

# CTBTO Spectrum

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## Who we are

The Comprehensive Nuclear-Test-Ban Treaty bans all nuclear weapon test explosions. The Treaty is a cornerstone of the international nuclear non-proliferation regime. It opened for signature in New York on 24 September 1996, and today has achieved strong worldwide support.

The CTBTO Preparatory Commission is an international organization consisting of a plenary body composed of all States Signatories and the Provisional Technical Secretariat. It carries out the necessary preparations for the effective implementation of the Treaty, and prepares for the first session of the Conference of the States Parties to the Treaty after its entry into force.

## Inside this issue

*Using seismic data in air crash investigations*  
 by Dr David McCormack .....1

EDITORIAL .....2

NOTES & QUOTES .....3

COMMISSION UPDATE .....4

STATUS OF SIGNATURE AND RATIFICATION ....5

SECRETARIAT SNAPSHOTS .....6

OUTREACH ACTIVITIES .....7

IN THE SPOTLIGHT:

*Tom Grönberg, Ambassador of Finland* ....8

PERSPECTIVES:

*The Twin Pillars of the CTBT*  
 by Jayantha Dhanapala, former United Nations Under-Secretary-General .....10

VERIFICATION HIGHLIGHTS .....12

VERIFICATION SCIENCE .....14

POTENTIAL CIVIL AND SCIENTIFIC APPLICATIONS .....15

PTS PUBLICATIONS .....16

CALENDAR OF MEETINGS .....16

## Using seismic data in air crash investigations

by Dr David McCormack

When an aircraft crashes, not many people think of turning to seismology. However, seismic data can sometimes play a key part in determining the nature of a crash. Analysis of seismographs can quickly produce a crash location, information that may be vital to directing search efforts in remote, wooded or snow-covered areas. In addition, more detailed study of the seismic signals recorded from an impact can give insight into whether an aircraft was intact when hitting the ground and an estimate of the speed at which the plane struck the surface. The strength of seismic signals from an impact depends on the energy contained in the falling object. This in turn is a function of the mass and velocity at the time of impact such that the heavier the object, or the faster it is travelling, the larger the resulting seismic signal. Adding up these factors can give clues about whether the craft exploded in air, rapidly descended intact to the surface, or was attempting to make a crash landing. Such information is particularly important where more traditional crash information from the so-called 'black boxes' is absent.

Perhaps the most widely known example in recent years of seismic waves generated by aircraft impact was from the Lockerbie crash in 1988. Following a mid-air explosion, a Pan Am Boeing 747 crashed on the small town of Lockerbie, located close to the International Monitoring System (IMS) seismic station at Eskdalemuir, Scotland. The impact was clearly recorded as a local event by the seismographs of the array (Figure 1). Comparison of the seismic signals with radar recordings of the descent of the wreckage permitted identification of distinct impacts from various major pieces of the wreckage, leading to a better understanding of the relationship between size and speed of impactors and the amplitude of the seismic signals recorded.

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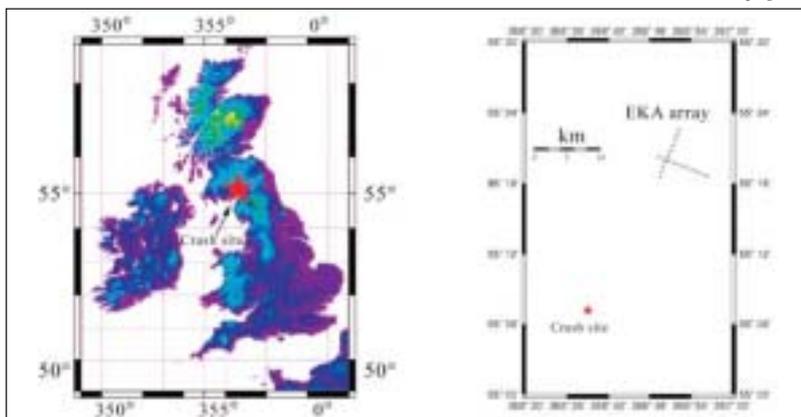


FIGURE 1. THE LOCATION OF THE LOCKERBIE CRASH, USING THE SEISMIC SIGNALS RECORDED BY A SEISMOMETER AT THE NEARBY ESKDALEMUIR IMS STATION (EKA ARRAY)

## Editorial



*When the Comprehensive Nuclear-Test-Ban Treaty (CTBT) opened for signature in 1996, the international community took a significant step forward in making our world safer and more secure. The international focus on peace and security is just as strong today.*

*Although the Treaty is not yet in force, it plays an important role in global stability, as it has become a vital component in the nuclear non-proliferation regime and a substantial impediment to the qualitative development of new types of nuclear weapons. For the international community, it is of primary importance that the CTBT not only enters into force, but that it is as universal a Treaty as possible. With over 85% of the nations of the world having signed the Treaty, and more than 50% having ratified it, the goal of universality comes nearer every day.*

*This year Member States will meet to discuss ways and means to accelerate entry into force. This important Conference is convened under Article XIV of the Treaty, and in previous years it has resulted in a substantial increase in signatures and ratifications in the months immediately prior to the Conference.*

*This issue of CTBTO Spectrum looks at the 'mechanisms' of Conferences on Facilitating the Entry into Force of the CTBT, focusing in particular on the upcoming Conference, which will take place in Vienna from 3 to 5 September this year. An interview with Ambassador Tom Grönberg, who is chairing the preparatory process of the 2003 Conference, and a special feature article by the former United Nations Under-Secretary General Jayantha Dhanapala, concentrate on this theme. This issue also provides an overview of the Commission's work over the past six months, including an update on the latest session of the Preparatory Commission. In addition, the cover story by David McCormack, a Canadian seismologist, gives an example of the potential benefits of civil and scientific applications of the CTBT verification technologies.*

*I hope that readers will find this issue a useful source of information on the activities of the Commission.*

Wolfgang Hoffmann  
Executive Secretary  
Preparatory Commission for the Comprehensive  
Nuclear-Test-Ban Treaty Organization

## The legal basis of the Article XIV Conference

The legal basis of the Conference on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) is laid out in Article XIV of the Treaty. Article XIV, paragraph 1, provides that the Treaty must be ratified by 44 named nuclear-capable States before it can enter into force.

Recognizing that it might not be easy to meet this strict requirement, the negotiators of the CTBT conceived of a mechanism to promote early entry into force. If the Treaty had not entered into force three years after the date of its opening for signature, a conference of States which have ratified the Treaty could be convened to examine the extent to which the requirement for entry into force has been met, and "what measures consistent with international law may be undertaken to accelerate the ratification process in order to facilitate the early entry into force of this Treaty" (Article XIV, paragraph 2). The first such conference took place in Vienna from 6 to 8 October 1999.

Article XIV, paragraph 3, states that unless otherwise decided by the conference or other such conferences, further conferences should be held at subsequent anniversaries of the Treaty's opening for signature until the CTBT enters into force. A second Conference on Facilitating the Entry into Force of the CTBT was held in New York from 11 to 13 November 2001 and the third will be held in Vienna from 3 to 5 September this year.

Article XIV also provides that the conferences are convened by the United Nations Secretary-General in his capacity as Depositary of the Treaty, at the request of a majority of ratifying States. All States Signatories must be invited to attend and decisions of the conferences must be taken by consensus. ■

# Notes & quotes

## 2003 NPT Preparatory Committee

States Parties to the Nuclear Non-Proliferation Treaty (NPT) held their Second Preparatory Committee (PrepCom) meeting for the 2005 Review Conference in Geneva, from 28 April to 9 May 2003, under the chairmanship of Ambassador Laszló Mólnár of Hungary.

The meeting took place at a time when issues of non-proliferation and disarmament were attracting increased global attention. It addressed, *inter alia*, issues of non-compliance, nuclear disarmament, non-strategic nuclear weapons, security assurances, safeguard agreements and the peaceful uses of nuclear technology, both in a general debate and in specific cluster debates.

The significant link between the Comprehensive Nuclear-Test-Ban Treaty (CTBT) and the NPT as expressed by the NPT Review Conferences (1980, 1995) and the Thirteen Steps to nuclear disarmament agreed upon by the NPT Review Conference in 2000, was also underlined in Ambassador Mólnár's Factual Summary of the 2003 PrepCom.



PALAIS DES NATIONS, UNITED NATIONS OFFICE AT GENEVA, THE VENUE OF THE 2003 NPT PREPCOM MEETING

Courtesy of United Nations Office of Geneva

Ambassador Mólnár, who had consulted with key delegations before issuing the Factual Summary, expressed strong support for the CTBT and underscored the importance of early entry into force of the CTBT in paragraph 14:

“States which had not ratified the Treaty, especially those remaining 13 States whose ratification was necessary ... for its entry-into-force, were urged to do so without delay. Strong hope was

expressed that more countries will sign and ratify the Treaty between now and the 2003 Conference on Facilitating the Entry into Force to be held on 3-5 September in Vienna. States parties reaffirmed the importance of maintaining a moratorium on nuclear-weapon-test explosions or any other nuclear explosions and noted the progress made by the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization in establishing the international monitoring system.” ■



“We believe that the recent international debate in the United Nations Security Council, including statements by its Permanent Members, on weapons of mass destruction, including nuclear weapons, underlined international concern about the legitimacy, possession and possible use of such weapons. These statements should provide further impetus to international effort to de-legitimise all nuclear weapons and to hasten international efforts towards nuclear disarmament. These statements moreover underline our basic belief that the only real guarantee against the use of any weapons of mass destruction anywhere, including nuclear weapons, is their complete elimination and the assurance that they will never be used or produced again.”

*Hon. Marian Hobbs, Minister of Disarmament of New Zealand. Statement on behalf of the New Agenda Coalition at the NPT Preparatory Committee meeting, 28 April 2003*

# Commission update

## Report on the June 2003 session

The Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) held its Twentieth Session from 24 to 25 June 2003 in Vienna under the chairmanship of Ambassador Javier Paulinich of Peru. Seventy-one Member States attended the session.

### The report of the Executive Secretary

Mr. Wolfgang Hoffmann, Executive Secretary of the CTBTO Preparatory Commission, reported in detail on the progress achieved in the implementation of all Major Programmes of the Preparatory Commission. He informed Member States that 55 out of the 337 International Monitoring System facilities have now been certified as fully meeting the stringent technical requirements of the system. The Executive Secretary pointed out that the Organization is operating under severe financial constraints. A budget release of only 50 % on most projects had to be introduced earlier this year due to currency fluctuations and the uncertainty as to whether all Member States would pay their 2003 contributions. As of 24 June 2003, the collection rate of assessed contributions for 2003 stood at 76,89% and the budget implementation rate at 47,5%.

The Executive Secretary informed the Commission that the implementation of the seven year service limit will be applied from March 1997 and that he will exercise his prerogative to make exceptions to the seven year limit in order to retain essential expertise in the Provisional Technical Secretariat (PTS).

### The plenary debate

The plenary debate focused on several issues, including the importance of promoting signature and ratification, the significance of a balanced approach in dealing with all elements of the verification regime, and the severe financial constraints the PTS is facing. Member States welcomed the signing of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) by Gambia and the ratifications by Albania, Cote d'Ivoire, Kuwait, Mauritania and Oman since the last session of the Commission. The Member States encouraged the PTS to continue its outreach activities and to carry on holding training courses, seminars and workshops.

States Signatories expressed their views on the initial draft 2004 Programme and Budget proposals. On the one hand, concerns were expressed that the budget was no longer programme driven. On the other hand, Member States reiterated their position that "the PTS should do its utmost to keep the draft 2004 Budget at the level of the 2003 Budget". Several delegations supported the PTS draft budget proposal as a good basis for further discussions.

### Conclusions

Support was expressed for the convening of the 2003 Conference on Facilitating the Entry into Force of the CTBT in Vienna and for the continuing build-up of the global verification system. Ambassador Thomas Stelzer of Austria was elected as the next chairperson of the Commission for the second half of 2003. ■

## Chairperson of the Preparatory Commission

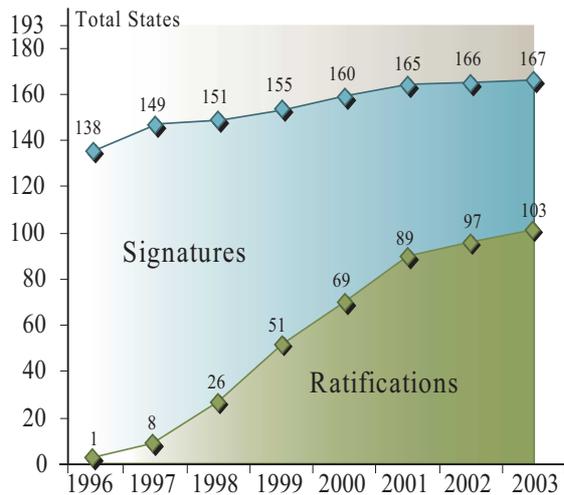
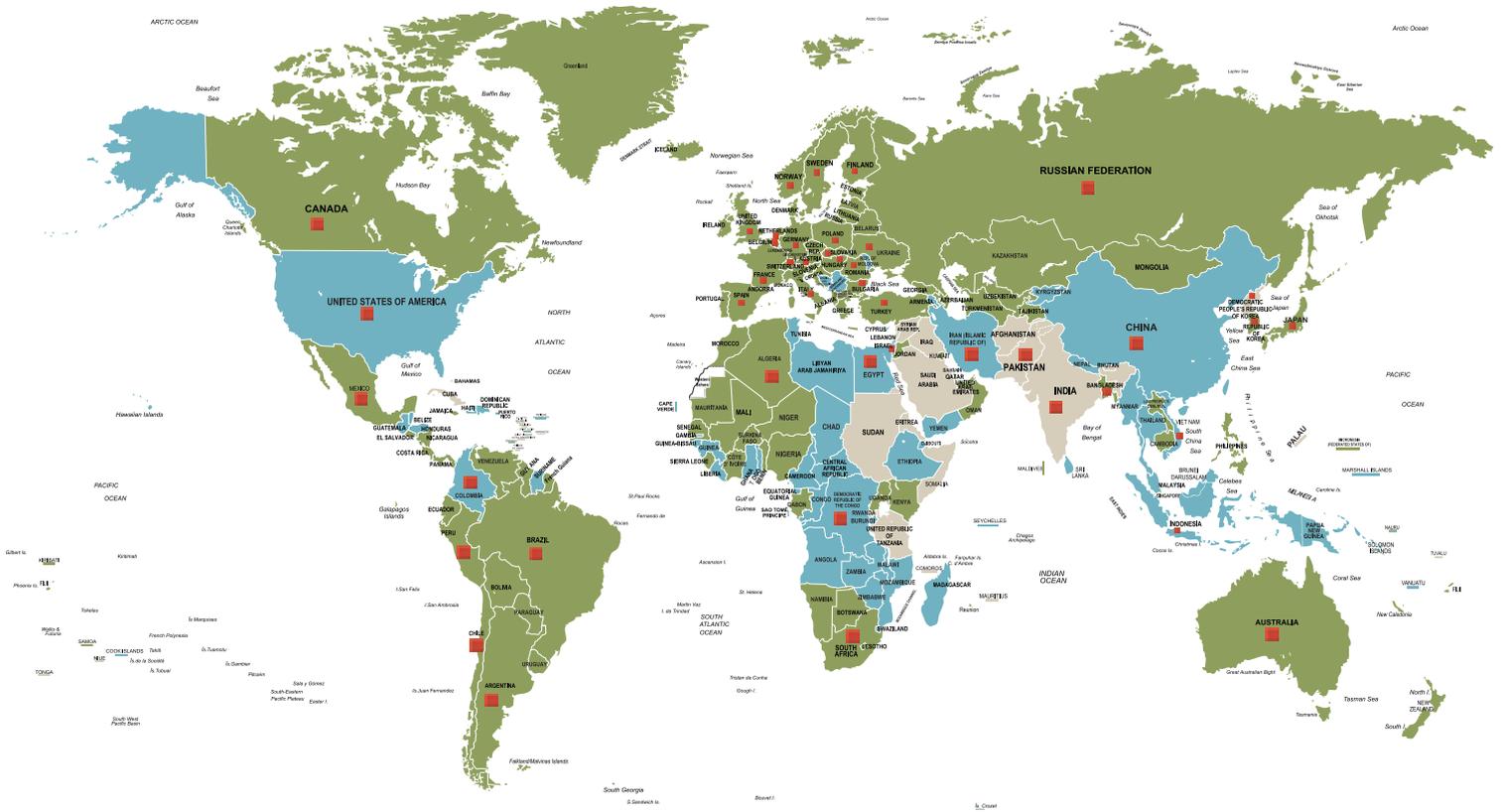


Ambassador Javier Paulinich, Permanent Representative of Peru to the CTBTO Preparatory Commission since 2000, has served as chairman of the Commission for the first half of 2003. He was elected by the Commission during its Nineteenth Session in November 2002.

Ambassador Paulinich studied in Peru at, *inter alia*, the Universidad Nacional de San Augustin in Arequipa and the Universidad Nacional Mayor de San Marcos. He holds qualifications in Social Science, International Relations and Sociology.

Ambassador Paulinich joined the diplomatic service in 1976, and served in the United Kingdom, Iceland and Yugoslavia. He held several high-ranking positions in the Foreign Service, including Permanent Representative to the United Nations in New York and Alternate Permanent Representative to the international organizations and the World Trade Organization in Geneva. He also served as Director for Asia and Oceania of the General Directorate for European, African, Asian and Oceanic Matters for the Peruvian Ministry of Foreign Affairs. ■

# Treaty signatures and ratifications



On 30 April 2003, the total number of ratifications of the Comprehensive Nuclear-Test-Ban Treaty rose to 100, when Mauritania deposited its instrument of ratification with the United Nations Secretary-General in New York. This figure marks a significant milestone on the road to Treaty universality.

STATUS AS OF 11 JULY 2003

TOTAL STATES 193

SIGNATORY STATES

RATIFYING STATES

NON-SIGNATORY STATES

44 STATES LISTED IN ANNEX 2 TO THE TREATY

167  
41

103  
32

26  
3

# Secretariat snapshots

## Electronic information security management

The Provisional Technical Secretariat (PTS) safeguards the integrity and availability of the information from stations in the International Monitoring System that it gathers, processes and disseminates, and protects this information against unauthorized disclosure. One of the Secretariat's tasks is to establish and maintain an adequate level of electronic information security within its organizational, administrative and technical infrastructures.

An information security baseline has been established and an assessment

was carried out of the current level of security within the PTS and the Global Communications Infrastructure (GCI). Assessment activities included security scans of the PTS networks and the GCI in order to identify and test vulnerabilities within the networks and the information system connected to these networks.

Based on the assessment, the PTS has identified various improvement projects such as the development of electronic information security policies, the strengthening of the data authentication

measures of the International Data Centre, and the establishment of a higher protection level for PTS networks, servers and applications.

The Secretariat is connected to its Member States and other partner organizations, and has opened up many of its software applications to them. As a consequence, the level of information security of the PTS partly depends on the level of information security of its partners. To support them in their security efforts, the PTS offers security scan services and advice to its partners. ■

## Gender distribution of Provisional Technical Secretariat staff

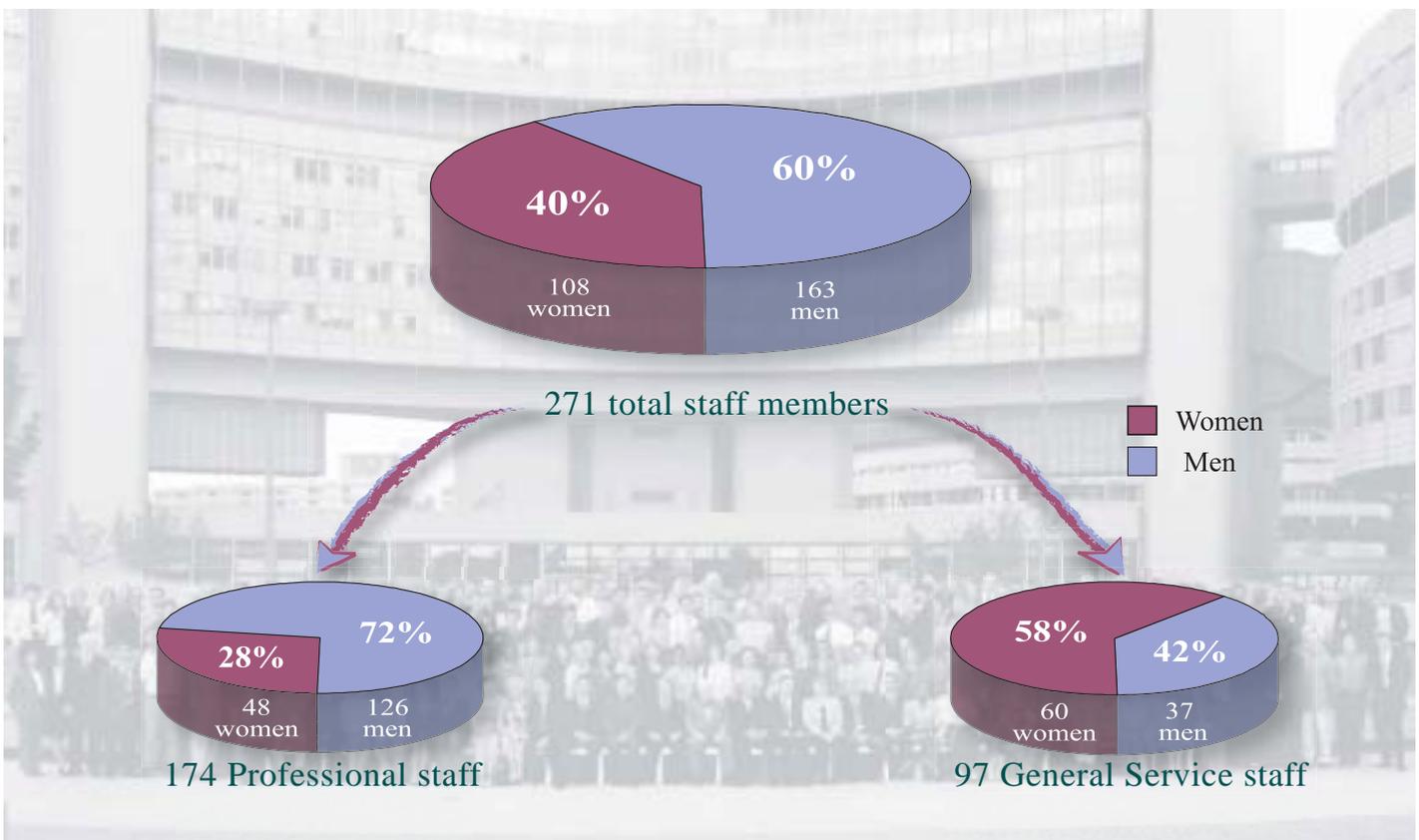


FIGURE 2. AS OF 24 JUNE 2003, THE PROVISIONAL TECHNICAL SECRETARIAT HAD 271 STAFF MEMBERS FROM 70 STATES SIGNATORIES, OF WHOM 174 WERE IN THE PROFESSIONAL CATEGORY. THE REPRESENTATION OF WOMEN IN PROFESSIONAL POSITIONS WAS 48, WITH 60 IN GENERAL SERVICE POSITIONS.

# Outreach activities

*The PTS conducts a variety of activities focusing on enhancing the Treaty understanding of decision-makers and the general public, generating political support, encouraging international cooperation and building national technical capacities through training.*

## External relations

The Provisional Technical Secretariat (PTS) carries out external relations activities to encourage universal adherence to the Comprehensive Nuclear-Test-Ban Treaty (CTBT) and to enhance participation in the Commission's work. The PTS also encourages and participates in multilateral conferences and meetings to further Treaty support. Several multilateral bodies have undertaken initiatives at the global and regional level backing the Treaty.

At the global level, the United Nations General Assembly (UNGA) has approved successive resolutions in favour of the CTBT in its sessions in 2000, 2001 and 2002. On the margins of the last UNGA, eighteen Foreign Ministers issued a joint statement calling upon outstanding States to sign and ratify the Treaty as soon as possible. To date, 52 States have associated themselves with this statement.

The Final Document of the Thirteenth Conference of Heads of State or Government of the Non-Aligned Movement (NAM) held in Kuala Lumpur, Malaysia, in 2003, also supported the CTBT, stressing the significance of achieving universal adherence to the Treaty. The Twelfth NAM Conference in 1998 also endorsed a similar initiative.

At the regional level, the General Assembly of the Organization of American States (OAS) has approved resolutions in support of the CTBT every year since 2000. Between 1998 and 2002, the Pacific Islands Forum (PIF), the Association of South East Asian Nations (ASEAN) and the Agency for the Prohibition of Nuclear Weapons in Latin America (OPANAL), all called in various communiqués for signature and ratification of the Treaty.

## International cooperation and training

The Preparatory Commission conducts a variety of international cooperation activities to further Treaty understanding and to assist in building national capacities for Treaty implementation. The activities include international cooperation workshops, expert discussions on civil and scientific applications of verification technologies and information visits. The most recent

international cooperation workshop was held in Fiji in June 2003, with 25 participants from 15 States in the Pacific.

The Commission also plays a role as a clearing house in promoting international cooperation among its Member States, and serves as a focal point for voluntary contributions to support international cooperation activities. Technical support is also provided to some States, including the establishment of national data centres, to facilitate national implementation of the Treaty.

Training is another important activity of the Commission. Various technical training courses and other capacity-building activities are offered by all three verification Divisions on a regular basis. Initial steps are being taken to develop a training manual designed to provide general guidelines on how to standardize training courses throughout the Organization. A database of training-related information on courses, training opportunities and follow-up activities is under preparation. ■



INTERNATIONAL COOPERATION WORKSHOP FOR STATES IN THE PACIFIC, FIJI, 16-17 JUNE 2003

# In the spotlight

## Ambassador Tom Grönberg

**Q:** This September, Finland, after Japan (1999) and Mexico (2001), will chair the 2003 Conference on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty (Article XIV Conference) in Vienna.



ARTICLE XIV CONFERENCE, NEW YORK, 11-13 NOVEMBER 2001

*What kind of focus will the upcoming Conference take under the Finnish leadership?*

**A:** The aim of the Conference is to decide what measures may be undertaken to accelerate the ratification process in order to promote the entry into force of the Treaty.

Both of the two previous Conferences have produced strong appeals urging countries who have not yet ratified the Treaty to do so. Also this time we need a strong political appeal. But in addition to that, most countries seem this time to prefer a concrete plan on measures to be taken to promote the ratification process. Adopting such a plan is consequently the main task for this Conference besides launching the political appeal.

**Q:** With 167 Signatories and 102 ratifications the Comprehensive

*Nuclear-Test-Ban Treaty (CTBT) is now approaching universality. However, the Treaty will not enter into force until it is ratified by the 44 nuclear-capable States listed in its Annex 2. Thirty-one of these States have ratified so far.*

*What concrete measures are under discussion in the pre-Conference consultations to encourage in particular the outstanding thirteen Annex 2 States to sign and ratify the Treaty?*

**A:** Last September a number of Foreign Ministers signed a statement in which they called upon all States, and in particular those listed in Annex 2, to sign and ratify the Treaty as soon as possible. They further stated that they will make representations individually and together in order to make the Treaty a focus at the highest political level. This is a very important statement and it spells out precisely what can and should be done.

Awareness raising will obviously play an important role in all our activities. This is nothing new but it is

**“Awareness raising will obviously play an important role in all our activities. This is nothing new but it is clear that we have to stress information activities even more in the future.”**

clear that we have to stress information activities even more in the future.

There are of course countries where the non-ratification is linked to technical and administrative constraints. These have to be solved, but here the

problems differ from country to country and have to be addressed individually.

**Q:** A key activity of the Preparatory Commission is the establishment of a global verification regime to monitor Treaty compliance. This regime needs to be operational at the Treaty's entry into force. Member States have been discussing a range of potential useful civil and scientific applications of the verification data already available to States Signatories.

*In your view, what practical implications will the additional benefits of the verification system have for the future of the CTBT?*

**A:** One important element in the information activities is of course to tell what the benefits of the International Monitoring System (IMS) are. While the verification technologies are designed to monitor compliance with the Treaty, many Member States have identified additional ways in which they could potentially be put to use. These include enhanced meteorological and environmental monitoring and

improved seismic assessment capabilities which could contribute to sustainable development and human welfare. After all, the IMS is the largest network of seismic, hydroacoustic, infrasound and radionuclide monitoring facilities in the world – a network



which no country can replicate by itself.

For a number of countries this information is vital when they prepare their ratification of the Treaty. But, in a broader perspective, this information will also further the acceptance of the Treaty.

**Q:** *Multilateral mechanisms and treaties play a central role in arms control and disarmament. The CTBT is one of the pillars of a global regime to*

**“The Treaty is today even more important than it was seven years ago when it was agreed upon. The developments during the last years bear witness of this. Non-proliferation has become one of the central multilateral issues.”**

States that have not joined the Treaty often lack confidence in other States’ intentions. Building such a confidence is then, of course, of utmost importance. This Conference will provide an opportunity in this respect. I think we have to bear in mind that the only way to secure global peace and to build confidence is to proceed with sometimes relatively small but well-prepared and steady steps.

**Q:** *The Treaty, although not yet in force, plays an important role in international peace and security as it has created an international climate within which a moratorium on nuclear test explosions is now regarded by many as a norm.*

*What developments in the future role of the Treaty do you see at this stage?*

**A:** The Treaty is today even more important than it was seven years ago when it was agreed upon. The developments during the last years bear witness of this. Non-proliferation has become one of the central multilateral issues. I can only hope that the new awareness of the problems we might be facing rallies a new support for the Treaty. ■

*control weapons of mass destruction. However, global non-proliferation can only be successful if all members of the community of nations are involved.*

*How is the upcoming Conference positioned to build consensus in the field of multilateral non-proliferation among the community of nations?*

**A:** The Conference is no doubt an important step towards a consensus on multilateral non-proliferation. This is perhaps best illustrated by the fact that the first step out of the thirteen in the list adopted at the 2000 Review Conference of the Nuclear Non-Proliferation Treaty (NPT) deals with the CTBT.

### Biographical note



*Ambassador Tom Grönberg, Permanent Representative of Finland to the international organizations in Vienna, is chairing the preparatory process of the Conference on*

*Facilitating the Entry into Force of the CTBT, to be held in Vienna from 3 to 5 September 2003.*

*Mr. Grönberg joined the diplomatic service in 1975 as Deputy Director-General for the Finnish International Development Agency. Prior to this, he held several positions including Secretary to the Prime Minister. Between 1983 and 1987, he served as Ambassador to Kenya, Ethiopia and Uganda, and also as Permanent Representative of Finland to the United Nations Environment Programme and the United Nations Centre for Human Settlements.*

*Before being appointed Permanent Representative to the Council of Europe in 1994, he served as Director-General for the Legal Department. He has served as Ambassador of Finland to Austria and Slovenia since 1998. ■*

## The Twin Pillars of the Comprehensive Nuclear-Test-Ban Treaty

by Jayantha Dhanapala, former UN Under-Secretary-General for Disarmament Affairs

If a polling organization were to sample worldwide opinion on the question of whether there should be additional nuclear-weapons tests, the result would undoubtedly be a resounding NO. A follow-up question asking whether such a prohibition should be legally binding would likely elicit an equally strong affirmative response.



AUSTRIA CENTER, VIENNA, VENUE OF THE 2003 ARTICLE XIV CONFERENCE

This should surprise no one. Relying on common sense, average citizens across the globe understand that a total ban on such tests is in everybody's interest. Some might recall the human health and environmental effects of atmospheric nuclear testing. Some might remember how the many nuclear tests in South Asia have aggravated tensions in that region. And still others might point to the vast resources that continue to flow into nuclear weapons pursuits, particularly by the five nuclear-weapon states who made an "unequivocal undertaking" at the 2000 Nuclear Non-Proliferation Treaty (NPT) Review Conference to eliminate their nuclear arsenals.

Given these concerns, what is needed to bring the Comprehensive Nuclear-Test-Ban Treaty (CTBT) into force?

### The road to entry into force

The Treaty itself outlines a legal process to achieve this goal. In accordance with Article XIV, and upon request of a majority of ratifying States, the United Nations Secretary-General – the Treaty's Depository – has twice convened special conferences (Conferences on Facilitating the Entry into Force of the CTBT) to "consider and decide by consensus what measures consistent with international law may be undertaken to accelerate the ratification process", and thereby achieve this goal. A third such conference will take place in Vienna, from 3 to 5 September this year.

Yet by all indications, the key challenge ahead is not of a legal nature, or even technical – given the growing capabilities of the Treaty's International Monitoring System (IMS) and the Provisional Technical Secretariat – but political in virtually all its aspects.

### The political challenge

The challenge is political because the Treaty is engaged in establishing a new

global norm, one that will require significant changes of the policies of several governments. It will require investments of time and effort, including the dedicated use of scientific and financial resources. It will require political leaders in legislatures to understand the Treaty's benefits, as well as the commitments needed to sustain them. Above all, it will require greater attention as a goal of civil society, which often tends to assume that actions in conformity with common sense take care of themselves without the need for heroic efforts.

Diplomatic efforts should continue to focus on encouraging the remaining 13 Annex 2 States to ratify the Treaty. These efforts should stress not just the benefits of the Treaty, but also the risks if it fails to enter into force, including potential damage to the NPT regime. Backed by strong popular support from civil society, such diplomacy can succeed.

The keys to the early entry into force of the CTBT thus remain where they have always been, in the hands of the people and their leaders. Each time

**“Diplomatic efforts should continue to focus on encouraging the remaining 13 Annex 2 States to ratify the Treaty. These efforts should stress not just the benefits of the Treaty, but also the risks if it fails to enter into force, including potential damage to the NPT regime.”**



we see a consensus Final Declaration emerging from a Conference on Facilitating the Entry into Force of the CTBT, we see this political process in action. Each time leaders join to pronounce their common views on the Treaty – as seen most recently in the Joint Ministerial Statement on the CTBT, originally bearing the signatures of 18 foreign ministers (now 52 have signed) – the process moves forward. Each time the General Assembly adopts by overwhelming majorities (most recently by a vote of 164-1-5) resolutions calling for the “earliest entry into force” of the Treaty, we see additional steps forward.

### Other goals of entry into force

While the case for this Treaty is already compelling as an end in itself, its entry into force would also advance a wide range of other important goals. The Treaty would serve a confidence-building function by serving the interest of strategic stability. It would effectively put an end to qualitative nuclear arms races, while promoting non-proliferation and disarmament goals. The CTBT would also conserve resources that could be devoted to meet more compelling security or development challenges. Many countries are increasingly aware of the civilian scientific and technical benefits that derive from the full implementation of the IMS, including new educational and training opportunities for young scientists around the world. Entry into force would also fulfill

a key commitment that led to the indefinite extension of the NPT in 1995.

### The future of the CTBT

The Final Declaration of the Conference on Facilitating the Entry into Force of the CTBT in 2001 recognized the

“The keys to the early entry into force of the CTBT thus remain where they have always been, in the hands of the people and their leaders.”

important role of civil society in bringing the Treaty into force, and underscored the Member States’ determination to “use all avenues open to us in conformity with international law” to achieve this aim. The future of the CTBT will rest upon these twin pillars of support from governments and the people.

A week after the next Conference on Facilitating the Entry into Force of the CTBT opens in Vienna on 3 September this year, the world will commemorate the seventh anniversary of the signing of the CTBT. This should be an occasion not for gloom or recriminations, but to celebrate the tenacity of the human effort to achieve at long last one of the greatest initiatives on the road to global nuclear disarmament. The absence of explosive nuclear tests over the last five years did not result from chance. The will of the people will prevail. ■

### Biographical note



*Jayantha Dhanapala, a Sri Lankan national, has served as United Nations Under-Secretary-General for Disarmament Affairs from January 1998 to June 2003.*

*He joined the Sri Lankan Foreign Service in 1965 and held diplomatic appointments in London, Beijing, Washington D.C. and New Delhi. In 1984 he was appointed Ambassador, and subsequently served as Permanent Representative of his country to the United Nations in Geneva and Vienna, and to the United States with concurrent accreditation to Mexico.*

*In addition to his diplomatic posts, Mr. Dhanapala held positions as Director of the United Nations Institute for Disarmament Research (UNIDIR) in Geneva in 1987, and as Diplomat-in-Residence at the Monterey Institute of International Studies in the United States in 1997.*

*Mr. Dhanapala has chaired many international conferences and has received several awards for his work in diplomacy and disarmament, including two honorary doctoral degrees. ■*

# Verification highlights

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

## IMS station status

Considerable progress has been made in certifying and establishing IMS stations in the past six months. The number of certified facilities meeting all technical specifications has increased from 34 to 57, including two radionuclide laboratories. Site surveys have been completed for 284 stations out of the 337 IMS facilities. Altogether 150 stations have already been established or substantially meet specifications, and 80 additional stations are under construction or in contract negotiation. Some 80 facilities are currently sending data to the International Data Centre in Vienna, where the data are processed and released to Member States for final analysis.

## IMS station installation: The Crozet Islands mission

The IMS network of seismic, hydroacoustic, infrasound and radionuclide

facilities covers the entire globe. Some IMS stations are located in very remote areas, and the installation and maintenance of these stations can pose unforeseeable engineering challenges.

Due to the efficient propagation of sound waves through water, the IMS hydroacoustic network consists only of eleven stations, six of which are hydrophone stations with sensors in the ocean. Between 5 March and 26 April 2003, three staff members from the CTBTO Provisional Technical Secretariat (PTS) participated in a mission to install hydroacoustic station HA04 on Crozet Islands in the Southern Indian Ocean.

The Crozet Archipelago has an isolated and inhospitable environment, notable for raging winds, cold and rain. The treeless islands are uninhabited except for a small French scientific base and millions of birds. Nearly 25 million come to breed here. With winds blowing at more than 100 km/h more than 120 days per year, the archipelago is one of the windiest places on earth.

The mission started its 2500 kilometre journey to the Crozet Islands on 8 March from Cape Town, South Africa, on board the cable ship René Descartes,



CAFETERIA OF THE RENÉ DESCARTES – NO FRENCH LUNCH TODAY, 11 APRIL 2003



ONE OF THE 25 MILLION 'CROZET ISLANDERS' WATCHING OUT FOR NEW ARRIVALS

which measures approximately 144 by 22 metres and has a complement of 80 people. Six days later, after crossing three time zones, the ship arrived at the Crozet Islands. One PTS staff member went ashore at the scientific base to check the shore facility and test the data as the hydrophones were deployed, and two PTS staff members remained on board to monitor operations and help in planning. A daily e-mail mission update was sent to the PTS Headquarters in Vienna.

After successfully deploying one out of six hydrophones on the first day, the underwater installation nearly came to a halt due to the adverse weather conditions. Gusty winds reaching 165 km/hour, ship rolls to 34 degrees to the side and sea swells up to eight metres made life on board a memorable experience. On 11 April, the mission reported that it was necessary to hold on to the furniture to avoid being thrown out of the chairs: "The cafeteria has been devastated by strong ship rolls. A table welded on the floor broke apart and

## Data handling and processing at the IDC

Data collected by the International Monitoring System are transmitted in near-real time via the satellite-based Global Communications Infrastructure (GCI) to the International Data Centre (IDC) in Vienna for processing and analysis.

The IDC immediately transmits the data to Member States that have requested this service, via the GCI links. In 2002, around 300 gigabytes of continuous data were distributed by the IDC. The IDC processes the data automatically, using software specially designed and developed for Treaty verification purposes. Events such as earthquakes, mining blasts or volcanic eruptions that are detected and located automatically contribute to build event lists that are made available to Member States. Data received from radionuclide stations are also processed automatically to identify the radionuclides carried by the winds to the stations.

Even excellent software can not replace the work of experienced analysts in reviewing the automatic results as well as the raw data. The IDC analysts produce Reviewed Event Bulletins based on waveform data and Reviewed Radionuclide Reports based on radionuclide data. The IDC also assists Member States in identifying the nature of the events by computing parameters that may enable the Member States to characterize the events.

Although the IDC is still in the development and testing phase, IMS data and IDC products are currently distributed to more than 140 designated organizations in 65 Member States. These figures are constantly increasing as new Member States realize the importance of accessing such data and products. ■

## Simulating on-site inspection tasks: The 2002 OSI field experiment

Preparing for an on-site inspection (OSI) which will clarify whether or not a nuclear test explosion has taken place is a major activity for the Preparatory Commission. An extensive field experiment was conducted in late 2002 to simulate and test initial phase OSI activities. Twenty-seven surrogate inspectors spent two weeks in a remote part of Kazakhstan testing OSI equipment and procedures.

The surrogate inspectors were chosen primarily for their technical expertise and field-based operational experience. Eighteen inspectors representing 17 different countries were selected from nominees from Member States, and nine came from the Provisional Technical Secretariat (PTS) staff. Three women participated, including two technical specialists.

Using an implicit, broad-area search strategy, complemented by their judgement about where a simulated violation of the CTBT might have occurred, nine seismic specialists collected and analysed data from about a dozen seismometers deployed throughout the inspection area.



SETTING UP A PASSIVE SEISMIC STATION IN A POTENTIALLY RADIOACTIVE ENVIRONMENT, OSI FIELD EXPERIMENT, KAZAKHSTAN, 17 SEPTEMBER - 15 OCTOBER 2002

In parallel, a group of four radionuclide specialists collected soil, water and gas samples to test handling and security procedures. Five visual specialists led other inspectors in searching the 550 km<sup>2</sup> inspection area, including by helicopter, for visual indicators of the simulated nuclear explosion, such as craters, displaced rocks, cabling and so on.



TAKING OFF FOR AERIAL OBSERVATION, OSI FIELD EXPERIMENT, KAZAKHSTAN, 17 SEPTEMBER - 15 OCTOBER 2002

A geographical information system was available to display the activities and help integrate the findings. Communications between subteams, the Base Camp and Vienna were provided by satellite phones. Two health and safety specialists created a radiation monitoring facility, and could render aid if any inspectors became ill or injured. Other inspection team members ensured the maintenance and distribution of all equipment, ran the field operations centre and prepared daily inspection plans and reports. All these activities were directed by the Inspection Team Leader without intervention by the experiment's PTS designers.

An independent evaluation has produced several hundred raw lessons which are still being distilled and analysed. Already, some have been included in the process for elaborating the OSI Operational Manual, and more will follow. ■

# Verification science

*The network of the International Monitoring System (IMS) with its associated communications infrastructure and the International Data Centre (IDC) was designed by a Group of Scientific Experts at the Conference on Disarmament in Geneva to be fully capable of monitoring compliance with the Treaty. New research and improved communications technology continuously strengthens and refines the detection capabilities of the IMS. This column introduces some of the latest developments in the field of verification science.*

## Atmospheric transport modelling activities

Among the different technologies applied to verify compliance with the Comprehensive Nuclear-Test-Ban Treaty, radionuclide monitoring may be the only technology capable of detecting an ambitiously disguised, or decoupled, nuclear explosion. In such cases source region association through state-of-the-

art atmospheric transport modelling (ATM) is used to help determine the region from which the suspicious radionuclides may originate.

The main purposes of the CTBTO Preparatory Commission's ATM activities are:

- to attach the best possible source region estimation information, called Field of Regard, to all radionuclide products,
- to describe the transport of nuclear debris from test locations to radionuclide monitoring stations as accurately as possible, taking into account inherent uncertainties, and
- to help monitor the detection capability of the radionuclide verification network.

The Commission cooperates on ATM with the World Meteorological Organization (WMO) and its Specialized Meteorological Centres (RSMCs). This cooperation addresses the uncertainties associated with the dynamics of the atmosphere, providing views from different geographical regions and thus helping to build confidence in the source



CTBTO-WMO WORKSHOP, VIENNA, 16-18 OCTOBER 2002

region estimation results delivered to the Member States. The cooperation is governed by the CTBTO-WMO framework agreement which was approved by the Commission in November 2000 and by the WMO Congress in May 2003.

The CTBTO-WMO response system allows the Commission to obtain, within hours, the best possible ATM results from a set of highly experienced and 24-hour operational organizations distributed all over the world. The first co-ordinated experiment using this powerful new system was conducted successfully in March 2003. A small pre-experiment which engaged all relevant RSMCs as well as a couple of National Data Centres took place in early February 2003.

Figure 3 shows overlaid fields of regard identified by the 11 participants to the February 2003 CTBTO-WMO pre-experiment. The colours indicate how many participants agreed on regions where hypothetical radionuclides were sufficiently sensed during a hypothetical 24-hour radioactivity measurement at radionuclide station Tristan da Cunha (RN 68), United Kingdom. The higher the number of participants in agreement on a potential source region, the greater the confidence in focusing on this area in case the sample bears Treaty relevant radionuclides. ■

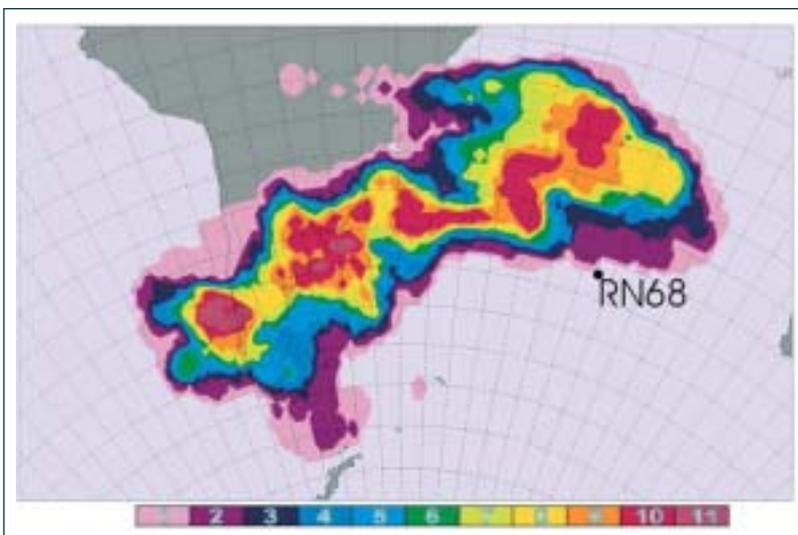


FIGURE 3. OVERLAID FIELDS OF REGARD IDENTIFIED BY THE 11 PARTICIPANTS TO THE FEBRUARY 2003 CTBTO-WMO PRE-EXPERIMENT

# Potential civil and scientific applications

*The International Monitoring System uses seismic, hydroacoustic, infrasound and radionuclide monitoring technologies capable of detecting evidence of nuclear explosions in underground, in water and in the atmosphere in order to monitor compliance with the Comprehensive Nuclear-Test-Ban Treaty. These verification technologies, together with the data, technologies and products of the International Data Centre, have potential civil and scientific applications which can provide significant benefits to States and the international scientific community.*

## Using seismic data...

*continued from front page*

Such understanding was critical to the analysis of seismic data from the impact of another large passenger aircraft in 1998. A Swiss Air MD11 crashed in shallow water at Peggy's Cove near Halifax, Canada, following an onboard fire (Figure 4). No onboard data were recovered for the last few minutes



FIGURE 4. PEGGY'S COVE SWISSAIR CRASH LOCATION

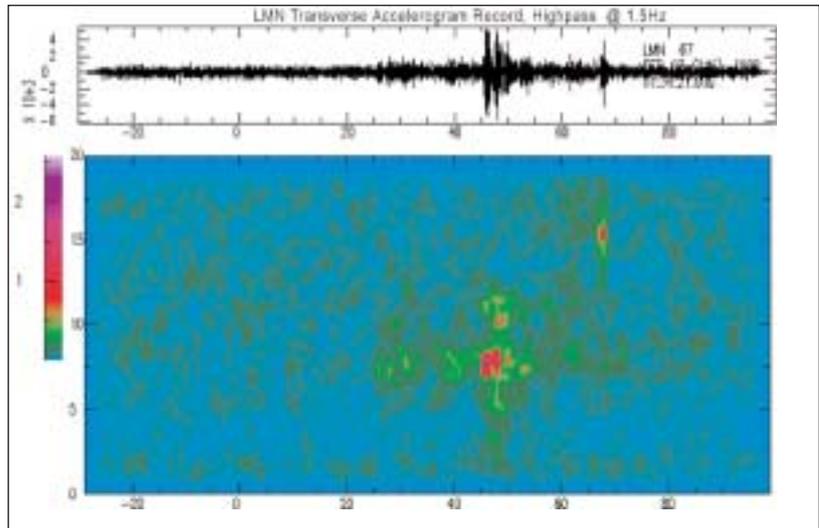


FIGURE 5. SIGNALS GENERATED BY THE SWISSAIR MD11 CRASH AND ASSOCIATED SPECTROGRAM FROM THE SEISMIC STATION OF THE CANADIAN NATIONAL NETWORK (LMN)

of the flight, and the crash occurred in an area of poor radar coverage. Although the location of the crash was quickly established from eyewitnesses and wreckage, seismic data provided the only accurate means of timing the crash. In addition, analysis of the signals from a nearby broadband seismic station (Figure 5) of the type used throughout the IMS rapidly suggested that the impact velocity was very high. This was confirmed many months later by engineering analysis of the aircraft engines.

Seismic signals associated even with high-speed impacts of the heaviest aircraft types are small, typically equivalent to those from magnitude 2 earthquakes or even smaller, which means they are generally detectable only within a few hundred kilometers of the crash site even by the most sensitive equipment under optimal conditions. However, with the growing numbers of seismic stations around the world, both as part of the IMS and in other scientific networks which transmit data in real time, it is becoming increasingly possible to detect such seismic signals

when these unfortunate events occur, and to provide the information to crash investigators in a timely fashion. ■

## Biographical note



*David McCormack is based in Ottawa where he currently heads the nuclear explosion monitoring programme of the Geological Survey of Canada. Originally from Northern*

*Ireland, he has degrees in physics and seismology. Dr McCormack has held several research positions related to nuclear treaty monitoring in the United Kingdom and Canada. Since 1997, he has acted as a senior technical adviser to the Canadian delegation to the CTBTO Preparatory Commission. ■*

## IMS station installation...

*continued from page 12*

squashed some chairs before being smashed on the bulkhead. It is pretty uncomfortable at the moment!"

In addition to the extreme weather conditions, the installation team had to deal with a series of technical problems such as damage to a cable caused by a ship's anchor prior to this mission. Altogether, the PTS staff spent 41 days on board the René Descartes, including many days due to weather delay, to complete

the installation. During this period over 30 kilometres of optical fibre cable were laid out, two hydrophone triplets were installed and the station communications tested until the station was successfully sending data to the International Data Centre in Vienna. On 20 April the PTS team left Crozet Islands for Cape Town, knowing that "if you can deal with the problems thrown up by working at sea, you can deal with almost anything". ■

*All quotations are taken from the daily e-mail chronicle sent to PTS Headquarters.*

## Publications of the Provisional Technical Secretariat

The following publications are currently available in hard copy or can be downloaded electronically from the reference area of our web site at [www.ctbto.org](http://www.ctbto.org):



2002 ANNUAL REPORT  
of the Preparatory Commission for the  
Comprehensive Nuclear-Test-Ban Treaty Organization  
AVAILABLE IN ARABIC, CHINESE, ENGLISH, FRENCH, RUSSIAN AND SPANISH.



BASIC FACTS: SIX BOOKLET SERIES  
Booklet 1: The Comprehensive Nuclear-Test-Ban Treaty (CTBT) at a Glance  
Booklet 2: The Preparatory Commission for the CTBT  
Booklet 3: The Global Verification Regime and  
the International Monitoring System

Booklet 4: The Global Communications Infrastructure and the International Data Centre

Booklet 5: On-Site Inspections    Booklet 6: Membership Benefits

AVAILABLE IN ENGLISH, FRENCH AND SPANISH.



BROCHURE: OBJECTIVES AND ACTIVITIES  
Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty  
AVAILABLE IN ENGLISH, FRENCH AND SPANISH.

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## Calendar of Meetings 2003

### Preparatory Commission:

20th Session 24 - 27 June 2003  
21st Session 10 - 14 November 2003

### Working Group A:

23rd Session 10 - 13 June 2003  
24th Session 29 September - 3 Oct. 2003

### Working Group B:

20th Session 17 Feb. - 7 March 2003  
21st Session I 26 May - 6 June 2003  
21st Session II 1 - 12 September 2003

### Advisory Group:

20th Session I 22 - 25 April 2003  
20th Session II 26 - 30 May 2003  
21st Session 22 - 26 September 2003

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