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**VERIFYING A BAN ON NUCLEAR TEST EXPLOSIONS**
Multilateral Verification, Collective Security: The Contribution of the CTBT
Vienna International Centre, Austria, 18 July 2012
By Andreas Persbo, Executive Director

Let me first thank the CTBTO team for getting me here on time. It is of course fantastic to be back in the Vienna International Centre. And, of course, it is good to see so many of you here today. You have had a full agenda, and you have the best before you with tomorrow's simulation of the Executive Council.

Now, I have been asked to say a few words about the effective verification of the Comprehensive Nuclear-Test-Ban Treaty. There is a lot to say about that, especially with the new report by the National Academy of Sciences underpinning the debate.

Alongside the Academy report, I'd like to recommend a book by Ola Dahlman, Jenifer Mackby, Svein Mykkeltveit and Hein Haak. It is called '*Detect and Deter: Can Countries Verify the Nuclear Test Ban?*' and it goes through the technical capabilities of the CTBT's verification system in great detail. So this year has seen a number of very authoritative studies on the treaty. But what do they all say?

When the CTBT was opened for ratification more than 15 years ago, the envisioned verification system was already more sophisticated than all previous regimes. It was the first treaty ever to have a regime that relied primarily on remote monitoring techniques rather than on-site inspections.

It was the first system that transmitted unprocessed data directly to the state parties, enabling them to draw their own conclusions on compliance. It also placed the Director-General and the Secretariat in a rather passive role. Tibor Toth has sometimes referred to this as the 'democratization of verification'.

In addition, it was the first system that relied on a large and sophisticated global communications infrastructure, relaying data from the source event to the treaty organization and its state parties in near-real-time.

At the time, it all felt a bit like science fiction. But as you now know, science has now caught up with fiction. And in some cases, even surpassed it.

Twenty years ago, the system was envisioned as being able to detect any nuclear explosion larger than one kiloton. Let us put that in perspective. One kiloton is one million kilograms of TNT. Or, put a different way, about 4,000 rather large precision-guided bombs going off in one tiny space in about a microsecond. That is a very large explosion.

Twenty years later, today, the system is far more capable—detecting man-made seismic events in the range of tens of tons in certain regions of the world. Yet some critics, especially in the United

States, continue to argue that the treaty is unverifiable or that it cannot provide 100 percent confidence that other states are complying with the nuclear-test ban.

There could be a number of possible explanations for this. Some may believe that even very small nuclear-test explosions, not more than tens of tons, are militarily significant. Others might argue that any instance of non-compliance, no matter how small, would seriously undermine the treaty and, by extension, the national security of the state parties. Still others argue that their country must retain the option to conduct nuclear tests and that the test ban therefore constrains future choices. Many of these arguments, but not all, can be countered. No verification regime can provide one hundred per cent assurance, and no sane person would expect it to.

The IMS, by the way, does not exist in splendid isolation. It can be enhanced, and in the future I think it will be. The IMS is far more sensitive when combined with states' national technical means of verification than it is by itself. For example, there are now more than 16,000 seismic stations around the world, organized in several networks. Two continents, Europe and North America, are virtually covered with them. In addition, the 'ring of fire' around the Pacific Ocean is lined with hundreds upon hundreds of stations. These could be used for test ban treaty verification also, significantly increasing the sensitivity of the regime as a whole.

Add to that ever-increasing satellite capabilities and readily-available high-resolution commercial imagery, and it becomes clear that it is increasingly difficult to hide not only a nuclear test, but also nuclear-test site preparations. The authors of *Detect and Deter* call this 'precision monitoring' and describe it as focusing state assets on one particular region of the world.

The science is progressing also. Seismology has been equipped with new methodology in recent years, which should enable states to better understand and use data obtained both in close proximity to or at some distance from an event.

The system is very sensitive even without national technical means. The detection threshold can be as low as magnitude 2.8 at the 10 per cent confidence level. This is a very small event. In some cases, magnitude 2.8 corresponds to a yield of less than 10 tons of kilograms of TNT. Those 4,000 smart bombs I've talked about earlier have been reduced to only 40.

When the IMS was initially designed, the auxiliary stations were envisioned as providing on-call data to the system, should the primary network detect a suspicious event. It was considered costly and unnecessary to bring these stations on-line. Of course, the designers could not have foreseen a rapid decline in the price of data transmission or, for that matter, the consequences of the evolution of silicon memory chips. The last decade has seen a radical transformation of our virtual world.

In the 1990s, the CTBTO's bandwidth requirement was seen as staggering. Today, its data can be easily carried on the internet. Moreover, many auxiliary stations are able to provide near-real-time data to the IMS, increasing the sensitivity and responsiveness of the system. And the rapid evolution of computing power and transmission speeds shows few signs of slowing down.

So what does this mean? Let me give you the words of John Walker, another CTBT veteran. He said, in a recent VERTIC brief on verification and deterrence, and I quote: 'A regime that can demonstrate a very high level of technical reliability, coverage and sensitivity presents a formidable obstacle to anyone who wants to cheat. The IMS does that.' End of quote. I agree.

Once the treaty comes into force, of course, the on-site inspection provisions of the CTBT can also be brought into play. If an on-site inspection were approved, the ability of the CTBTO to conduct an on-site inspection would equip the organisation with a powerful additional tool to conclusively detect instances of non-compliance. There is still work to do here, but the fundamentals of the inspection regime are already in place. We saw this on the steppes of Kazakhstan in 2008. We will see this again in Jordan in 2014. I am confident of this.

As Edward Ifft noted in a 2009 VERTIC brief, and I again quote: 'One can expect that there would be a high probability that a properly conducted OSI would identify any militarily significant nuclear explosion,' and crucially, that 'the possibility of an OSI should have a powerful deterrent effect on any country contemplating cheating.'

And so, returning to Dr Walker: 'Knowing that the treaty's OSI capability is effective and would stand a very good chance of uncovering facts strongly suggestive of non-compliance, a cheating state will have to obstruct the inspectors in the field.'

Obstruction is by no means a good option for a non-compliant state. A pattern of evasion, delay and obfuscation will tell its own story. The inspection team leader will note down this narrative in the final inspection report, and it will have consequences in the Executive Council. Yes, you could possibly cheat, and try to cover your tracks. On balance, however: would it be worth it?

In conclusion, I don't think there should be much debate about the verifiability of the treaty. The treaty regime is strong right now, and will become even stronger in the future.

Of course, we need this treaty to enter into force for it to be legally-binding on its members. We all know the difficulties with the entry-into-force formula of the treaty. It may take some more time. But once the treaty does enter into force, we're entering into a new era: a world where nuclear test explosions are banned in all environments, for all time. This will be good for our environment. This will be good for international security. And this will be good for arms control and disarmament. Let us look forward to that day, and prepare for it in the meantime.

Thank you for your attention.