CTBT verification: A system of ties

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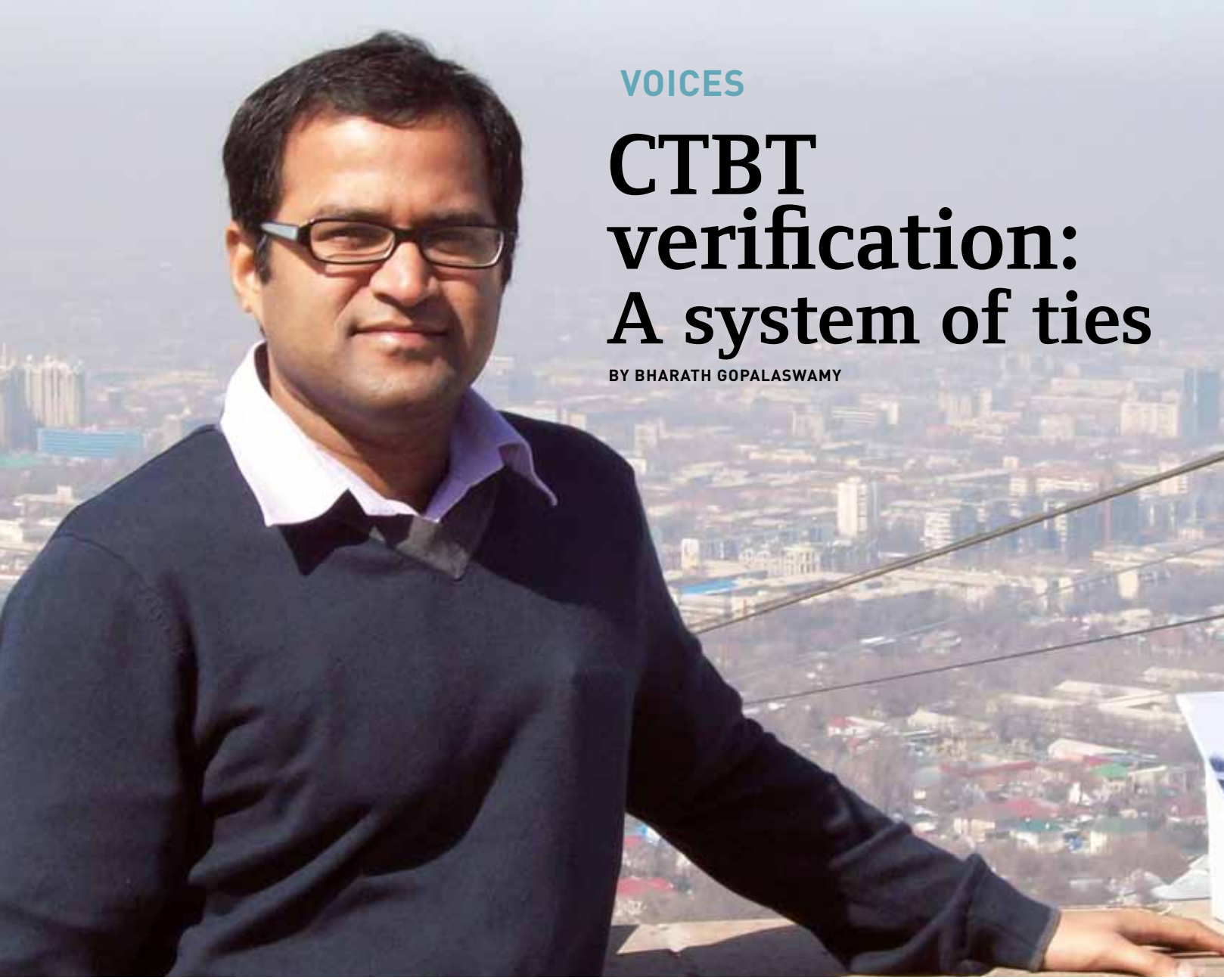

With Indonesia's decision to start the ratification process of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) in May 2010, ratifications from only eight more nations will be needed before the Treaty can enter into force: China, the Democratic People's Republic of Korea, Egypt, India, Iran, Israel, Pakistan and the United States. Nearly all of them have expressed their support for the CTBT's entry into force by signing the Treaty and through documents adopted by the CTBT entry into force conferences, the Nuclear Non-Proliferation Treaty Review conferences, or United Nations General Assembly resolutions. The countries mentioned above have given various different reasons for not having ratified the Treaty yet. One argument claimed by a few has been that parts of the CTBT verification regime could be used for espionage. However, by taking a look at the Treaty text itself, as well as its negotiating history and the use of the CTBT monitoring system since the Treaty opened for signature in 1996, it is evident that such concerns are baseless.

The Treaty and its verification regime strike a careful balance between fulfilling the CTBT's mandate, i.e. detecting any nuclear explosion anywhere by anyone, while at the same time ensuring that Member States' legitimate national security interests are not endangered.

WEALTH OF CIVIL & SCIENTIFIC APPLICATIONS

The CTBT's technologies and verification methods have capabilities that can monitor events other than nuclear explosions. This is unavoidable. In the search for the needle in the haystack (i.e. a nuclear explosion), the IMS registers a large number of other events, mainly earthquakes, but also various natural and man-made events such as mining explosions, large chemical explosions, meteors and storms.

Data generated by the monitoring stations have a number of potential civil and scientific applications, especially in the field of disaster mitigation. Seismic data already help provide earlier tsunami warnings while infrasound data could help improve civil aviation safety by warning pilots of large ash plumes caused by volcanic eruptions. IMS verification data could also be used for climate change research, research on the Earth's structure, monitoring underwater volcanic explosions, ice shelf break-up and the creation of large icebergs.

THE VERIFICATION REGIME

The CTBT prohibits all nuclear explosions anywhere by anyone. The Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) is tasked with facilitating the Treaty's entry into force and developing its verification regime. The regime consists of several components, including the International Monitoring System (IMS), the International Data Centre (IDC), and provisions for on-site inspections.

As of 27 October 2010, 258 IMS stations were fully operational and sending data to the IDC in Vienna for analysis. Data are collected using four key verification technologies: seismic, hydroacoustic, infrasound, and radionuclide. When complete, the IMS will comprise 321 stations: 50 primary and 120 auxiliary seismic, 11 hydroacoustic, 60 infrasound, and 80 radionuclide stations. Sixteen laboratories for radionuclide analysis are also part of the system. The facilities are located strategically around the world in over 80 countries and monitor the globe for any sign of a nuclear explosion, providing States with an effective and reliable verification mechanism.

Once the CTBT enters into force, an on-site inspection (OSI) can be carried out as a final verification measure. Requests for an OSI must be approved by at least 30 of the CTBTO's 51-member Executive Council.

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CTBT NEGOTIATIONS AND THE USE OF NATIONAL TECHNICAL MEANS (NTM)

During the negotiations for the CTBT, countries such as China, India, Iran, Israel and Pakistan expressed concern about the potential use of the Treaty's verification regime for espionage purposes, especially through the use of National Technical Means (NTM). The reason that negotiators agreed to allow Member States to use their own NTM (which include monitoring methods such as satellite imagery analysis and radars) to detect potential Treaty violators was that a CTBT-specific satellite system was regarded as prohibitively expensive. Furthermore, the majority of the delegations felt that the CTBTO would be able to acquire necessary information from national and commercial satellites. China argued that NTM could include detection devices that could be construed as forms of espionage. India and Pakistan joined China in opposing the incorporation and legitimization of NTM, fearing that information acquired in this way would not necessarily be shared and could give some States an advantage over others.

However, in a statement to the Conference on Disarmament (CD) on 1 August 1996, Sha Zukang, China's Ambassador to the CD, finally conceded to the use of NTM, saying: "On the issue of national technical means (NTM), China has consistently opposed in the past two years and more the concept of allowing NTM to play a role in the CTBT verification regime, particularly in the triggering of OSIs. With a drastic adjustment of its position China can now agree to allow purely technical NTM to play a supplementary role in triggering OSIs." When China signed the CTBT

Raw data and analysis results are distributed by the IDC in Vienna to the CTBTO's Member States.

on 24 September 1996, it submitted a declaration stating its opposition to "the abuse of verification rights by any country, including the use of espionage or human intelligence to infringe on the sovereignty of China." Although Iran was a staunch opponent of NTM, it signed the Treaty on the same day as China, while declaring that "National Technical Means should not be interpreted to include information received from espionage and human intelligence."

ON-SITE INSPECTIONS AS A FINAL VERIFICATION MEASURE

During the Treaty negotiations, another contentious issue was that in the event of an on-site inspection (OSI), the Member State subject to an inspection may be required to open its military or other sensitive areas to inspectors as well as a representative from the country requesting the inspection. China, India, Israel and Pakistan argued that an OSI should be a tool of last resort, used rarely, and only undertaken if a mandatory period of consultations failed to resolve an ambiguous data record or suspicious event. Israel pushed for inspected State Parties to have the right to "exclude locations and facilities at the initial stage" of an inspection and "to exempt sensitive facilities from access on the basis of national security, proprietary rights and health and safety reasons." China finally agreed to the provision of on-site inspections. Israel also signed the Treaty on 25 September 1996.

COUNTRIES' LEGITIMATE SECURITY CONCERNS PROTECTED

In all these cases, it is important to remember that the CTBT was negotiated to detect any nuclear explosion, regardless of yield. It is a zero-yield treaty. The final language in the Treaty text was carefully crafted to enable the Treaty to fulfill its mandate. At the same time, the negotiators took into consideration those concerns expressed at the CD, making sure that countries' legitimate security concerns were also protected. There are legal, technical, and political reasons that support this.

The Treaty requires the CTBTO to conduct its verification activities in the least intrusive way possible. The general provisions of the Treaty stipulate that the CTBTO "shall request only the information and data necessary to fulfil its responsibilities under this Treaty. It shall take every precaution to protect the confidentiality of information on civil and military activities and facilities coming to its knowledge in the implementation of this Treaty and, in particular, shall abide by the confidentiality provisions set forth in this Treaty." Furthermore, under Article IV. 12 of the CTBT: "State Parties undertake to promote cooperation among themselves to facilitate and participate in the fullest possible exchange relating to technologies used in the verification of this Treaty in order

Central site of IMS hydroacoustic station HA09, Tristan da Cunha.

to enable all States Parties to strengthen their national implementation of verification measures and to benefit from the application of such technologies for peaceful purposes."

With regards to OSI verification activities, inspected State Parties are granted "managed access" rights whereby a State can take appropriate "measures to protect sensitive installations and locations" as well as preventing "disclosure of confidential information not related to the purpose of the inspection." Mechanisms also exist within the Treaty to prevent frivolous or abusive inspections, with ways of reprimanding a State for making illegitimate requests.

STATES WITH BETTER NTM CANNOT REQUEST MORE OSIs

Because some countries have better developed NTM than others, they have the advantage of being able to collect more data. This does not, however, mean that that they have discriminatory powers to request more OSIs. In the final text of the Treaty, Member States agreed that in order to request an OSI, they would allow information to be collected by NTM "in a manner consistent with generally recognized principles of international law" as well as data from the IMS stations. In this way the IMS and NTM technologies combine to make intelligence gathering a synergistic operation.

MULTIPLE TECHNOLOGIES IMPROVE RELIABILITY OF THE INTERNATIONAL MONITORING SYSTEM

The IMS technologies are very reliable and have been developed to detect nuclear explosions in all environments. The three waveform technologies (infrasound, seismology, and hydroacoustic) can detect, locate, and identify explosions in the atmosphere, underground, and underwater. However, these three technologies alone cannot determine with certainty whether the source of an explosion is nuclear; such a confirmation is obtained by the IMS radionuclide system.

Multiple technologies improve the reliability of the system and help avoid situations such as the August 1997 incident, when U.S. officials claimed an earthquake off Novaya Zemlya (a former nuclear test site used by the USSR) was actually a nuclear test. Data from IMS seismic stations in Norway, Sweden, Finland, and Russia, and analyses from independent scientists, led to the clear conclusion that the seismic event was an earthquake, not a nuclear explosion.

DATA DISTRIBUTED IN AN EQUAL AND NON-DISCRIMINATORY WAY

The IMS proved its worth again in 2006 and 2009. When North Korea tested a nuclear device in October 2006, 22 IMS sensors detected the event within seconds. The final confirmation that a test had occurred came when a radionuclide monitoring station in Yellowknife, Canada, detected traces of radioactive xenon. Through state-of the-art atmospheric modelling, the noble gas release was traced back to North Korea. In May 2009, North Korea conducted what it called a "successful nuclear explosion." The event was once again recorded by IMS sensors all around the world (61 this time); however, the lack of detection of radioactive xenon gas by anyone emphasized the necessity of the verification regime's OSI component.

CTBTO Member States have the advantage of participating in verification processes at the CTBTO's IDC in Vienna, where in-house experts provide substantial data filtering and analysis. This ensures that those Member States that have limited technical capabilities gain experience in analyzing data. Capacity building and training provided by the CTBTO enable all Member States to participate in the decision making process on an equal footing. CTBTO data are distributed to all Member States in an equal and non-discriminatory way. At the time of the DPRK tests in 2006 and 2009, the members of the UN Security Council – nuclear weapon and non-nuclear weapon States alike, had the same information about the location, magnitude, time and depth of the tests hours before the deliberations in the Council. Remaining outside the CTBT means that a State will not have access to such data or these benefits.

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MEMBER STATES HAVE FULL ACCESS TO ALL DATA

It is beneficial for States to become members of the CTBTO. Member States are informed about the technical implications of membership, can receive assistance with the establishment of a National Data Centre, and participate in the CTBTO's decision-making structures.

The monitoring system gathers data through sensors which detect and register events. This process is entirely automatic. Once the data reach the IDC, the responsibility shifts to data analysis, whereby the analyst discards events which are not real, adds signals which have not been associated to an event, and corrects and improves the location estimates of real events. Member States have the right of full access to

Participants attending the National Data Centre Development Workshop for Middle Eastern and South Asian States, Amman, Jordan, 27 to 30 September 2010.

all monitoring data and data bulletins, which can assist a State in exercising its prerogative to make the final judgment in the case of a suspicious event. Countries outside the Treaty are at a serious disadvantage by not having access to collected data and the "know-how" of experts who analyze it.

UNIQUE GLOBAL MONITORING SYSTEM

The CTBTO is establishing an unparalleled verification regime that is approaching completion. The IMS sensors are global, and the network's operating conditions are stringent and highly reliable. Furthermore, the system is multilateral, which enhances the legitimacy of the verification mechanisms. Such an arrangement grants all CTBTO Member States equal access to the monitoring data, allowing them to analyze ambiguous events, pass final judgment on the nature of the event, and decide if they wish to request further measures such as OSIs.

The Treaty is now close to universalization, with 182 signatures and 153 ratifications. Any State that remains outside the CTBT based on fears that the Treaty's verification regime might be used for espionage should take these facts into consideration, for there is no indication that this has ever occurred or will ever occur.

BIOGRAPHICAL NOTE

BHARATH GOPALASWAMY joined the Arms Control and Nonproliferation program of the Stockholm International Peace Research Institute (SIPRI) in 2009. Prior to that, he was a postdoctoral associate at Cornell University's Peace Studies Program, where he applied his technical knowledge to current foreign policy issues. Dr Gopalaswamy has also worked at the Indian Space Research Organization's High Altitude Test Facilities and the European Aeronautics Defense and Space Company's Astrium GmbH division in Germany.