuclear test explosions were conducted, primarily by the United States and the Soviet Union, but also by China, France and the United Kingdom. Since the CTBT's adoption in September 1996, none of the NPT nuclear weapon States have conducted nuclear tests nor have any of the other CTBT Signatory States. This global moratorium was however breached in 1998 when both India and Pakistan carried out tests. Both States subsequently declared self-imposed moratoria, to which they have so far adhered.

The most recent breach of the moratorium has, of course, been by North Korea with its 9th October 2006 test. The test broke the moratorium and challenged the norm against nuclear testing that had been gaining in strength over the past decade. The vast majority of the international community rallied to the norm's defence through swift condemnation of North Korea's act, with the Chair of the CTBT Preparatory Commission calling it a threat to international peace and security and urging North Korea to refrain from further testing.

VERTIC believes that the North Korean test must spur Treaty members to redouble their efforts to bring the CTBT into force at the earliest possible opportunity. The debate should encompass all options, even controversial ones. CTBTO Member States have two important opportunities to engage in these discussions in 2007: The bi-annual Article XIV Conference in September and the NPT Preparatory Commission in April and May. Real advances must be made relatively quickly or States' dedication to the comprehensive test ban may wane, most critically that of those nuclear weapon States that have signed the Treaty.

The former US President Bill Clinton observed that the CTBT was "the longest-sought, hardest-fought prize in the history of arms control"[1]. It is time now to bring the Treaty fully to life, so that the benefits to international peace and security are completely realized. ■

Biographical note

Michael Crowley joined VERTIC as Executive Director in June 2005, having worked for nearly twenty years on arms control, security and human rights issues, including at the Omega Foundation, the Arms Trade Treaty (ATT) project at the Arias Foundation in Costa Rica, the British American Security Information Council (BASIC), and Amnesty International. ■

ABOUT VERTIC

The Verification Research, Training and Information Centre (VERTIC) promotes effective and efficient verification as a means of ensuring confidence in the implementation of international agreements and intra-national agreements with international involvement. VERTIC aims to achieve its mission through research, training, dissemination of information, and interaction with the relevant political, diplomatic, technical, scientific, academic and non-governmental communities.

Founded in 1986, VERTIC is an independent, non-profit-making, non-governmental organization. ■

[1] James Bennet, "Clinton, at U.N., Says "He'll Press Senate on Test Ban Pact", The New York Times, 23 September 1997

Verification highlights

Installing IS50 on Ascension Island: green turtles and mysterious data spikes

The main activity of the CTBTO Preparatory Commission is the establishment of a global verification regime, capable of detecting nuclear explosions underground, underwater and in the atmosphere. As defined by the Treaty, this regime consists of an International Monitoring System supported by an International Data Centre, consultation and clarification mechanisms, on-site inspections and confidence-building measures, all of which must be operational at the Treaty's entry into force.

IMS network status

The establishment of the International Monitoring System (IMS) network has continued in all four technologies - seismic, hydroacoustic, infrasound and radionuclide. The complete network includes 321 stations and 16 laboratories in 89 countries.

As of 31 December 2006, 193 facilities, including 9 radionuclide laboratories have been certified; 244 stations were installed and substantially met specifications. In addition, 40 stations were either already under construction or under contract negotiation, and 95 stations as well as 4 radionuclide laboratories had contracts for operation and maintenance. During the last six months, 26 additional facilities including 3 radionuclide laboratories have been certified. Furthermore, approximately 190 stations were configured in the International Data Centre (IDC) operational system.

Thus the Provisional Technical Secretariat (PTS) is facing a double challenge of continued build-up and sustainable maintenance of facilities. By mid-2008, the PTS expects that approximately 90 per cent of the IMS network will be installed. ■

LOW-FREQUENCY INFRASOUND ARRAY ELEMENT, IS50, ASCENSION ISLAND

Establishing International Monitoring System (IMS) stations requires a diverse set of professional and interpersonal skills from staff members of the Provisional Technical Secretariat (PTS). Working at remote places and in difficult climatic environments, PTS staff members need to be resistant to extreme heat and cold, familiar with state of the art technology and able to handle social and cultural sensitivities of the host country. In addition, as the installation and certification visits on Ascension Island show, they also need to have a 'Sherlock-Holmes'-like mind.

Ascension Island is one of the most isolated islands in the world. It is located in the Southern Atlantic Ocean, some 1,600 kilometres from the coast of Africa and nearly 1,300 kilometres away from Saint Helena, the next inhabited island. The wind-

VIEW FROM GREEN MOUNTAIN TOWARDS 'WIDEAWAKE' AIRFIELD, ASCENSION ISLAND

torn, sub-tropical island is named after the day of its recorded discovery, Ascension Day.

Most of Ascension's nearly 100 square kilometres are dry and barren, covered by basalt lava flows and cinder cones. The island is the peak of an enormous volcano rising from the depths of the Atlantic Ocean, just west of the mid-Atlantic ridge. It has 44 dormant, but not extinct, volcanic craters. An exception to the moon-like appearance of Ascension is the lush vegetation on Green Mountain, a large-scale artificial forest which was planted in 1843 and is gradually growing since.

The strategic position between the continents shaped the history of the island. For centuries, the mariners of the East Indies fleets used it only as a stop over to collect meat, mainly from the enormous green sea turtles that nest there – adults reach 100 centimetres in carapace length and 150 kilograms in mass. Today, the green turtles are the main attraction on Ascension Island. They swim more than 1,000 kilometres from their feeding grounds off the coasts of Brazil, using the earth's magnetic field for navigation, to the sandy beaches of Ascension Island to lay their eggs.

Ascension became strategically significant when Napoleon I was incarcerated at Saint Helena. The British, concerned about possible rescue attempts, established a small naval garrison. Since then, Ascension belongs to the United Kingdom. It is a British Overseas Territory, which, together with Saint Helena and Tristan da Cunha, forms a single territorial grouping under the sovereignty of the British Crown.

Ascension Island experienced the peak of its military importance during the Second World War, when the United States Government built an airstrip, the so called 'Wideawake Field'. More than 25,000 planes transited the island on their way to the North African and European battle fields. In 1982, Ascension played a determining role to support operations in the Falkland war.

GREEN SEATURTLE ON ITS WAY TO LAY EGGS

Present-day Ascension has a population of about 1,250, mostly military and civilian contractors of the United States and the United Kingdom, along with government employed workers from Saint Helena. Due to its strategic location, the island provides telecommunications services to Africa and hosts large relay stations, including one of the three ground antennas that assist in the operation of the GPS navigational system.

Until recently, Ascension Island was effectively inaccessible to the casual visitor and was practically a 'closed' island. In order to get there every visitor still needs

TRACES OF SEATURTLES AND SEATURTLE EGGS REMOVED FROM THEIR NESTS BY BIRDS

Verification highlights

Installing IS50 on Ascension Island: green turtles and mysterious data spikes

continued from previous page

a written permission by the Administrator. This was also the case for two PTS staff members, who went to Ascension to supervise the final station construction of the infrasound station IS50, conduct the installation of equipment and perform the certification tests. In early November 2004, they boarded a civilian aircraft at Brice Norton, a military airport close to London, with the invitation of the British Crown in their pockets. After a seven-hours flight, the subtropical heat and stormy winds welcomed them on the island.

IS50, an eight-element array, is located in the center of Ascension Island, in a very dry environment with almost no vegetation, subjected to the constant winds blowing over the island. All elements of the station are accessible by dirt tracks and fenced in to protect them against wild donkeys and sheep. The PTS team progressed with the equipment installation as planned, while the Ascension Island Works and Services Agency finished in parallel the station construction. During the first few days of the installation period, another contractor installed the Global Communications Infrastructure (GCI) equipment.

PTS STAFF MEMBER SETTING UP EQUIPMENT FOR NOISE STUDY CLOSE TO THE DIESEL GENERATORS, MARCH 2005, ASCENSION ISLAND

On 21 November 2004, IS50 commenced sending data from all elements to the International Data Centre in Vienna. When performing a first set of certification tests, a number of spikes in the power spectral density plots associated to each array element was noticed, indicating the presence of some kind of disturbance. This problem required further investigation (see Figure 1). In addition, the ultrasonic

POSSIBLE SOURCE OF INTERFERENCE WITH INFRASOUND EQUIPMENT

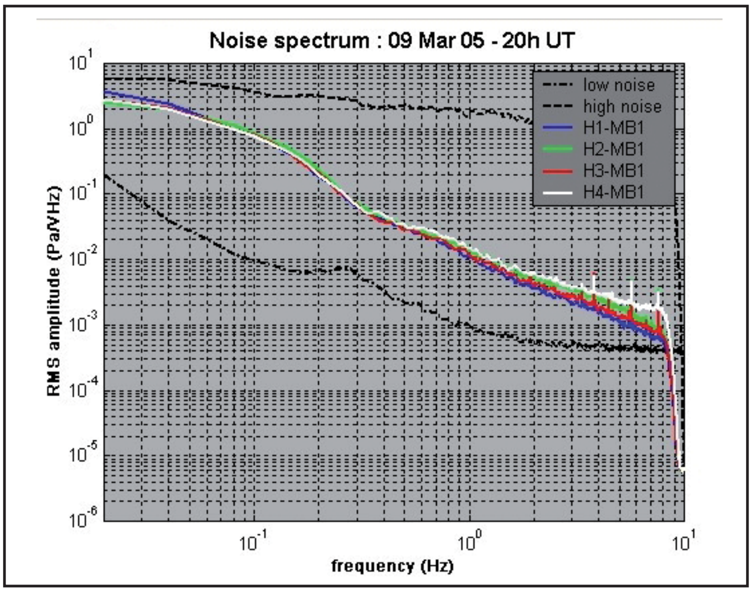


FIGURE 1: A TYPICAL POWER SPECTRAL DENSITY PLOT ASSOCIATED TO DATA RECORDED ON 9 MARCH 2005 AT IS50 AND FILTERED WITH A HIGH FREQUENCY OPTIMIZED PIPE ARRAY. THE SPIKES GENERATED BY THE WIND GENERATORS ARE VISIBLE AT ALL SITES.

wind sensor and the uninterruptible power supply for the infrasound equipment at the Central Processing Facility failed. Therefore, not all certification tests could be concluded.

During a second visit to Ascension Island in March 2005, two PTS staff members replaced the faulty instruments and continued their search for the source of the 'mysterious' spikes in the data. They first thought that the spikes were caused by some kind of electronic problem in the station equipment. However, a series of tests ruled out this possibility very clearly.

The second hypothesis made by the two PTS staff was that the spikes were generated by the electromagnetic fields associated to the numerous antennas and relays installed on the island. But also in that case, a series of tests ruled out this possibility. All the tests conducted to rule out the first two hypotheses were clearly indicating something intriguing: the spikes were generated by acoustic, and not by electronic noise. Based on this latter observation, the PTS team decided to conduct a noise study in three separate areas, using portable equipment.

The noise study revealed that the diesel generators of the first two locations were not the source of the noise picked up by the infrasound array elements of IS50. After several days of hectic investigations it became clear that the movement of the turbines installed at the wind generator farm operated by the US Air Force was the origin of the noise picked up by the microbarometers installed at the infrasound array. Several independent studies performed after the first observations of the PTS team on Ascension Island confirmed that the turbines of a wind farm generate the typical signature in the data observed at IS50. The clear identification of the source of the spikes is very important for the post-processing of the incoming data by the IDC experts in Vienna. ■

LOCATION OF ONE OF THE LOW-FREQUENCY ARRAY ELEMENT (RED CIRCLE) WITH RADIO-ANTENNAS IN THE BACKGROUND

PTS STAFF MEMBER PERFORMING NOISE STUDY IN FRONT OF WIND GENERATORS, MARCH 2005, ASCENSION ISLAND

WILD DONKEY LOOKING INSIDE THE CENTRAL PROCESSING FACILITY OF IS50

Verification highlights

The future role of the International Monitoring System

The initial phase of the International Monitoring System (IMS) build-up, , as described in an earlier article by the former IMS Director, Gerardo Suárez, was characterized in its early days as a 'build-as-you-design' phase. Today, nine years after setting up the initial plan, challenges remain. The most demanding being the completion of 90% of the network by the mid-2008.

With more than half of the IMS stations already certified and approximately 85% of them either under construction, testing or in the process of certification, the remaining part of the network not only contains challenging technical difficulties but a number of political factors as well.

The current restructuring of the IMS and International Data Centre (IDC) Divisions and the 2007 turnover of more than 30% of professional staff members of the Provisional Technical Secretariat (PTS) as a result of the implementation of the personnel rotation policy creates a combination of factors that will definitely have an impact on achieving the 90% milestone.

With the ever growing number of installed stations and the current rate of certifications, it seems reasonable that the IMS must increasingly concentrate on the maintenance of already installed stations while, at the same time, it continues to finish the build-up of the network. Facing this double challenge, the IMS deals with maintenance, engineering, development and logistics support of the network on one hand, and on the other, brings together the technical functions that support PTS operations, computer infrastructure and global communications. The two newly created sections of the IMS, the Monitoring Facilities Support and the Networks and Systems Support, reflect the Division's adjustment to these new challenges.

The third section, Engineering, should be in place by the time of the completion of the 90% build-up phase of the IMS network, by mid-2008. The core group of staff members, which in the old IMS structure was in charge of the build-up of the individual verification technologies, works now in the Installation and Certification Group (ICG).

The future Engineering Section will be responsible for the sub-functions engineering provision and scientific and project management expertise to support an integrated technology development programme. At the same time, it will be responsible for engineering issues related to PTS software, monitoring stations and communications systems, as well as for any remaining monitoring station installations and certifications, and for major repair work of stations.

In the meantime, until the work of the ICG is completed, the IMS Division will initially conduct internal discussions in order to establish the concepts of the future Engineering Section required to support the maintenance of the IMS network. During this time and until the IMS progresses in achieving the 90% installation milestone, the ICG will slowly begin to be shaped into what will become the Engineering Section. The move towards assuming engineering functions will be achieved by rotating staff members reaching the limitation of service.

The tasks assigned to the ICG are supported by the Installation and Certification Task Force (ICTF). This task force, recently established by the CTBTO Executive Secretary and introduced at the last Working Group B meeting, has the mandate to support the ICG on a PTS-wide basis by prioritizing and facilitating actions needed in achieving the 90% installation milestone.

As the restructuring of the PTS continues to be implemented, the IMS is faced with a substantial brain drain as part of the current personnel rotation policy. At the same time, the recruitment of new staff is a time consuming process, which might have an impact on the build-up of the IMS network. In this context, it is important to optimize existing resources and minimize possible delays through careful planning.

Undoubtedly, the dedication of the IMS staff is the main asset in achieving the completion of 90% of the network by the mid-2008. This major undertaking cannot, however, be achieved by the PTS alone and requires timely and unconditional support from Member States. Support in this context is not only a matter of paying the assessed contributions, but also of the continued commitment by Member States to cooperate with the PTS in the build-up of the IMS stations as specified in the Treaty.

With the current installation and certification rate, the IMS expects to achieve the 90% installations milestone by the middle of 2008, with 290 station installations completed and 270 stations certified, representing 84% of the network. The remaining 10% of the installations and 16% of the certifications that cannot be completed by the middle of 2008 are to be treated on an individual basis as independent projects.

Despite the challenges, the 'new' IMS is looking forward with optimism to achieve the long awaited task of completing the build-up of the IMS network and share this proud moment with the States Signatories, who have technically and financially supported this ambitious verification regime. ■

Testing OSI logistics in the field

The On-Site Inspection (OSI) is 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, and equipment together with infrastructure. These elements were developed at the beginning, somewhat independently of each other, but have now matured enough to be mutually integrated to conduct Integrated Field Exercises, which are designed to build-up OSI capacity before entry into force of the Treaty.

In 2008, the CTBTO Preparatory Commission will hold its first On-Site Inspection (OSI) Integrated Field Exercise (IFE08) in Kazakhstan at the former Semipalatinsk nuclear test site.

For one month, a n inspection team of 40members from various countries and cultures is expected to conduct forensic activities in this remote field location, far from any infrastructure. Due to the large distances involved, a temporary Base of Operation consisting of tents and shelters will have to be set up nearby the inspection area. All necessary amenities, such as site transportation, accommodation, food, heating, showers, communications, recreational areas etc., will have to be organized. For that purpose, and for the conduct of inspection activities, the PTS is planning to ship 20 to 25 tons of equipment from Vienna to Kazakhstan that will be utilized in conjunction with locally procured supplies and equipment.

BASE OF OPERATION, OSI DIRECTED EXERCISE, SLUNJ, CROATIA, JULY 2006

Logistics is the key to make such a comprehensive operation successful! The PTS has already gained experience from past field exercises and has initiated the development of a limited logistical system which is based on an OSI logistical concept. ‘Logistics’, in this context, refers to a broad set of activities supporting the primary ‘forensic’ activity of an OSI. In order to allow the inspection team to be in a position to perform its verification activities in accordance with the inspection plan, and in case of inspection plan modification or an unexpected event adversely affecting it, the basic principles and considerations consist of:

- Advanced preparation and readiness, rapid initial implementation, sustainability of the support, and reactivity according to circumstances.
- Readiness for self sufficiency and for securing the essential logistical functions in an autonomous manner
- Anticipating the steps to be taken for the logistical support of an OSI at any time or any location; being permanently in a position to identify, mobilize, organize and deliver without delay the appropriate logistical support
- Updating the logistical support or taking corrective measures as necessary in order to match in a timely manner new logistical requirements or to restore any affected component.

OPERATION CENTRE, OSI DIRECTED EXERCISE, SLUNJ, CROATIA, JULY 2006

This requires establishing a logistical system based upon an appropriate Technical Secretariat infrastructure and corresponding organizational readiness, together with the development of arrangements with the States Parties, other international organizations or commercial entities. These basic principles and considerations for OSI logistics have been drawn from contributions by Member States at OSI workshops, and from the lessons learned during tabletop and field exercises conducted between 1999 and 2006.

Field exercises will be necessary for verifying the adequacy of the logistical concept and of its implementation procedures. In this regard, IFE08 will be an excellent opportunity to test some aspects, focussing in particular on field support, of the logistical concept. ■

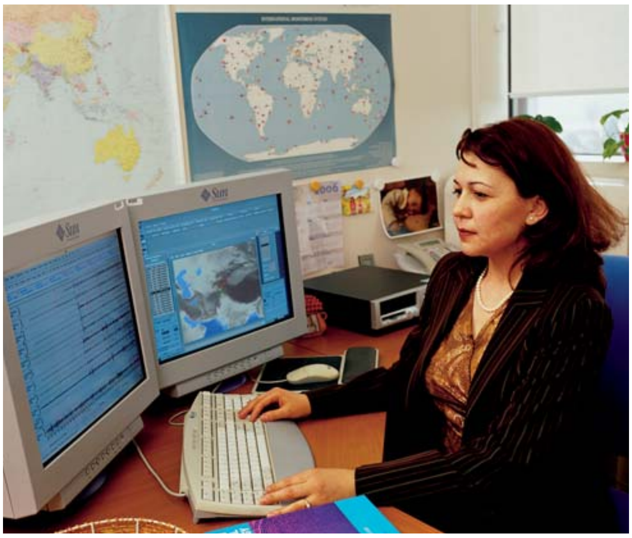
Verification highlights

IDC moves application software to 'open source'

Every day, some five gigabytes of data are sent from the International Monitoring System stations through the Global Communication Infrastructure to the International Data Centre (IDC) in Vienna, where the data are analyzed, processed, archived and forwarded to States Signatories.

To carry out its role, the IDC employs a number of fairly powerful computers and a large collection of both commercial and specialized software, specifically written for the various monitoring tasks. As in any other datacentric enterprise, the computer hardware and software elements need to be regularly replaced, to remove failed elements, to guard against obsolescence and to make use of advances in computer technology.

In 2003, during the Twenty-First Session of Working Group B, the IDC Programme Coordinator established an informal technical experts group to review various options for modernizing and replacing the current computer hardware used at the IDC. The work of the experts group was guided by two major objectives: to increase the efficiency of the available resources – getting more for less – and to decrease dependency on hardware or software from individual vendors.



ANALYST AT WORK IN THE INTERNATIONAL DATA CENTRE

One of several recommendations from the experts' group meetings was to develop a 'roadmap' containing details on 'migrating' the IDC application software to 'open source'. That is, to move the application software from the proprietary hardware/software combination currently in use and to make it work with a wider range of hardware and operating systems, favoring open systems, where possible.

Open source software is available free or at low cost, in source form. The availability of the source code means that a qualified person can read the software and understand its functions completely in order to modify it, fix bugs, and make sure there is no hidden functionality.

Following these recommendations, the IDC is migrating its software to GNU/Linux, an operating system and toolset which is completely open and freely available. The intent is to make the application software run on open systems, so as to increase the choice of operating hardware, and lower acquisition and maintenance costs, but not to make the IDC software itself open source or available to the public.

In this context, the availability of source code for IDC application software is critical for transparency, verifiability, maintainability, and potential use at National Data Centers (NDCs). That is, if Member States can review, and even run at their home base, the exact same software in use at the IDC, they can independently verify the processing results. In addition, anyone who is conversant with the code is free to suggest improvements.

Much of the software used at the IDC stems from the early 1990s. Since then, entire technologies, programming languages and styles have appeared and disappeared again, sometimes leaving a mark on IDC applications. In some cases, the original software is not available in source form and therefore cannot be recompiled (translated to machine language) for any new host computer. When the current hardware goes out of manufacture, the software will cease to function. In this case, the IDC must replace the module with an equivalent or better module.

Once such dependencies on a particular set of hardware and operating software have been reduced or eliminated, the IDC has more freedom to choose equipment from the market which best fits the purpose. The software is also, as a consequence, more likely to be portable to other, yet unknown, computer systems.

During the migration work so far, gains have been observed in efficiency, and some subsystems have been simplified. It is, however, of paramount importance that the processing results do not lose accuracy or precision when ported to a new system. Therefore, testing and comparison of results play a very important role in this porting effort. The processing results of the new software are carefully compared with those of the old system and any differences are carefully analyzed.

The IDC-specific application software consists of hundreds of separate programmes with close to two million lines of source code. In the first year of the five-year migration roadmap, the automatic waveform processing software has been converted to run on Linux. Some auxiliary systems are also ported, e.g. the archiving- and message subsystems. Work continues apace: the next large subsystem to be migrated will be the interactive processing software for the waveform analysts. By 2010, the IDC plans to have completed the migration of its application software to open source. ■

Forensic seismology and CTBT verification …

By Professor Paul G. Richards

continued from page 6

210 KT ATMOSPHERIC NUCLEAR TEST EXPLOSION 'TRUCKEE' CONDUCTED BY THE UNITED STATES ON 9 JUNE 1962 AT 15:37 GMT, 10 MILES SOUTH OF CHRISTMAS ISLAND, A NON SELF-GOVERNING TERRITORY OF AUSTRALIA.

phenomenon, and it was important to learn that their implosive nature could be reliably determined from seismic recordings.

The Kara Sea earthquake was too small to apply the Ms: mb discriminant (the surface waves were too small to measure reliably). This event showed the importance of accurate locations, and of using spectral ratios of regionally (from distances less than about 1500 km) recorded P (pressure) and S (shear)-waves to discriminate small events. This method exploits the fact that for explosions, P-waves are typically stronger than S-waves. Therefore the ratio of P to S amplitudes can be used to distinguish the type of event (see Figure 1 on cover page).

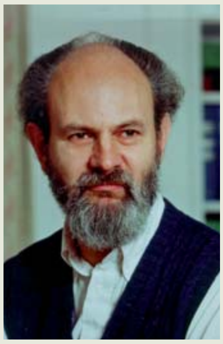
The North Korea nuclear test is of interest as an example of a nuclear explosion that was promptly detected globally, though its yield has been estimated as less than one kiloton. This event required regional seismic data in order to determine that indeed an explosion had been carried out and that the signals were not from an earthquake.

Some of these special events were associated with press releases by government agencies that, on technical issues, such as assessments of the difficulty of discrimination, and yield values, differed from work being reported by individuals in the monitoring community. At present there is no good open forum for experts in the monitoring community to have their work assessed, to see if a consensus can be developed on how to characterize a particular special event. This problem of discrepancies between government press releases and expert commentary is compounded by rules imposed by some monitoring agencies that prevent their experts from speaking to the press at times of intense public interest in a current story, such as the assessment of the North Korean test of October 2006.

But these are short-term issues, and in practice the record of analysis of special events over the last ten years is that a consensus on each of the special events has eventually emerged. In fact, the best seismological data to resolve a specific monitoring issue has sometimes come from stations that are not part of any treaty-monitoring network. The contribution from such stations is often made in the context of routine analysis already done by dedicated networks and data centres. Typically, it is found that the data from such networks, and in particular the location estimate, provide guidance on what additional stations might be contacted to provide additional data.

Though we do not yet know in detail what future procedures will be adopted in the evaluation of forensic evidence, if the CTBT were in effect and a Treaty violation were to be indicated, we already have experience derived from special events. This shows that the combined capabilities of the CTBTO monitoring networks and of numerous other stations that may also gather relevant data permit monitoring of nuclear explosions down to very low levels of yield, with very high confidence. ■

Biographical note



Prof Paul G. Richards was born in the United Kingdom and has lived in the United States since 1965, where he has taught at Columbia University since 1971. He is a seismologist, co-author of the advanced text "Quantitative Seismology" (translated into Russian, Chinese, and Japanese), and co-discoverer of the super-rotation of the earth's inner core. ■

Photo courtesy of Lamont-Doherty Earth Observatory

Potential civil and scientific applications

The importance of PTS data for tsunami warning centres

By Patricio A. Bernal, Executive Secretary of the Intergovernmental Oceanographic Commission, Assistant Director-General of UNESCO

DEVASTATION CAUSED BY 2004 TSUNAMI, MALACCA VILLAGE, SRI LANKA

The International Monitoring System uses seismic, hydroacoustic, infrasound and radionuclide technologies to monitor compliance with the Comprehensive Nuclear-Test-Ban Treaty. These technologies, together with the data and the products of the International Data Centre, have potential civil and scientific applications which may benefit States and the scientific community.

The Indian Ocean tsunami

At 0100 GMT on 26 December 2004 a 9.3 magnitude earthquake occurred on the sea floor near Aceh in northern Indonesia, generating a powerful wave resulting in the strongest tsunami the world has seen in over forty years. The wave spread in all directions. Towards the east, the tsunami surged ashore without warning just north of Phuket, Thailand, where the waves hit the beaches with a height of up to 10.5 metres and speeds of up to 8 metres a second (29 km/hr). Towards the west, it continued on, still without warning, taking close to two hours to reach Colombo, Sri Lanka, and then the east coast of India. Almost eight hours after the tsunami had hit Asia, the fishing communities of Somalia and Kenya still had no idea that the wave was coming.

The Indian Ocean tsunami is estimated to have killed over 240,000 people and severely affected more than 158 million more. Half a million people were injured, one million displaced and at least five million more needed urgent assistance. Today, millions of people in the region are still struggling to regain their livelihoods and reestablish their homes.

The need for a tsunami early warning system

There is little doubt that thousands of lives could have been saved if an alert system, similar to that operating in the Pacific since 1965, had been in place in the Indian Ocean region. The population in Banda Aceh would most likely have had to depend on its own awareness and emergency preparedness to protect itself. However, the coast of the rest of Indonesia, Thailand, Malaysia, Sri Lanka, India, the Maldives, Seychelles, Australia, Somalia, Kenya, and in fact all the rest of the Indian Ocean Basin would have been fully protected had there been a properly issued warning.

Only a small proportion of earthquakes generate destructive tsunamis. Tsunami warning depends on early detection of a tsunami perturbation in the ocean itself. Nevertheless, monitoring seismic activity is critical for tsunami warning. Within a minute or two, such monitoring would provide information on the location, depth and magnitude of an earthquake. Any strong, shallow earthquake under the seafloor would trigger the alert system. A warning centre would notify national authorities, calculate travel times of a potential tsunami wave and communicate those to all national centres which monitor real-time sea-levels and pressure sensors in the sea.

Immediately after the Indian Ocean tsunami and in an effort to transfer its experience in running the tsunami warning system in the Pacific Ocean, the Intergovernmental Oceanographic Commission (IOC) of UNESCO started to organize a tsunami warning system in the Indian Ocean (see Figure 1).

An earthquake of magnitude 9.3 will eventually be registered by all functioning seismographs on the planet, and there are hundreds of them. However, only a small fraction of them transmit seismic information in real-time. Furthermore,

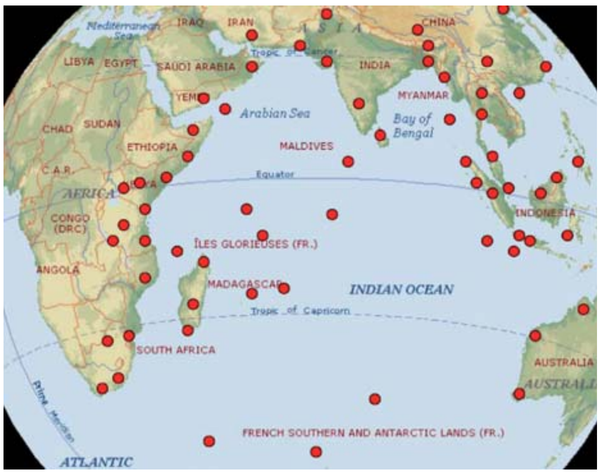


FIGURE 1. COMMITTED UPGRADES FOR SEISMOGRAPHIC NETWORK IN THE INDIAN OCEAN BY THE IOC MEMBER STATES.

DIGITALGLOBE'S QUICKBIRD NATURAL COLOR IMAGES OF BANDA ACEH COASTLINE, INDONESIA, BEFORE (LEFT) AND AFTER (RIGHT) DESTRUCTION BY THE 2004 TSUNAMI.

stations at considerable distance from an earthquake will take longer to register the relevant waves. On 26 December 2004, only five seismic stations in the neighborhood of the Indian Ocean sensed the movement in the first seconds and minutes after it occurred. None of them was very close to the epicentre. There was not a single instrument in the Indian Ocean capable of confirming the emergence of a tsunami wave.

The role of the CTBTO/PTS

It was only natural that we looked for existing networks in the region and quickly contacted the CTBTO Preparatory Commission and its Secretariat that operates a unique global monitoring network, the International Monitoring System (IMS).

From 3 to 8 of March 2005, representatives of the CTBTO Provisional Technical Secretariat participated in an intergovernmental meeting organized by the IOC in Paris, where governments agreed to start on 1 April an interim tsunami alert system. In parallel, the CTBTO Preparatory Commission decided in early March 2005 to release continuous real-time IMS data to tsunami warning centres recognized by UNESCO on a test basis. The Northwest Pacific Tsunami Information Centre in Tokyo, Japan, and the Pacific Tsunami Warning Centre in Hawaii, United States of America, which received the test data were able to confirm in 2005 that "the use of IMS data increases their ability to identify potentially tsunamigenic earthquakes and to give more rapid warnings".

In a technical experiment conducted during 2005, IMS waveform data were received with a maximum delay of 30 seconds, while those from other networks were received with an average delay of 100 to 180 seconds. In a simulation exercise for the Indian Ocean, the inclusion of data from CTBTO/IMS stations significantly reduced the horizontal error of estimated hypocentres, allowing for a clear distinction between earthquakes under the continent, where there is no risk of a tsunami being created, and earthquakes under the seafloor.

During its Twenty-Seventh Session in November 2006, the CTBTO Preparatory Commission endorsed a recommendation by its technical organ, Working Group B, to provide real-time and continuous data to relevant tsunami warning organizations. There is no question that the access to IMS data for tsunami warning systems is a major contribution by the CTBTO Member States, which may reduce the loss of lives and property due to natural disasters, a common goal of all the nations of the world. This is a common public good objective, as highlighted by the Director General of UNESCO, Mr Koichiiro Matsuura, in his statement commemorating the second anniversary of the Indian Ocean tsunami: "I am convinced that the data concerned must be considered as a Global Public Good. I therefore believe that its free and open exchange needs be upgraded to the level of a universal binding intergovernmental agreement, in order to commit nations to sustaining an integrated ocean observing system". ■

Biographical note

Dr Patricio Bernal holds a PhD in Oceanography from Scripps Institution of Oceanography, University of California San Diego. At Scripps he obtained the Carl Eckart Prize for the 'most outstanding dissertation in 1980' working on the bi-hemispheric nature of El Nino and on the long-term, large scale physical driving of pelagic ecosystems. He is author of many papers and essays in the international scientific literature. As a Professor of ecology and oceanography, he has served as Head of the Department of Oceanography in the Catholic University of Chile and Dean of the Faculty of Fisheries and Oceanography at the Universidad Austral de Chile.

Dr Patricio Bernal is Executive Secretary of the Intergovernmental Oceanographic Commission and is Assistant Director-General of UNESCO since April 1998. ■

‘Geological’ phenomenology of nuclear test explosions from an OSI perspective

By Yosef Bartov, Director of the Earth Science Research Administration, Israel

The International Monitoring System (IMS) and the International Data Centre were designed to be fully capable of monitoring compliance with the Treaty. New research and improved communication technologies continuously refine the detection capabilities of the IMS. This column introduces some of the latest developments in verification science.

The on-site inspection (OSI) within the framework of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) has been recognized as a scientific enterprise (see Figure 1) and a multidisciplinary challenge. It will have to be conducted “in the least intrusive manner possible, consistent with the efficient and timely accomplishment of the inspection mandate”. The inspection team will have to recognize the geological phenomena related to underground nuclear explosions (UNEs) and translate them into targets for geophysical techniques as certified by the CTBTO Preparatory Commission.

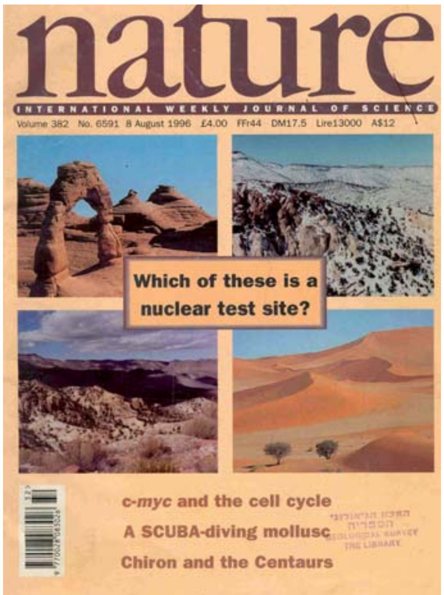


FIGURE 1 NATURE JOURNAL COVER PAGE (1996), REFERRING TO THE SCIENTIFIC ENIGMA OF OSI.

At the initial period of the inspection, geological features, to be identified by visual inspection methods, are extremely important in the decision making process of the inspection team, and in evaluating the successful conduct of the inspection. Among those features that have been recognized at UNE sites, the most important ones are: craters (throw-out), collapse sinks, other subsidence structures, pressure ridges, domes, disturbed ground fractures, cracks, faults, ground slumps, landslides, fragmented rocks and man-made artifacts.

All these elements might be detected also by initial overflight observations, so that they might serve as direct indicators for events related to the purpose of the inspection. Some other physical parameters might also be observed or even measured. However, their recognition is dependent not only on the inspectors’ experience but also on their integration into other geo-scientific findings and their overall interpretation. The following phenomena have been monitored and observed over time: plant stress, water table rise, aftershocks, cavity collapse and chimney formation.

Still other anomalies have been reported as possible indicators for a UNE, but as to the present, no agreed phenomenology has been established concerning anomalous radon, geochemistry, heat and high temperature mineralogy, including rock melt.

Since much of the UNE phenomenology has well known natural equivalents (e.g. ‘geologic’ circular elements), measures have to be taken to eliminate or minimize the on-site background noise in the natural or man-made realm.

AUTHOR (RIGHT OF HELICOPTER DOOR) AS PARTICIPANT IN INITIAL OVERFLIGHT OF FE02 EXPERIMENT, KAZAKHSTAN, 2002

Minimizing the natural background noise depends mainly on the experience of the inspection team, which includes their close observations and their ability to differentiate by secondary features (e.g. craters showing radial jointing, typical for UNEs, see Figure 2; in contrast to circular features typical for gravitational processes such as the formation of sinkholes, see Figure 3). Other interpretational methods rely on the comparison of existing data, e.g. from public domain sources or on data provided by the Inspected State Party. Except for the passive seismologic monitoring (aftershock measurements), the inspection team is only allowed to apply geophysical methods in a later phase of the inspection mandate..

Geophysical methods can be of an intrusive nature (e.g. active seismic surveys, borehole logging,) as well as of a non-destructive, non-invasive nature (e.g. natural electrical currents, observation of the natural magnetic field of the earth, gravity). With today’s instrumentation, operating costs for geophysical surveys became

quite low. However, the size and the geometry as well as the geological properties of the inspection area have to be taken into account.

During the various OSI workshops and field exercises, it was found that more research must be geared towards a well-considered methodology selection. This research may be conducted by State Signatories as well as the Provisional Technical Secretariat (PTS) and would heavily rely on the access to public domain data sources. It can be implemented and quality-checked either in former nuclear test sites or on new chemical explosions test-beds.

A number of issues in OSI earth sciences are unresolved: there is no agreement yet on geological and geophysical phenomenology; there is no-existing standard methodology for geological mapping or for sampling; and there is no procedure for using background data bases (e.g. authentication and storage). In order to improve visual inspection and geophysical surveys, the professional staff of the inspection team, which must include well-trained geologists and geophysicists with access to UNE phenomenology from test areas, should go through repeated training sessions.

State parties should be encouraged to establish relevant voluntary databases, aimed to supply needed information to OSI staff. The database should be prepared in accordance with up-to-date UNE knowledge concerning phenomenology. These data-bases will enable the inclusion of a consultation phase within the initial stages of an OSI, in which local experts could help the inspection team to eliminate natural geological anomalies from the investigation. The same procedures proposed for the visual inspection are suggested for the application of the geophysical methods during the final phase of the inspection mandate. ■

Biographical note

Dr Yosef Bartov is Director of the Earth Science Research Administration and Chief Scientist at the Ministry of the National Infrastructure, Israel. He has a PhD in Geology from Hebrew University in Jerusalem. Between 1984 and 1987, he served as Director of the Geological Survey of Israel.

He participated in all OSI workshops, in two of the field experiments in Kazakhstan (1999 and 2002), and as a lecturer in three of the Experimental Advanced Courses organized by the Provisional Technical Secretariat. ■

FIGURE 2: AREAL PHOTO FROM NEVADA TEST SITE, UNITED STATES (COURTESY DEPARTMENT OF ENERGY). CIRCULAR STRUCTURES RELATE TO UNES CONDUCTED SINCE 1963.

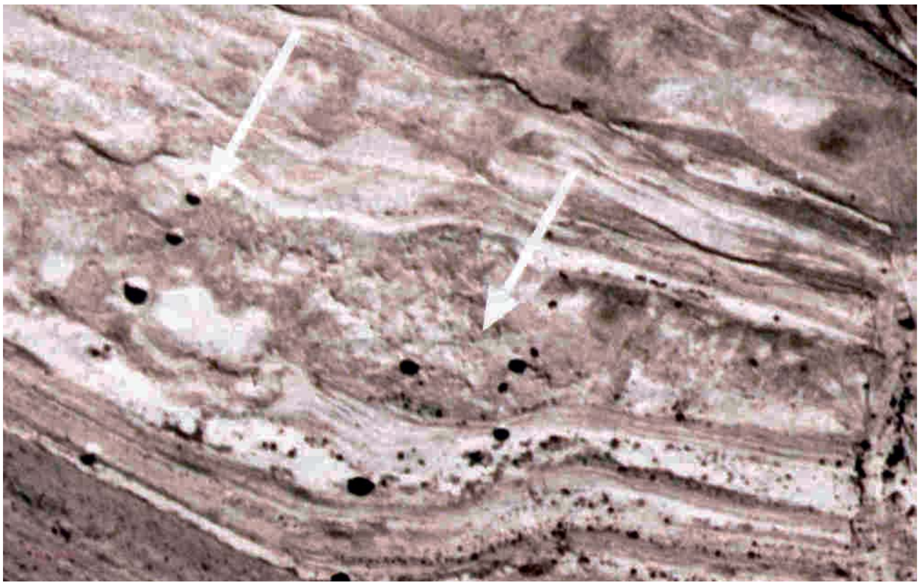


FIGURE 3: AREAL PHOTOGRAPH FROM DEAD SEA VALLEY, ISRAEL. CIRCULAR FEATURES ARE SINKHOLES FORMED DUE TO RECENT DEAD SEA LEVEL DROP. NOTICE RESEMBLANCE WITH CIRCULAR FEATURES IN FIG.2 (COURTESY GEOLOGICAL SURVEY, ISRAEL)

Verification science

North Korea: a real test for the CTBT verification system?

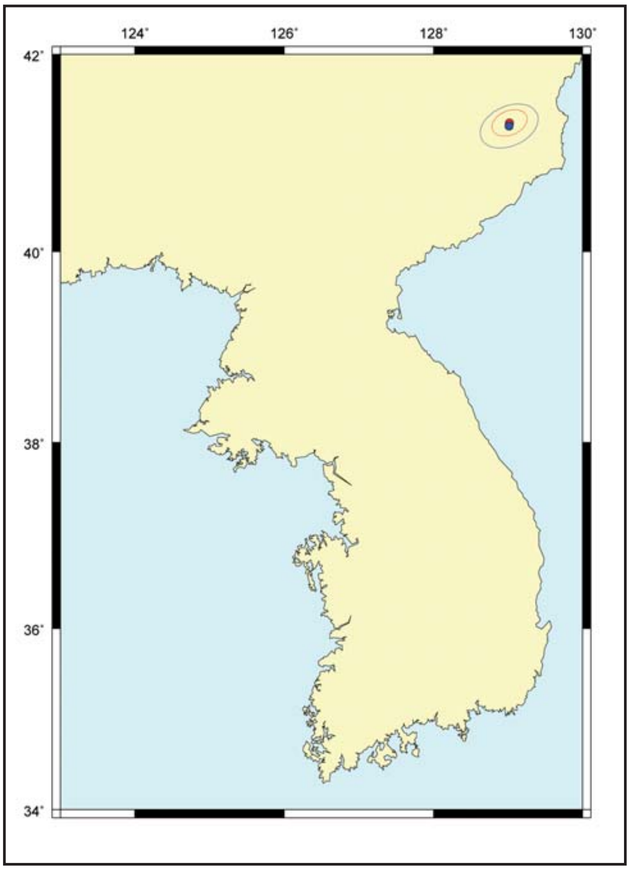
The International Data Centre (IDC) receives daily several gigabytes of data from the International Monitoring System (IMS) network. The IDC processes and analyses these data, and makes available to authorized users from States Signatories the results, which are referred to as 'IDC Standard Products'.

One of the IDC standard products is Standard Event List 1 (SEL1). It includes the preliminary locations of mostly underground events from which signals have been detected by at least two primary seismic stations of the IMS. Most of these events are earthquakes or perhaps chemical explosions carried out during mining activity. SEL1 is prepared entirely automatically 24 hours a day and is issued for every 20-minute interval of time. Typically, SEL1 includes well over 100 events each day. Some of these events are not real or are poorly located, but SEL1 is the most rapid event list issued by the IDC; it is issued within two hours.

On 9 October 2006, SEL1 included an event located in the Democratic People's Republic of Korea (DPRK) using signals detected at more than ten IMS primary seismic stations throughout the world. The uncertainty estimate for the location (referred to by seismologists as the 'confidence ellipse') covered an area close to 2,500 square kilometres.

This event generated considerable interest among States Signatories. In view of this, the Provisional Technical Secretariat (PTS) decided to expedite the issue of its primary waveform product, the Reviewed Event Bulletin (REB) for 9 October. The REB for a given day contains all those events which have been detected at IMS seismic, hydroacoustic and infrasound stations and which meet specific quality criteria (referred to as the 'event definition criteria'). All the data and parameters for every event in the REB have been reviewed by waveform analysts in the IDC, and seismic events may include data from IMS auxiliary seismic as well as primary seismic stations. For the IDC waveform analysts the DPRK event was just one event of over 100 in the REB for 9 October; each event presents its own set of issues for analysts. The REB for 9 October was issued late on 11th.

The REB confirmed the validity of the event issued in SEL1, and its location and time. Moreover, the inclusion of signal detections at one additional primary and a range of well-distributed auxiliary seismic stations, together with the improvements associated with analyst review, resulted in a reduced uncertainty in the location, the confidence ellipse covering less than 1,000 square kilometres. Figure 1 shows both the SEL1 and REB locations together with their confidence ellipses. The depth of the event was fixed to the earth's surface. This happens for many events and signifies that the uncertainty in the depth determination allows the event to be close to the surface.



THE LOCATIONS AND CONFIDENCE ELLIPSES OF THE 9 OCTOBER 2006 DPRK EVENT AS GIVEN IN THE IDC SEL1 (BLUE) AND REB (RED).

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) provides that the IDC applies approved 'screening criteria' to REB events in order to exclude events compatible with natural phenomena or non-nuclear man-made phenomena when the Standard Screened Event Bulletin (SSEB) is issued. This is an automatic bulletin of events which is issued shortly after the REB. The IDC currently applies approved experimental event screening criteria. The DPRK event was one of ten REB events on 9 October that were 'not screened out' after application of these screening criteria. This information was included in the SSEB that was issued automatically two hours after the REB.

Under the terms of the Treaty, it will not be for the CTBTO to pass final judgement on the origin of any particular event after entry into force. Rather, it will make available to States Parties all the IMS data and IDC products in a timely way, and provide upon request technical assistance to help States Parties to make their own judgements.

So what prognosis does this event provide for the CTBTO's future capability to meet these responsibilities? This event

continued on page 28

Secretariat snapshots

Exploring new synergies between the scientific and the CTBT community

The scientific symposium "CTBT: Synergies with Science, 1996-2006 and Beyond", held 31 August - 1 September 2006 in Vienna, attracted nearly 400 participants, among them internationally renowned scientists, key personalities acknowledged for their efforts toward nuclear non-proliferation and disarmament, and representatives from Member States and the press.

"To cooperate with science is not a luxury that we can have or not, but a necessity for the long-term sustainability of this organization." These words by Ola Dahlman, former Working Group B Chairman and moderator of the symposium, summarize best the two-day long exchange of ideas aimed at strengthening the interaction between the global scientific community and the CTBTO Preparatory Commission.

The close cooperation between the CTBTO and the scientific community dates back to the pre-negotiations of the CTBT at the Conference on Disarmament some 20 years ago when scientists helped to design the most comprehensive verification system ever built in order to verify compliance with the Treaty. Since then, many significant scientific developments have taken place that are of relevance to the CTBT verification system. Some of them were discussed at the symposium:

- 'Precision seismology' to improve the accuracy of event location;
- Improved understanding of earthquake sources;
- New computational tools to understand wave propagation;
- New and improved methods and procedures for the analysis of large data volumes;
- Developing new analysis methods and procedures to increase the understanding of infrasound observations.

> "Without CTBT in force, we risk that new countries might be tempted to test nuclear weapons without violating any legal norm."
>
> Mr Mohamed ElBaradei, Director General of the IAEA

> "We cannot talk about nuclear disarmament without a sincere reflection of possible human tragedy that nuclear arsenals could bring upon people."
>
> Mr Nobuaki Tanaka, United Nations Under-Secretary-General for Disarmament Affairs

Today, with nearly three quarters of the International Monitoring System (IMS) completed, there is a great scientific interest in the data from the global IMS network. During the symposium and in the discussions afterwards, several scientists highlighted the great treasure of CTBTO data and their multiple long-term uses in scientific research which can lead to improved methods of data acquisition and analysis. Other scientists emphasized that cooperation should not be a one-way street: international scientific cooperation has helped to provide state of the art models for the interpretation of CTBTO monitoring results; now Governments need to make verification data available for scientific purposes.

It became clear from the discussions that the scientific community and the CTBTO/PTS both could benefit from common research projects and data sharing. CTBTO data could be used in studies of the earth's structure as well as in research on earthquakes, underwater explosion location and climate change monitoring. It could also help to improve early warning systems for tsunamis, volcanic and disastrous chemical explosions, and tropical cyclones.

Hopes were expressed that the important synergies that already existed between the CTBTO capabilities and the scientific community would be further developed. It is now up to the policy-making organs of the Preparatory Commission to digest the many ideas generated at the symposium and to take a fresh look at the many potential additional synergies. ■

Secretariat snapshots

Managing the diverse administrative functions of the PTS

For the past five years, Mr Pierce Corden has served as the Director of Adminstration, managing human resources, general services, financial services, procurement, preparation of the programme and budget, the Medium Term Plan, and administrative information technology support.
These diverse areas required him to be continuously in a multi-tasking mode.

In 2001, the Provisional Technical Secretariat (PTS) was subject to an external evaluation of human resources. The resulting report contained seventy-eight recommendations for improvements, ranging from recruitment to staff appraisal. In response, the then-Executive Secretary, Mr. Wolfgang Hoffmann, appointed a Steering Committee under the chairmanship of the Director of Administration and with participation from all PTS Divisions. The Committee in most cases proposed steps which led to changes in practices within the PTS. Examples included establishing summer working hours, providing language training subsidy, regularizing the recruitment process and strengthening the performance appraisal process. The Committee concluded its work in 2005.

Human resources is in some ways the most vital part of the Preparatory Commission, as the success in achieving the organizations' objectives to a large extent depends on the quality and commitment of its roughly 286 staff, drawn from some 60 Member States. The professional staff typically serves up to seven years in the Commission, which has a service limitation policy for such staff, designed to bring in fresh views and broaden participation in the work. However, the policy also makes a provision for extending a staff member's contract on an exceptional basis if he or she possesses essential memory or expertise, so that over time the institutional framework and capabilities of the Secretariat are optimized.

Because many professionals were hired at about the same time, presently Personnel is implementing recruitment procedures in a large number of cases in order to determine whether to bring on board new staff members or extend exceptionally staff members who are approaching the end of their contracts. This demanding task is carried out in addition to the normal recruitment and administration of services to staff members. The Personnel Section also implements personnel actions required as a result of the major restructuring of the International Data Centre (IDC) and International Monitoring System (IMS) Divisions. In this context, some 23 persons 'switched' Divisions and an additional 123 were affected by changes in job descriptions and organizational structure, necessitating numerous changes in the Personnel database. In addition, Personnel provides key support to the Joint Consultative Panel, the chief mechanism for staff relations, for which the Director of Administration has typically been the Chairman.

General Services has the responsibility for ensuring that all staff members work in a comfortable environment with appropriate resources. It maintains the inventory of furnishings and equipment and ensures that the physical infrastructure of the Secretariat is in good shape. General Services is also the principal interface with other organizations in the Vienna International Centre (VIC) and participates in the Security and Building Management Advisory Groups, and the Garage, Kindergarten and Commissary Committees. The Chief of General Services advises the Director of Administration at the meetings of the Committee on Common Services, composed of the administration directors of the four organizations working in the VIC. The Chief also serves as a member of the Committee on Contracts, which reviews major procurements to ensure their effectiveness and consistency with the Commission's regulations and rules.

The Financial Services Chief serves as the Chair of the Committee on Contracts. More generally, Financial Services ensures that the payroll is met, implements the annual budget, prepares the annual programme and budget performance report, interacts with the external auditor and provides support to the Advisory Group on financial matters. It is to the credit of the Section that the external auditor has always provided an unqualified opinion on the accounts of the Commission.

Procurement is another key function. Without the work of this Section, the build-up and maintenance of the 337 facilities of the IMS network could not be accomplished. The Section has been especially challenged during the past year by the major contracting effort associated with the expiration of the existing contract for the Global Communications Infrastructure. Another major part of procurement is devoted to contracting for both hardware and software for the IDC.

Within the Office of the Director, the Senior Budget and Planning Officer has the responsibility to prepare the annual programme and budget. The Secretariat has benefited from substantial support from Member States in maintaining the funding necessary to implement its ambitious program of IMS facility installation, operation and maintenance, upgrade information technology in the IDC, and carry out exercises and equipment acquisition in the On-Site Inspection Division. Other cross-sectional and cross-divisional tasks, such as the preparation of the Secretariat-wide Mid-Term Plan are also managed in this Office. Finally, it provides the 'back-office' IT support needs for the Secretariat.

This summary is succinct. On any given day, there may be multiple additional demands placed on the relatively modest Administration staff of some 50 persons. ■

Fourth experts' meeting on civil and scientific applications in Hungary

From 2 to 3 September 2006, 44 experts from 28 countries met in Budapest, Hungary, to review and discuss new potential benefits deriving from the application of CTBT verification technologies for civil and scientific purposes. The event, which was organized by the Provisional Technical Secretariat (PTS) of the CTBTO Preparatory Commission and funded by a voluntary contribution of the Government of Hungary, built on expertise exchanged in previous such meetings held in London, United Kingdom, in 2002, Sopron, Hungary, in 2003, and Berlin, Germany, in 2004.

The meeting was divided in two substantive sessions, one focused on civil and scientific applications of CTBT verification technologies and the other one on the PTS e-learning project as a contribution to national capacity building.

As a result of the first session, it was stressed that there was an urgent need to provide verification data in real time and on a continuous basis to tsunami warning organizations recognized by UNESCO. With regard to volcano monitoring, the participating experts saw a clear need for scientific work on how verification data and products could be used to contribute to the provision of rapid alerts for the aviation industry.

It was further suggested that the scientific interface between the PTS, National Data Centres (NDCs) and the scientific community should be improved, and scientific results should be published, for example through links in the CTBTO public web site. In the context of radionuclide and noble gas detection technologies, it was felt that the publication of PTS in-house developments in scientific journals could raise the profile of the PTS and enhance awareness of the Preparatory Commission and its work.

In the second session, e-learning was recognized as a powerful training tool that can reach many more individuals than a traditional classroom environment. However, participants also cautioned that it should not become too complex to use and the material made available for e-learning should be carefully chosen. NDCs can support the PTS in this context by testing and evaluating the prototype, and, where applicable, they can also make material available for e-learning.

A booklet of the experts' meeting was issued at the beginning of January, together with a CD-ROM containing the summary, statements and presentations made at the event as well as summaries of the London, Sopron and Berlin meetings. ■

New PTS Operations Centre completed

The newly built PTS Operations Centre (OC) will be fully operational in February 2007. It is responsible for monitoring PTS operations and system-wide incident management. This includes identification of operational incidents, logging and re-assigning, as well as timely reporting and classification of every incident. The OC is also a focal point for station operators and National Data Centres for IMS station operations. It ensures that IMS raw data reach the IDC, data and data products get distributed in a timely fashion, and that necessary corrective actions are taken to maintain quality and timely data availability. ■

Treaty Status

Signatures	177
Ratifications	138
Annex 2 Ratifications	34

AS OF 31 JANUARY 2007

North Korea: a real test for the CTBT…

continued from page 24

was well-recorded world-wide. The PTS made available a good location in SEL1 within two hours. It issued the REB for 9 October within the timescale planned for after entry into force, and the REB location corroborated the location issued in SEL1. Moreover, the REB reduced the location uncertainty to less than the 1,000 square kilometres, the maximum allowed for an on-site inspection to be initiated under the Treaty. Thus the PTS was able to provide States Signatories with valuable information that would assist them to make their judgements – the system worked as intended. This was achieved with less than 60% of IMS stations contributing to provisional operations, at a time when IDC's data processing systems and formal procedures are still incomplete or under development, and when the organization is in a test and provisional operation mode only. This bodes very well for the future verifiability of the CTBT.

Also included in the IMS network are radionuclide particulate stations and radionuclide noble gas stations, although the latter are currently operating only on an experimental basis. Radionuclide monitoring results relevant to this DPRK event will be described in the next edition of *CTBTO Spectrum*. ■

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Calendar of Meetings 2007

Preparatory Commission:

28th Session	19 – 22 June 2007
29th Session	12 – 15 November 2007

Working Group A:

31st Session	4 – 6 June 2007
32nd Session	8 – 10 October 2007

Working Group B:

28th Session	5 – 17 February 2007
29th Session I	21 May – 1 June 2007
29th Session II	20 August – 7 Sept. 2007

Advisory Group:

28th Session I	23 – 27 April 2007
28th Session II	14 – 18 May 2007
29th Session	10 – 14 September 2007

Joint Session for WGA and WGB:
Monday, 12 February 2007
Monday, 21 May 2007
Monday, 3 September 2007

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