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A Collection of Fellowship Research Papers

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A Collection of
Fellowship Research Papers

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About the CYG-CENESS Research Fellowship

CYG-CENESS Research Fellowship was launched in 2021 to help promising young scholars to build their professional network by giving them access to top professionals and experts in the field of nuclear disarmament and nonproliferation. The Fellows were invited to attend webinar series lectured by prominent experts and diplomats, to conduct research on CTBT, nonproliferation and disarmament issues, and to engage with distinguished scholars and practitioners.

About the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization

The Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) was established in 1996 with its seat in Vienna. Its main tasks are the promotion of the Comprehensive Nuclear-Test-Ban Treaty and the build-up of the verification regime so that it is operational when the Treaty enters into force. It is headed by the Executive Secretary, Dr. Robert Floyd. CTBTO Youth Group (CYG), launched in January 2016, is open to students and young professionals dedicated to achieving the entry into force and universalization of the CTBT. By the end of 2021, the Group had grown to nearly 1200 members coming from over 117 countries.

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The Center for Energy and Security Studies (CENESS) is an independent, non-governmental think-tank established in 2009. Headquartered in Moscow, the main goal of CENESS is to promote independent, unbiased, systematic, and professional analyses related to nuclear nonproliferation, arms control and atomic energy. The flagship project of CENESS is the Moscow Nonproliferation Conference organized averagely every 30 months. The Director of the Center is Anton Khlopkov.

NOTE

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DPRK and the CTBT: What Could Come Next after the Moratorium?

Haeyoon Kim ■ Zhaniya Mukatay ■ Qiyang Niu

ABSTRACT

At the 25th anniversary of the opening for signature of the Comprehensive Nuclear-Test-Ban Treaty (CTBT), this paper explores how a self-imposed nuclear test moratorium by the Democratic People's Republic of Korea (DPRK) could be used for achieving further progress in the country's policy regarding a complete ban on nuclear testing; analyzes Kazakhstan's experience in dismantling the Semipalatinsk nuclear test site and how it could be applied in the DPRK; and proposes recommendations on how to encourage the DPRK to join the CTBT. First, the CTBTO Preparatory Commission (CTBTO) should consider inviting the DPRK for CTBTO training and workshops to build trust; second, the international community should encourage the DPRK to vote in favor of UNGA resolutions on the CTBT as a next step forward towards the signing of the Treaty; and third, the international community should regard the DPRK's signing of the CTBT as a reason to consider relaxing sanctions against the DPRK in the future. Together, these actions could not only push forward the CTBT with its coming into force but also melt the current stalemate of engaging with the DPRK positively.

INTRODUCTION

The DPRK is one of the eight remaining countries whose signatures and ratifications are necessary for the CTBT to enter into force. This paper aims to present the followings in three parts: the DPRK's current state on nuclear disarmament and the recent diplomatic developments that led to the current moratorium; how and why Kazakhstan's gradual and staged closure of the Semipalatinsk site could lend lessons to the DPRK; and finally, how to take the opportunity of the moratorium to induce the DPRK to come back to the negotiating table and move forward on issues around the CTBT.

DPRK'S NUCLEAR NEGOTIATIONS SINCE 2018

Since the successful hosting of the PyeongChang Winter Olympic Games in early 2018, then newly elected President of the Republic of Korea (ROK), Moon Jae-in, pushed for a foreign policy initiative to improve Seoul's relations with Pyongyang. This unique diplomatic opportunity was triggered by the 2018 New Year's address delivered by the DPRK leader, Kim Jong Un, in which he announced that his delegation will be participating in the ROK-hosted Winter Olympics, and politically advocated by the International Olympic Committee President, Thomas Bach, under the name of promoting peace.

A series of summit meetings between President Moon and Chairman Kim followed in 2018; the first-ever meeting between the two leaders in April produced the Panmunjom Declaration, promising to realize the common goal, "through complete denuclearization, a nuclear-free

Korean peninsula"[1]; it also yielded President Moon 80 percent range approval ratings at the time.[2] Fueled by such public support, the second summit in May and the third summit in September followed shortly.

While the Moon-Kim reconciliation was at play, Chairman Kim met with Chinese President Xi Jinping twice, in March and in May 2018, prior to his historic summit meeting with US President Donald Trump. Most noticeably, amid such rapid developments on and around the Korean peninsula, the DPRK released a statement in April 2018 announcing a moratorium on nuclear and long-range ballistic missile tests, and efforts towards the dismantlement of its Punggye-ri nuclear test site, where all six of its nuclear tests were conducted since 2006.[3] The DPRK also demolished some of the Punggye-ri test facilities in May 2018 in the presence of foreign journalists, and released a video of the demolition to be broadcasted internationally.

Against this backdrop, the first meeting between President Trump and Chairman Kim took place in June 2018 in Singapore. The pledges listed in the joint statement echoed the commitment "to work towards a complete denuclearization of the Korean peninsula."[4] But many American hawks in Washington were against the idea of giving the DPRK the legitimacy it had long been craving through a summit meeting, and questioned Trump's top-down approach to tackling North Korea's nuclear program.

Almost immediately after the Singapore summit, Kim met with Xi – their third meeting in 2018 alone – which demonstrated Beijing's strong political leverage over Pyongyang. The South Korean government, eager to take the driver's seat in the ongoing nuclear talks between the US and the DPRK, also sought for a third summit in Pyongyang, which produced the Pyongyang Joint Declaration; in that declaration, the two leaders once again reasserted their commitment to "pursuing a complete denuclearization of the Korean peninsula."[5]

President Moon, during his visit to New York for the 73rd session of the United Nations General Assembly, echoed the recent achievements on the Korean peninsula, and called for a second Trump-Kim meeting. Chairman Kim – only about a month ahead of the second US-DPRK meeting – visited Beijing again for a fourth Sino-DPRK meeting in early 2019, where Xi publicly supported the upcoming meeting and called for concessions from both Washington and Pyongyang.[6]

Yet, the much anticipated second summit between President Trump and Chairman Kim in February 2019 ended without a deal; at the Hanoi summit – according to a book written by then US national security advisor John Bolton – Trump asked for more than giving up the Yongbyon nuclear facility in exchange for a partial lifting of the sanctions against the DPRK,

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1 Panmunjom Declaration, April 27, 2018.

2 KBS, "Moon's Job Approval Rating Jumps to 83%," May 4, 2018, <http://world.kbs.co.kr/service/news_view.htm?lang=e&Seq_Code=135988>

3 Mark Fitzpatrick, On the Mountaintop with North Korea, April 27, 2018, <https://www.iiss.org/blogs/survival-blog/2018/04/mountaintop-north-korea>.

4 Singapore Declaration, June 12, 2018.

5 Pyongyang Joint Declaration, September 18-20, 2018.

6 Al Jazeera, "In Talks with Kim, China's Xi Backs Second North Korea-US Summit," January 10, 2019, <https://www.aljazeera.com/news/2019/1/10/in-talks-with-kim-chinas-xi-backs-second-north-korea-us-summit>.

but Kim rejected the deal.[7] Concerning whether the US-offered deal was too big or too small for Kim, opinions vary. But a joint assessment by the Center for Energy and Security Studies and the International Institute for Strategic Studies in July 2021 suggested that dismantling all Yongbyon facilities "would significantly reduce Pyongyang's capability to make weapons-usable fissile materials."[8] The joint assessment also argued that "if only one other enrichment plant is operational, then eliminating the Yongbyon facilities would reduce North Korea's weapons-production capacity by up to 80 percent."[9]

The two sides sat down face-to-face seven months later in Sweden to resume working-level negotiations, but again, failed to come to an agreement. After an 18-month-long pause, the DPRK resumed firing missiles in May 2019. Pyongyang also made it clear in a statement in January 2020 that it would no longer be bound by the self-imposed moratorium.[10]

It is evident that since the failure of the Hanoi summit, no significant progress has been made in nuclear negotiations with the DPRK. Adding fuel to the fire, the global COVID-19 pandemic led to the country's shut-down, making it much harder for the stakeholders to negotiate with Pyongyang. The DPRK, cornered by COVID-19 and natural disasters on top of the sanctions, released a series of harsh statements denouncing Seoul for its joint military exercise with the US, and in June 2020, blew up the inter-Korean liaison office – South Korea's de facto embassy in DPRK – located in Kaesong.

Yet under such circumstances, the DPRK has not fired long-range ballistic missiles targeting the US, nor has it conducted another nuclear test. Concerning nuclear testing, Pyongyang, since its sixth and last test in September 2017, declared that it has perfected its nuclear capabilities, and opened up for dialogue in 2018. Although the talks have stalled, and the missiles, including the ballistic ones, are back, the moratorium presents a window of opportunity for the key stakeholders to bring the DPRK back to the negotiating table for nuclear talks today.

NUCLEAR TESTING SITE DISMANTLEMENT: LESSONS TO LEARN

The recent de-escalation of the Korean peninsula and progress towards a US-DPRK rapprochement have created a window of opportunity for discussions on North Korea's denuclearization. Some policymakers claim that Chairman Kim's unilateral nuclear test moratorium and the reported closure of the Punggye-ri test site have signaled his willingness to denuclearize. However, the the absence of independent inspectors to witness the process of the nuclear test site's dismantlement raise questions among the international community, especially given the DPRK's history of departures from such agreements. One example is a situation in mid-2008, when North Korea destroyed the cooling tower of its plutonium-production reactor in Yongbyon, but when the negotiations collapsed after they refused verification, the DPRK restored the reactor by building a new cooling system.11 Therefore, since an

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7 John Bolton, The Room Where It Happened: A White House Memoir (Simon & Schuster, 2020).

8 The Center for Energy and Security Studies and the International Institute for Strategic Studies, DPRK strategic capabilities and security on the Korean Peninsula: looking ahead, July 14, 2021, <https://www.iiss.org/blogs/research-paper/2021/07/dprk-strategic-capabilities-security-korean-peninsula>.

9 Ibid

10 Anthony Kuhn, "North Korea's Kim Jong Un Says He Is No Longer Bound By Nuclear Missile Moratorium," NPR, December 31, 2019, <https://www.npr.org/2019/12/31/792793583/north-koreas-kim-jong-un-says-he-is-no-longer-bound-by-nuclear-missile-moratoriu>.

11 Mark Fitzpatrick, "Yongbyon restart: North Korea ramps up nuclear tension," BBC News, April 2, 2013. <https://www.bbc.com/news/world-asia-22006636>.

immediate and complete North Korean denuclearization is unlikely to result from recent negotiations, the parties interested in dismantlement will need a conceptual framework taxonomy of required steps and stages. One of such frameworks is derived from Kazakhstan's successful closure of the Semipalatinsk nuclear test site.

Kazakhstan's experience and progress in dismantling one of the world's most-used nuclear test sites in Semipalatinsk, also known as "Polygon," can be used as a framework for the DPRK in their effort of irreversible closure of the Punggye-ri site in a manner that would be verifiable to the international community and beneficial for the country. The details of the Kazakh experience and their applicability for North Korea are outlined below.

The closure of Semipalatinsk was a gradual and staged process with periodic remediation activities such as economic and humanitarian aid to deal with the consequences of testing. The dismantlement of the "Polygon" consisted of three main stages. The first stage was to cease the testing. Upon becoming an independent state, Kazakhstan immediately declared the termination of all nuclear activities on its territory and the dismantlement of its test site. In the same vein, Chairman Kim's self-imposed moratorium on nuclear testing (although it has now been lifted), coupled with the collapse of three existing tunnels at the Punggye-ri site, can be interpreted as a freeze on nuclear testing. The DPRK, therefore, is currently at this stage, and in the short run, no radical actions are required.

The second stage was to put nuclear activities under the IAEA safeguards. In 1992, Kazakhstan opened all nuclear facilities and nuclear materials to regular inspections by IAEA inspectors.[12] Shortly afterwards, Kazakhstan signed an agreement with the IAEA under which the agency undertook to provide assistance to the country in dealing with the consequences of testing at the Semipalatinsk site as well as in further development of nuclear energy.[13] Theoretically, at this stage, the DPRK is expected to terminate all nuclear activities, allow international inspections at its test sites for verification, and grant access to databases of production sites. But the interested parties should signal that they will offer quid pro quos such as lifting some of the sanctions and providing aid to induce North Korea to undertake these steps. Since this stage does not require a permanent dismantlement of the plants, the incentives offered also should be either temporary or reversible, that is, sanctions should not be eliminated but rather suspended, and instead of comprehensive economic aid, humanitarian assistance should be provided.

The last stage was dismantling the infrastructure. Along with Kazakhstan's decommissioning of its nuclear facilities at four locations and the sealing of underground testing tunnels at the Degelen Mountain Complex, Kazakhstan received extensive financial and technical assistance from the US under the Cooperative Threat Reduction Program, which helped Kazakhstan achieve the destruction of 148 silos, as well as the sealing of 13 boreholes and 181 tunnels, among other things.[14] For North Korea, the assumption at this stage is that the country would still retain its nuclear warheads, but international experts would either need to verify that the DPRK has indeed demolished the deep tunnels and infrastructure, or take

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12 Oxford Analytica, "Kazakhstan's example in promoting nuclear non-proliferation," September 2017, <https://www.oxan.com/media/1960/kazakhstan-nuclear-non-proliferation.pdf>.

13 IAEA, "Agreement of 26 July 1994 between the Republic of Kazakhstan and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons," IAEA-INFCIRC/504, April 1996.

14 Oxford Analytica, "Kazakhstan's example in promoting nuclear non-proliferation".

additional steps to make the complex unusable. North Korea could prove its full commitment by inviting the nuclear-weapon states (NWS) experts to verify the closure of the Punggye-ri site, as well as to explore opportunities for the CTBTO to contribute to related activities. Similar to Kazakhstan's case, the interested parties, presumably, the NWS should assist the DPRK at this stage. Along with the aid, after the dismantlement of the Punggye-ri site, some economic sanctions imposed by the United Nations, especially those that target commercial sources of revenue, should be eased in order to facilitate remediation.

DPRK MORATORIUM AND WAYS TO ACHIEVE PROGRESS ON THE CTBT

As of January 2022, the DPRK still maintains its self-imposed moratorium on nuclear tests. So long as the moratorium is in place, it presents a window of opportunity for the international community to incentivize the DPRK for signing the CTBT if not ratifying, since after all, the US and China have not ratified either. The tricky question is how to activate the interactive dynamics between the DPRK and the international community.

Existing analyses and proposals tend to focus primarily on the role of the CTBT in denuclearizing the DPRK. They suggest that the CTBT can prevent the DPRK from qualitatively improving its nuclear weapons, assist in verifying the destruction of the Punggye-ri test site, and increase pressure on the DPRK should it fail to comply or withdraw from the treaty.[15] However, regarding the benefits of signing the CTBT for the DPRK, apart from arguing that there is "no down side" for Chairman Kim Jong Un and that he can show his "bona fides," hardly anything is mentioned.[16] These "perks" are insufficient. The DPRK needs to see what there is to gain before agreeing to anything, just like when Pyongyang announced the moratorium, its calculation, as many believe, was to use it as leverage for potential negotiations with the US. In other words, the DPRK obtained political gains from announcing the moratorium.

Bearing this in mind, how to incentivize the DPRK to move forward with the CTBT process becomes the key question. This paper proposes the following policy recommendations as potential answers to this question:

1. The CTBTO should consider inviting the DPRK to take part in CTBTO training and workshops to build trust.
2. The international community should encourage the DPRK to vote in favor of United Nations General Assembly (UNGA) resolutions on the CTBT.
3. The international community should make it clear that the DPRK's signing of the CTBT counts as one of the reasons for international stakeholders to consider relaxing DPRK-related sanctions in the future. With appropriate efforts and coordination, these actions could not only facilitate the entry of the CTBT into force, but also end the current stalemate in the international community's efforts to engage with the DPRK. The rationale and feasibility of these recommendations are explained in the following paragraphs.

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[15] Stephen Herzog, "A Way Forward With North Korea: The Comprehensive Nuclear-Test-Ban Treaty," War On The Rocks, June 11, 2018, <https://warontherocks.com/2018/06/a-way-forward-with-north-korea-the-comprehensive-nuclear-test-ban-treaty/>. Lassina Zerbo, "The Nuclear Test Ban and the Verifiable Denuclearization of North Korea," Arms Control Today, November 2018, <https://www.armscontrol.org/act/2018-11/features/nuclear-test-ban-verifiable-denuclearization-north-korea>. Jon Wolfsthal, "Make North Korea's Nuclear Test Pause Permanent," 38 North, May 7, 2018, <https://www.38north.org/2018/05/jwolfsthal050718/>.

[16] Ibid.

Regarding CTBTO offering training and workshops to the DPRK, the non-political nature of such activities and the need for improving the DPRK capacity in disaster relief present a natural opportunity. Each year, the CTBTO runs training and workshops across a wide range of topics, including seismic data analysis, infrasound, and waveform processing. Several of these techniques can be used to detect natural events. Pyongyang, eager to address its insufficient capacity in natural disaster prevention and relief, is likely to be interested in certain CTBTO training topics.[17] Surely, any training or workshops offered to the DPRK have to be thoroughly reviewed to prevent them from advancing Pyongyang's military capability, but the pros of the CTBTO directly and positively engaging with the DPRK through such a confidence-building measure would be significant as the DPRK's faith in the CTBT can be enhanced.

On encouraging the DPRK to vote in favor of CTBT-related UNGA resolutions, there are also reasons to believe that it could be attractive to the DPRK and that it is achievable. First, fundamentally, signing the CTBT is in line with the DPRK's current policy. As many have observed, for the DPRK, there is no downside to signing the CTBT since the country is already in a moratorium, and Chairman Kim himself has said that further nuclear tests were no longer needed.[18] In early 2018, North Korea's permanent representative to the Conference on Disarmament even announced that the North will "join international disarmament efforts for a total ban on nuclear tests," which logically means joining the CTBT.[19]

Second, the legal nature of UNGA resolutions is conducive for this moderate progress, and the DPRK has very likely noticed it. Except for decisions regarding payments to the regular and peacekeeping budgets of the United Nations, UNGA resolutions are not binding for Member States.[20] This non-legally binding feature makes it more likely that the DPRK will vote in favor of the resolution on the CTBT, which is constantly on the UNGA agenda. According to diplomats who are familiar with the matter and spoke off the record, in 2018, the DPRK attempted to provide input for the draft text of the UNGA resolution on the CTBT. Although the attempt did not go through, it implies that the DPRK is interested in engaging in UNGA resolutions on the CTBT. Moreover, such a situation would not be unprecedented. Pakistan, despite being a non-signatory to the CTBT, has been voting in favor of the UNGA resolutions on the CTBT for years, which demonstrates that voting in favor would not force the DPRK to sign the treaty immediately.

Another benefit for the DPRK is that by voting in favor, the DPRK would be politically lifted to a somewhat better position at the UNGA sessions, whereas its "biggest enemy," the US, has been shifting between voting against and abstaining on CTBT-related resolutions.

Based on the recent episodes of US-DPRK talks outlined in this paper, the signals sent during the 8th Congress of the Workers' Party, and the DPRK's rejection of President Moon Jae-in's

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17 Antoine Bondaz and Eric Ballbach, "Coping With Natural Disasters: How the EU Can Support More Effective DPRK Disaster Management Mechanisms," 38 North, November 4, 2021, <https://www.38north.org/2021/11/coping-with-natural-disasters-how-the-eu-can-support-more-effective-dprk-disaster-management-mechanisms/>.

18 Soyoung Kim and Cynthia Kim, "North Korea says will stop nuclear tests, scrap test site," Reuters, April 21, 2018, <https://www.reuters.com/article/us-northkorea-missiles-idUSKBN1HR37J>.

19 Zerbo, "The Nuclear Test Ban and the Verifiable Denuclearization of North Korea."

20 Permanent Mission of Switzerland to the United Nations, The GA Handbook: A practical guide to the United Nations General Assembly (New York, NY: Permanent Mission of Switzerland to the United Nations, 2017), p. 52.

offer to sign an end-of-war declaration, it is clear that Pyongyang is, as it has traditionally been, most interested in sanctions relaxation that can bring economic improvement to the country. Given the substantive nature of the CTBT – which boils down to a ban on nuclear tests – the signing of this treaty alone can hardly bring the DPRK such economic benefits. Furthermore, the DPRK's signing of the CTBT would probably be too small a concession too to exchange it for any sanctions relaxation since the DPRK is still violating many of the United Nations Security Council (UNSC) resolutions. It is not rolling back its nuclear and missile programs, and may still be producing more fissile materials, as well as making other advancements in its weapons of mass destruction and missile programs.

However, packaging the signing of the CTBT as part of future sanctions relaxation can serve as a possible compromise solution for the DPRK and the international community. It could incentivize the DPRK while also demonstrating that the international stakeholders still hold fast to their standards. Here, engaging the US to negotiate an acceptable package or roadmap of sanctions relaxation is perhaps the most challenging task, for which the CTBTO, Russia and China could coordinate "behind the scene" their efforts to achieve the best effect. Such coordination may have already taken place: in September 2021, both the resolution in the General Conference of the IAEA and the declarations issued at the 12th Conference on Facilitating the Entry into Force of the CTBT included the content of the rollback terms of the DPRK-related UNSC resolutions, an idea which China and Russia have been proposing for years.[21] This also signals greater international support for considering an easing of sanctions. After all, many accompanying processes of denuclearization, including the dismantlement, remediation, and rehabilitation of test sites, cannot be achieved without some foreign aid, and therefore, a certain degree of sanctions relaxation (as this paper demonstrates when analyzing the Kazakhstan experience).

CONCLUSION

Based on the reasons above, linking the DPRK's signing of the CTBT with future sanctions relaxation, encouraging the DPRK to vote in favor of CTBT-related UNGA resolutions, and encouraging the CTBTO to offer training and workshops would be practical ways to break the current stalemate in facilitating the CTBT's entry into force and help improve the relations between the DPRK and the international community.

Meanwhile, it should be noted that the possibility of the DPRK abandoning the moratorium and restarting its nuclear tests still looms ahead. Regarding the self-imposed moratorium as leverage for future talks, the DPRK has threatened to end that moratorium in late 2019 and early 2020.[22] With the geopolitical situation in the Asia-Pacific region deteriorating, and with emerging new alliances such as the Quadrilateral Security Dialogue and the security pact between Australia, the United Kingdom, and the US potentially incentivizing new rounds of arms race, the current moratorium could be ended at any moment. The international community needs to act fast to facilitate the DPRK's progress with the CTBT before the opportunity is lost.

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[21] IAEA General Conference, GC(65)/RES/13, September 24, 2021. CTBT, "Draft Final Declaration and Measures to Promote the Entry into Force of the CTBT," CTBT-Art.XIV/2021/WP.1, September 23, 2021.

[22] Choe Sang-Hun, "North Korea Is No Longer Bound by Nuclear Test Moratorium, Kim Says," New York Times, December 31, 2019, <https://www.nytimes.com/2019/12/31/world/asia/north-korea-kim-speech.html>. Kelsey Davenport and Julia Masterson, "North Korea Reiterates End to Test Moratorium," Arms Control Now, January 30, 2020, <https://www.armscontrol.org/blog/2020-01-30/north-korea-denuclearization-digest>.

CORRECTING THE MOST SERIOUS MISTAKE: PROSPECTS FOR U.S. RATIFICATION OF THE CTBT*

Jeremy Faust ■ Artem Kvartalnov

ABSTRACT

This article examines the Senate debate regarding the Comprehensive Nuclear-Test-Ban Treaty (CTBT), traces a policy history of presidential administrations toward the CTBT since that debate, makes a case for why the U.S. should ratify the treaty, and recommends measures that may improve the prospects of U.S. ratification in the future. Following his election as the 46th President of the United States, Joe Biden – an outspoken advocate of the CTBT in the Senate – will have to decide whether to expend political capital on securing Senate advice and consent for the treaty. While the nuclear nonproliferation regime has seen many changes since the Senate last considered the CTBT in 1999, the debate over the treaty has remained remarkably static, with Republicans arguing that the treaty is unverifiable and threatens U.S. interests, and Democrats arguing that the treaty would lock in a U.S. testing advantage and strengthen U.S. global leadership. In examining the policy history of the treaty and making recommendations to facilitate U.S. ratification, this article seeks to reinvigorate the debate over the CTBT a quarter century after it first opened for signature.

"I truly think, I honestly believe that, in the 27 years I have been here, this is the most serious mistake the Senate has ever made — or is about to make."

Senator Joe Biden,
On the Senate's refusal to grant advice and consent to the Comprehensive Nuclear-Test-Ban Treaty,
U.S. Senate, 1999

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INTRODUCTION

On October 13, 1999, the U.S. Senate rejected the Comprehensive Nuclear Test Ban Treaty, which had been crafted to become the cornerstone of a nuclear order based on strong nonproliferation norms and the long-term vision of a world free of nuclear weapons. That fateful decision has now become a thing of the past. A CTBT observed but not ratified by the United States has come to be regarded as the new relatively stable status quo rather than something wrong and anomalous. In fact, this perception is deeply flawed. The Senate refusal to consent to the ratification of the CTBT harms the legitimacy of the nuclear nonproliferation regime, including the indefinite extension of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), which was predicated on the adoption of a nuclear test ban treaty. Without entry into force of the CTBT, progress on nuclear disarmament and nonproliferation has remained elusive, which has led to the advent of gift basket diplomacy and caused other non-binding approaches to flourish.

We are still living in a world where nuclear testing is legal. As of January 2022, 185 countries have signed the CTBT and 170 of them have ratified it. Eight Annex 2 states still have to ratify the Treaty for it to enter into force. One of these eight countries is the United States of America.[1] In 1999, Joe Biden, then a United States Senator from Delaware and ranking minority member of the Foreign Relations Committee, called the rejection of the CTBT "the most serious mistake" the Senate had made during his years in office. Wrongs need to be righted, and Joe Biden's presidency may provide the appropriate time for correcting the mistake made in 1999.

BACKGROUND

U.S. Signature of the CTBT and the Push for Senate Advice and Consent

On September 24th, 1996, U.S. President Bill Clinton signed the CTBT at the United Nations, declaring it ''the longest-sought, hardest-fought prize in arms control history.''[2] By banning nuclear weapons testing, the Clinton Administration sought to convince non-nuclear weapon states party to the NPT that the U.S. and other nuclear weapon states took seriously their Article VI commitment "to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament."[3] While Clinton's signing marked a historic milestone in efforts to ban nuclear weapons testing, it constituted just the first step in joining the treaty under U.S. law.

On September 22nd, 1997, Clinton formally submitted the CTBT to the Senate for advice and consent.[4] At that time, Republicans controlled the Senate with a 55-45 majority, which would remain throughout the CTBT ratification process. The split meant that the administration would have to convince 22 Republicans to vote for advice and consent. Clinton asked the Senate "to approve" the CTBT during his 1998 State of the Union Address, arguing that the

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1 CTBTO Preparatory Commission, Status of Signatory and Ratification, <https://www.ctbto.org/the-treaty/status-of-signature-and-ratification/>.

2 Alison Mitchell, "Clinton, at U.N., Signs Treaty Banning All Nuclear Testing," New York Times, September 25, 1996, <https://www.nytimes.com/1996/09/25/world/clinton-at-un-signs-treaty-banning-all-nuclear-testing.html>.

3 Treaty on the Non-Proliferation of Nuclear Weapons, March 5, 1970, Article VI.

4 Craig Cerniello, "Clinton Sends CTB Treaty to Senate: Hearing Set to Begin in October," Arms Control Today, Volume 27 (September 1997), <www.armscontrol.org/act/1997-09/press-releases/clinton-sends-ctb-treaty-senate-hearing-set-begin-october>.

treaty "can help to prevent the development of new and more dangerous weapons and make it more difficult for non-nuclear states to build them."[5] Despite Clinton's request, Senator Jesse Helms, Chairman of the Senate Foreign Relations Committee, decided to hold the treaty in committee and ended "a process of consultation between committee and administration staff that had been quietly going on since the treaty's submission to the Senate."[6] Without the support of Helms, the CTBT would sit in committee for over two years before receiving a hearing.

Senator Helms did not act alone in frustrating efforts to ratify the CTBT. Senator Jon Kyl, a conservative from Arizona, led Republican efforts to defeat the vote for advice and consent. Kyl hosted "gatherings of anti-treaty staffers," distributed "briefing books" for other Republican Senators, and organized meetings between senators and former defense and lab officials opposed to the CTBT. Kyl's staff also conducted whip checks to poll informally the number of senators opposed to the granting of advice and consent. From February to September 1999, the number of anti-treaty senators steadily grew, from "twenty-four firm no votes" to "forty-two solid votes against the CTBT," more than enough to refuse to grant advice and consent to ratification.[7]

Frustrated by Helms's decision to hold the treaty, Democrats threatened to obstruct Senate work until the CTBT received hearings and a date for a vote. Fearful of these threats, Majority Leader Trent Lott decided to offer a compromise on September 30th, 1999: he would bring the treaty to a vote within a week, with restrictions.[8] The Democrats, led by Minority Leader Tom Daschle, agreed to Lott's offer. After fourteen hours of debate between October 8th-12th, the Senate would vote on whether to grant advice and consent to the CTBT.

Despite its abbreviated schedule, the Senate general debate on the CTBT allowed proponents and opponents of the treaty to voice their views on whether the treaty advanced U.S. national interest. Kyl, the leading opponent of the CTBT, summarized his arguments against the treaty as follows:

> "[The CTBT] will jeopardize rather than enhance our national security. It will undermine our vital nuclear deterrent by jeopardizing the reliability of our nuclear stockpile. It will prevent us from making our weapons as safe as they can be. It will not stop nuclear proliferation, and it is not verifiable. It is not worthy of Senate approval."[9]

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5 Bill Clinton, "State of the Union Address," text reproduced at <https://www.washingtonpost.com/wp-srv/politics/special/states/docs/sou98.htm>, January 27, 1998 in Terry L. Deibel, "Inside the Water's Edge: The Senate Votes on the Comprehensive Test Ban Treaty," Georgetown University Edmund A. Walsh School of Foreign Service, Institute for the Study of Diplomacy Case Study Program, Case 290 (2003), <https://isd-georgetown-university.myshopify.com/products/inside-the-waters-edge-the-senate-votes-on-the-comprehensive-test-ban-treaty>, 4.

6 Deibel, 5.

7 Ibid., 10-11.

8 Ibid.,, 1.

9 145 Congressional Record, October 8, 1999, <https://www.congress.gov/106/crec/1999/10/08/CREC-1999-10-08-pt1-PgS12257-6.pdf>, S12262.

In addition to these concerns, Kyl also noted that the treaty failed to define "nuclear explosion" and argued that other states may hold a looser understanding of the test ban than the zero-yield standard understood by the United States, placing the U.S. at a disadvantage.[10]

In response to Republicans opposed to ratification, Democrats noted, in the words of then-Senator John Kerry, that the U.S. "enjoys a tremendous technological advantage over the other nuclear powers in both the sophistication of our weapons and our ability to maintain them reliably."[11] Kerry further argued that the CTBT's International Monitoring System would have the capability to detect any militarily significant testing, ensuring "an end to nuclear testing that advances the sophistication of current nuclear stockpiles or the development of new nuclear stockpiles."[12] Kerry also highlighted the CTBT's importance in securing the indefinite extension of the Non-proliferation Treaty (NPT) in 1995, noting that "failure of the United States to ratify the CTBT will seriously undercut our ability to continue our critical leadership role in the global nuclear non-proliferation regime."[13] Finally, Kerry noted that the Science Based Stockpile Stewardship program would allow the U.S. to maintain its nuclear arsenal without the need to engage in nuclear testing, "based on over 50 years of experience and analysis of over 1,000 nuclear tests, the most in the world."[14] In short, Democrats argued that the CTBT would enhance U.S. security interests by locking in the advantage of having conducted the most nuclear weapons tests and by preventing other nations from further testing their arsenals.

As the Senate debate veered towards a vote on advice and consent, Democrats realized that they lacked the votes required for ratification and, consequently, began a push for postponement. On October 12th, President Clinton sent a letter to Majority Leader Trent Lott requesting that he "postpone consideration of the Comprehensive Test Ban Treaty on the Senate floor."[15] Further, 62 Senators – including 24 Republicans – signed onto a letter dated October 12th, 1999, "supporting putting off the vote until the next Congress."[16] Despite calls for postponement, Lott – facing pressure from the conservative wing of his party – moved to resume consideration of the CTBT on October 13th in a party line vote of 55 Republicans to 45 Democrats.[17] Ultimately, the Senate refused to grant advice and consent to the CTBT in a 51-48 vote, returning the treaty back to the custody of the Senate Foreign Relations Committee.[18]

Changing Administrations, Changing Priorities

Despite the defeat in the Senate, President Clinton reiterated that the U.S. would continue a test moratorium, invited the other nuclear-weapon states to follow suit, and urged all

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10 Ibid., S12261.

11 Ibid., S12351.

12 145 Congressional Record, October 12, 1999, <https://www.congress.gov/106/crec/1999/10/12/CREC-1999-10-12-pt1-PgS12329-7.pdf>, S12351

13 Ibid., S12351-S12352

14 Ibid., S12352.

15 Ibid., S12333 in Deibel, 15.

16 Deibel, 16.

17 Ibid., 18

18 Eric Schmitt, "Defeat of a Treaty: the Overview; Senate Kills Test Ban Treaty in Crushing Loss for Clinton; Evokes Versailles Pact Defeat," New York Times, October 14th, 1999, <https://www.nytimes.com/1999/10/14/world/defeat-treaty-overview-senate-kills-test-ban-treaty-crushing-loss-for-clinton.html>.

nations to sign and ratify the CTBT.[19] In a letter dated October 18th, 1999, U.S. Secretary of State Madeline Albright further assured foreign ministers that "the United States will continue to act in accordance with its obligations as a signatory under international law, and will seek reconsideration of the treaty at a later date when conditions are better suited for ratification.»[20] Republicans rejected this view, with Lott arguing "if the Senate does not consent to ratification of a treaty – and in this case we didn't – it has no status for the United States in international law."[21] Helms also took issue with the Administration's interpretation, stating "since the Senate is a co-equal [in treaty-making] and the Senate has overwhelmingly vetoed the CTBT, the intention to never become a party has been made crystal clear."[22] Just over a year later, Republicans would retake the White House and redefine U.S. executive branch policy toward the CTBT.

As a candidate, George W. Bush left no doubts regarding his opinion of the CTBT. The 2000 Republican Party Platform referred to the treaty as an "anachronism of obsolete strategic thinking," arguing that the "treaty is not verifiable, not enforceable, and would not enable the United States to ensure the reliability of the U.S. nuclear deterrent."[23] Bush's 2001 Nuclear Posture Review reiterated this stance, noting that the Bush Administration would not seek ratification, but would maintain a unilateral nuclear testing moratorium.[24] John Bolton, then Undersecretary of State for Arms Control and International Security, went further, reportedly asking "the State Department's legal office to determine whether a president had the power to unilaterally withdraw a treaty pending before the Senate."[25] The State Department's lawyers responded that the president could not unilaterally withdraw a treaty from Senate consideration. The Bush Administration further reiterated its policy towards the CTBT in a July 5th, 2008 letter from Secretary of State Condoleezza Rice to Senator Kyl, highlighting numerous diplomatic statements expressing that the U.S. did "not intend to become a party to the treaty" and stating that "we do not believe the treaty imposes any current obligation on the United States resulting from U.S. signature in 1996, and we do not consider the United States to have obligations under international law as a signatory to the treaty."[26] Only six months after Rice's letter, the U.S. position on the CTBT would switch again, with the election of Barack Obama.

Following midterm elections in 2006, Democrats claimed only their second majority in the Senate since 1994. Section 3122 of the Senate draft version of the Fiscal Year 2008 National Defense Authorization Act (NDAA) noted "it is the sense of Congress that the Senate

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19 Deibel, 21-22.

20 Bill Gertz, "Albright says U.S. bound by nuke pact - Sends letters to nations despite Senate vote," The Washington Times, November 2, 1999, Page A1.

21 Bill Gertz, "Lott hits Clinton's stance on nuke pact - Says he's risking ties with Senate," The Washington Times, November 3, 1999, Page A1.

22 Gertz, "Lott hits Clinton's stance on nuke pact - Says he's risking ties with Senate."

23 Republican Party Platform of 2000, The American Presidency Project, University of California, Santa Barbara, July 31, 2000, <https://www.presidency.ucsb.edu/documents/2000-republican-party-platform>.

24 Congressional Research Service, "Comprehensive Nuclear-Test-Ban Treaty: Background and Current Developments," September 1, 2016, <https://crsreports.congress.gov/product/pdf/RL/RL33548>, 3.

25 Thom Shanker and David E. Sanger, "White House Wants to Bury Pact Banning Tests of Nuclear Arms," *New York Times,* July 7, 2001 <https://www.nytimes.com/2001/07/07/world/white-house-wants-to-bury-pact-banning-tests-of-nuclear-arms.htm>.

26 Letter From Secretary of State Condoleezza Rice to Senator Jon Kyl, July 5, 2008, reprinted in the Congressional Record, September 7, 2016, <https://www.govinfo.gov/content/pkg/CHRG-114shrg27232/pdf/CHRG-114shrg27232.pdf>, 45-47.

should ratify the Comprehensive Nuclear-Test-Ban Treaty, opened for signature at New York September 10, 1996."[27] In response to this section, 41 Republicans signed onto a letter written by Senator Kyl to Senate Armed Services Committee Chairman Carl Levin dated October 24th, 2007 that opposed the section, stating "we believe it denigrates the serious role of the U.S. Senate to claim in section 3122 to express the 'sense of the Congress' that the CTBT should be ratified."[28] The 2008 NDAA also convened a Congressional Commission on the Strategic Posture of the United States, chaired and vice-chaired respectively by former Secretaries of Defense William Perry and James Schlesinger.[29] The commission made two recommendations regarding the CTBT, calling for the Obama Administration to "secure P-5 agreement on a clear and precise definition of banned and permitted test activity" and "secure agreement among the P-5 to implement CTBT verification provisions without waiting for entry into force of the treaty," including on-site inspections.[30]

Just three months into his first term, President Barack Obama declared in his Prague speech that "my administration will immediately and aggressively pursue U.S. ratification of the Comprehensive Test Ban Treaty."[31] The overwhelming Democratic victory in the 2008 Senate elections also left Democrats with their largest majority since the early 1990s, at one point reaching a 60-40 split.[32] In such a Senate, advice and consent to CTBT ratification would likely have required only seven Republican votes. The administration's actions, however, did not match the president's rhetoric. Focused on domestic priorities and the negotiation and ratification of the New START Treaty, the Obama Administration did not make a concerted effort to secure CTBT ratification. As former Undersecretary of State for Arms Control and International Security Rose Gottemoeller has noted, securing Senate advice and consent to ratification of the New START Treaty required more political capital than expected, leaving little left for CTBT ratification.[33] By the time administration efforts began in earnest to educate the public and engage with Senators on the CTBT, Republicans had regained power in the Senate, with a majority of 54-46.

Late in his term, President Obama sought to promote the CTBT through a UN Security Council Resolution marking 20 years since the treaty's opening for signature. In the leadup to the resolution vote, the P-5 issued a September 15th, 2016 joint statement on the CTBT, reaffirming their nuclear test moratoria and "recognizing that a nuclear-weapon test

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27 U.S. Congress, Senate, To authorize appropriations for fiscal year 2008 for military activities of the Department of Defense, for military construction, and for defense activities of the Department of Energy, to prescribe military personnel strengths for such fiscal year, and for other purposes., S. 1547, 110th Cong., 1st sess., introduced in Senate June 5, 2007, <https://www.congress.gov/110/bills/s1547/BILLS-110s1547rs.pdf>.

28 153 Congressional Record, October 24, 2007, <https://www.congress.gov/110/crec/2007/10/24/CREC-2007-10-24-pt1-PgS13357.pdf>, S13358.

29 United States Institute of Peace, "Congressional Commission on the Strategic Posture of the United States," <https://www.usip.org/strategic-posture-commission/background>.

30 William J. Perry and James R. Schlesinger, "The Final Report of the Congressional Commission on the Strategic Posture of the United States," United States Institute of Peace, <https://www.usip.org/sites/default/files/America's_Strategic_Posture_Auth_Ed.pdf>, 87.

31 Barack Obama, "Remarks By President Barack Obama In Prague As Delivered," April 5, 2009, <https://obamawhitehouse.archives.gov/the-press-office/remarks-president-barack-obama-prague-delivered>.

32 United States Senate, "Party Division," <https://www.senate.gov/history/partydiv.htm>.

33 Anna Péczeli and Bruce Goodwin, "Technical Issues in the Comprehensive Nuclear Test Ban Treaty (CTBT) Ratification Debate: A 20 Year Retrospective," Lawrence Livermore National Laboratory, Center for Global Security Research (September 2020) <https://cgsr.llnl.gov/content/assets/docs/CGSRctbtONLINE.pdf>, page 49.

explosion or any other nuclear explosion would defeat the object and purpose of the CTBT."[34] A week later, the Security Council voted 14-0 to adopt Resolution 2130, which urges states to sign and ratify the CTBT and "calls upon all States to refrain from conducting any nuclear-weapon test or any other nuclear explosion."[35] Rather than raising support for the treaty on Capitol Hill, President Obama's efforts at the UN met fierce opposition from Republicans, who interpreted the UN Security Resolution as a means of effectuating an international nuclear test ban while circumventing the Senate's role of providing advice and consent to treaty ratification. Thirty-three Republican Senators signed onto Senator Marco Rubio's letter threatening to cut off funding for the CTBTO Preparatory Commission if the Security Council Resolution imposed binding restrictions on U.S. nuclear testing, while Senator Bob Corker, the Chairman of the Senate Foreign Relations Committee, held the first Senate hearings on the CTBT in nearly seventeen years.[36] Ultimately, the Obama Administration did too little, too late in its aborted attempt to seek ratification of the CTBT.

Reflecting the waning political salience of the CTBT, the 2016 Republican Party Platform made no mention of the treaty. In its Nuclear Posture Review, the Trump Administration stated that it would not seek CTBT ratification, while noting that it would "continue to support the Comprehensive Nuclear Test Ban Treaty Organization Preparatory Committee as well as the related International Monitoring System and the International Data Center."[37] In 2019, the head of the Defense Intelligence Agency, Lieutenant General Robert Ashley, accused Russia of conducting low-yield nuclear experiments in violation of its obligation under the CTBT, without substantiating the claim.[38] Shortly thereafter, Senator Tom Cotton, joined by three Republican colleagues, sent a letter to President Trump, in effect arguing that the U.S. should "unsign" the CTBT.[39] Just under a year later, news reports indicated that the intelligence community further believed that China may also have violated the zero yield standard adhered to by the United States.[40] As a response to these accusations, Trump Administration officials reportedly discussed resuming nuclear testing, which attracted

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34 "Joint Statement on the Comprehensive Nuclear-Test-Ban Treaty by the Nuclear Nonproliferation Treaty Nuclear-Weapon States," State Department, September 15, 2016, <https://2009-2017.state gov/r/pa/prs/ps/2016/09/261993.htm>.

35 UN Security Council Resolution 2310, S/RES/2310, September 23, 2016) <https://digitallibrary.un.org/record/842784#record-files-collapse-header>.

36 Marco Rubio to Barack Obama, September 8, 2016, <https://www.rubio.senate.gov/public/_cache/files/5144be8b-4cfc-422a-8017-cc19d362a778/6971525E619F533B35207A7868DEB787.ctbt-letter-final-2016.pdf>. See also *Hearing before the Committee on Armed Services*, S. Hrg. 114-724, The Administration's Proposal for a U.N. Resolution on the Comprehensive Nuclear Test-Ban Treaty, 114th Cong., 2nd sess., September 7, 2016, <https://www.govinfo.gov/content/pkg/CHRG-114shrg27232/pdf/CHRG-114shrg27232.pdf>.

37 Office of the Secretary of Defense, "Nuclear Posture Review," February 2018, <https://media.defense.gov/2018/ Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>, XVII.

38 Michael R. Gordon, "U.S. Says Russia Likely Conducting Low-Yield Nuke Tests, Defying Test Ban Treaty," *Wall Street Journal*, May 29, 2019, <https://www.wsj.com/articles/u-s-says-russia-likely-conducting-low-yield-nuke-tests-defying-test-ban-treaty-11559135102>.

39 Tom Cotton to Donald Trump, March 8, 2019, <https://www.cotton.senate.gov/imo/media/doc/190308_CTBT_Letter_POTUS.pdf>.

40 Michael R. Gordon, "Possible Chinese Nuclear Testing Stirs U.S. Concern," *Wall Street Journal*, April 15, 2020, <https://www.wsj.com/articles/possible-chinese-nuclear-testing-stirs-u-s-concern-11586970435>.

widespread criticism.[41] In the end, the Trump Administration did not take steps to resume testing and made no attempt to unsign the treaty, as advocated by Senator Tom Cotton.

THE BIDEN ADMINISTRATION AND THE CTBT

Upon coming into office in January 2020, Biden ran on a platform committing Democrats to push for ratification of the CTBT.[42] With an evenly divided Senate, the Administration would have to convince 17 Republican Senators to vote for advice and consent to ratification of the treaty. Given the increasing strength of the conservative wing of the Republican party and the fact that 29 current Republican Senators have either voted against or signed onto letters opposing the CTBT, the Biden Administration will have an uphill battle in seeking ratification of the treaty. To gain support of Senate Republicans, the Biden Administration will have to commit limited political capital and address Republican concerns repeatedly raised regarding the treaty over the past 25 years. These concerns include the lack of a definition of nuclear explosion in the CTBT, the verifiability of the treaty, and whether the U.S. can maintain – and modernize – its nuclear deterrent without a return to testing.

Table 1. Current U.S. Senators and the CTBT

Voted For in 1999<?>	Richard Durbin (D), Dianne Feinstein (D), Patrick Leahy (D), Patty Murray (D), Jack Reed (D), Charles Schumer (D), Ron Wyden (D)
Voted Against in 1999<?>	Susan Collins (R), Mike Crapo (R), Chuck Grassley (R), James Inhofe (R), Mitch McConnell (R), Richard Shelby (R)
2007 Kyl Letter Opposing CTBT Ratification<?>	John Barrasso (R), Richard Burr (R), John Cornyn (R), Mike Crapo (R), Lindsey Graham (R), Chuck Grassley (R), James Inhofe (R), Mitch McConnell (R), Lisa Murkowski (R), Richard Shelby (R), John Thune (R)
2016 Rubio Letter Opposing Obama UN Resolution on CTBT<?>	John Barrasso (R), Roy Blunt (R), John Boozman (R), Bill Cassidy (R), Susan Collins (R), John Cornyn (R), Tom Cotton (R), Ted Cruz (R), Deb Fischer (R), Lindsey Graham (R), James Inhofe (R), Ron Johnson (R), James Lankford (R), Jerry Moran (R), James Risch (R), Michael Rounds (R), Marco Rubio (R), Ben Sasse (R), Tim Scott (R), Dan Sullivan (R), Thom Tillis (R), Roger Wicker (R)
2019 Cotton Letter Calling for Unsigning the CTBT<?>	John Cornyn (R), Tom Cotton (R), James Lankford (R), Marco Rubio (R)

Table 2. Evolution of the U.S. Approach to the CTBT

Period	U.S. Administration	U.S. Congress

[41] John Hudson and Paul Sonne, "Trump administration discussed conducting first U.S. nuclear test in decades," *Washington Post,* May 22, 2020, <https://www.washingtonpost.com/national-security/trump-administration-discussed-conducting-first-us-nuclear-test-in-decades/2020/05/22/a805c904-9c5b-11ea-b60c-3be060a4f8e1_story.html>.

[42] Democratic Party Platform of 2020, The American Presidency Project, University of California, Santa Barbara, August 17, 2020, <https://www.presidency.ucsb.edu/documents/2020-democratic-party-platform>.

Clinton Administration 1993-2001 (D)	Consent to the zero-yield standard; CTBT negotiations; Signing of the CTBT; Advocacy for CTBT ratification; Nuclear test moratorium reaffirmed.	CTBT is submitted to the Senate; 45-55 split in the Senate; Failure to provide advice and consent.
W. Bush Administration 2001-2009 (R)	Not seeking ratification but maintaining a unilateral nuclear test moratorium; John Bolton contemplates the possibility of withdrawing the CTBT from Senate consideration; Condoleezza Rice states that the U.S. has no obligations as a signatory to the CTBT.	Democrats push for CTBT ratification in the draft 2008 NDAA; Congressional Commission on the Strategic Posture of the United States advocates for a specification of banned and permitted test activities.
Obama Administration 2009-2017 (D)	Prague Speech calls for CTBT ratification; CTBT ratification efforts are sidelined amid New START ratification challenges; UNSC resolution in support of CTBT ratification.	Democratic victory and large majority in the Senate; Loss of Democratic Senate Majority in 2010 midterm elections; Republican Senators oppose the UNSC resolution on the CTBT.
Trump Administration 2017-2021(R)	U.S. accuses Russia of conducting low-yield nuclear experiments; Discussions on a potential resumption of nuclear tests.	Some Republican Senators advocate “unsigning” the CTBT.
Biden Administration 2021-present (D)	Allegations against Russia are upheld; The Democratic platform endorses the CTBT, but the Administration takes no immediate action.	

WHY THE U.S. SHOULD RATIFY THE CTBT

CTBT Ratification and U.S. National Security Interests

Today, a case can be made that the strategy of resisting the CTBT lacks a consistent logic behind it. First and foremost, the technical concerns voiced in 1999 have either been addressed or become irrelevant. The Stockpile Stewardship Program (SSP) is a long-standing reality, and it is increasingly difficult to doubt the SSP’s effectiveness and feasibility 26 years after the program was conceived. Under both Democratic and Republican Administrations, the United States has poured billions of dollars into the SSP. Any Senator arguing that the program is insufficient or ineffective would question the policy previously pursued by fellow party members. Moreover, the SSP’s usefulness has over time been acknowledged in the National Laboratories with lab directors stating “that they certainly understand much more about how nuclear weapons work than during the period of nuclear testing.”[43] According to Parney Albright, former director of the Lawrence Livermore National Laboratory, testing

[43] Opening Remarks at the NNSA Stockpile Stewardship Program 20th Anniversary Event, October 22, 2015, <https://www.energy.gov/articles/opening-remarks-nnsa-stockpile-stewardship-program-20th-anniversary-event-delivered>.

is "a bad strategy, since our adversaries have not made the investments in the SSP that we have made, hence have less confidence in their weapons than we do, and hence stand by far the most to gain with a resumption of testing."[44] Therefore, CTBT ratification would allow the U.S. to restore global leadership by effectively exploiting America's technological edge.

Further, the U.S. has apparently accepted some of the deficiencies cited as reasons not to ratify the CTBT in the case of other treaties. As much as we would like to think otherwise, no single arms control, disarmament or nonproliferation treaty has ever been 100% verifiable. The Nuclear Non-Proliferation Treaty (NPT), widely regarded as the high point of multilateralism and universality, is no exception. The IAEA Additional Protocol "enhancing the IAEA's ability to detect undeclared nuclear material and activities"[45] has not been universalized yet, which means that we may simply lack information about some nuclear activities of concern. Is the risk of hydronuclear tests, which cannot lead to major weapon improvements, a sufficient reason to postpone the ratification of the CTBT provided that the risk of nuclear proliferation has not led us to question the value of the NPT?

Worth noting is that the logic of retaining a capability until everyone else has relinquished it is not the only game in town either. The Chemical Weapons Convention (CWC), prohibiting the development, production, stockpiling and use of chemical weapons, has been ratified by the United States, even though some other countries have neither signed nor ratified the Treaty. In fact, the U.S. is not linking the elimination of its own stockpile with the performance of either signatories or non-signatories, which is despite the fact that chemical weapons are no less dangerous than nuclear arms.

The U.S. would clearly benefit from CTBT ratification even if compliance and CTBT universalization issues remained unresolved. The history of nuclear nonproliferation demonstrates that violations can be detected and prevented reasonably well, although the international community lacks some specific details. There is every reason to believe that the CTBT framework, including its IMS and on-site inspections, suffices to minimize the ambiguity of foreign-policy decision making. The potential rise of another nuclear power would not go unnoticed by the United States with the CTBT in force.

CTBT Ratification and the Status Quo

It is equally important to acknowledge that the very idea of the status quo being beneficial or acceptable to the United States is based on false premises. To begin with, there is no alternative for the CTBT that would be better for U.S. interests. The CTBT cannot be renegotiated after most countries of the world have ratified it: it can be either accepted or rejected. In legal terms, a CTBT that has not gone into effect is not much different from a CTBT that has never been conceived. It is only after the CTBT enters into force that the U.S. will truly benefit from the global norm against nuclear testing.

Next, the notion of not being the only "obstacle to the entry into force" that has been implicitly adopted by policy circles in the United States and clearly articulated by China[46] implies that individual ratifications of the CTBT do not matter anymore, which is simply

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[44] Péczeli and Goodwin, 19.

[45] International Atomic Energy Agency, "Additional Protocol," <https://www.iaea.org/topics/additional-protocol>.

[46] Remarks by Ambassador Zhang Jun at Security Council Briefing on the Comprehensive Nuclear-Test-Ban Treaty, September 27, 2021, <https://www.fmprc.gov.cn/ce/ceun/eng/hyyfy/t1910386.htm>.

wrong. All Annex 2 States that have not ratified the CTBT share responsibility for the failure to indefinitely ban nuclear testing. There is no single spoiler, whether it be the DPRK or the United States. A U.S. ratification would definitely bring us closer to the entry into force since it would change the political calculus of the remaining seven states.

Last but not least, the present status quo strongly resembles a classical catch-22 situation: key U.S. concerns about the CTBT cannot be addressed until the CTBT enters into force. On-site inspections appear to be the only foolproof way to monitor compliance in cases where the International Monitoring System (IMS) is deemed incapable of detecting activities of concern, such as hydronuclear tests. Since on-site inspections are provided for in the CTBT, you need the CTBT to make sure that neither Russia nor China conducts hydronuclear tests. Before the Treaty's entry into force, Moscow and Beijing can barely be accused of violating even their self-imposed moratoria, as the specific terms of the moratoria are determined domestically rather than internationally.

CTBT Ratification and Normative Considerations

The non-ratification of the CTBT is also problematic from the normative perspective. A liberal democracy cannot contemplate national security measures causing evident damage to civilians in peacetime. The fact that some countries act otherwise is no justification for a potential resumption of nuclear tests contaminating indigenous lands in the United States. Moreover, the normative argument extends to the international level. According to Article VI of the NPT, Parties to the Treaty undertake "to pursue negotiations in good faith" on effective measures leading to nuclear disarmament.[47] The indefinite extension of the NPT in 1995 was implicitly conditioned upon banning nuclear tests. The failure to bring into force the CTBT effectively constitutes a broken promise, and it is widely known that broken promises tend to unravel international trust and cooperation.

RECOMMENDATIONS

Advocacy and Outreach in Times of Polarization

When the U.S. Senate decisively rejected the CTBT in 1999, 70 percent of the American public supported the Treaty, whereas only 13 percent opposed it.[48] There can be no better indication of how crucial it is to directly engage with stakeholders on Capitol Hill. This holds true even today, when Democrats and Republicans are more polarized than ever in the post-Cold-War era.

First, increased polarization has visibly strengthened party discipline. Although this renders the strategy of winning over individual Senators less effective, there may be more space for broader agreements between the two sides of the aisle. The provision of funding for weapon modernization in exchange for the ratification of an arms control agreement is a proven strategy. New tradeoffs can be developed at the intersection of nuclear policy, cyber security, outer space affairs and conventional weapons modernization. If CTBT ratification is put high on the political agenda, a tradeoff at the intersection of domestic and international policies will also be conceivable.

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47 Treaty on the Non-Proliferation of Nuclear Weapons.

48 Joseph Cirincione, "Status, Prospects and Politics: the Comprehensive Test Ban and Nuclear Non-Proliferation Treaties," June 28, 1999, <https://carnegieendowment.org/1999/06/28/status-prospects-and-politics-comprehensive-test-ban-and-nuclear-non-proliferation-treaties-pub-137>.

Second, it is still possible to identify moderate and radical Senators. As difficult as it is, CTBT advocates may start approaching those Senators and staffers who are less likely to tenaciously oppose ratification but who still doubt the value of the CTBT. A carefully streamlined advocacy campaign may yield positive results even in challenging circumstances.

Further, international advocacy efforts aimed at the CTBT's entry into force and its ratification by the U.S. may be reshaped to maximize the impact on the U.S. domestic political agenda. As Robert Putnam put it in 1988, "international pressure is more likely to reverberate negatively if its source is generally viewed by domestic audiences as an adversary rather than an ally."[49] It seems that Russia and China have dominated the public discourse surrounding the CTBT in recent years. If the European Union and Washington's Asian allies reaffirmed their commitment to the Treaty's entry into force and publicly urged the United States to ratify the CTBT, they would certainly help those arguing for ratification on American soil.

Securing broader popular support is no less important, though not in itself sufficient. We currently lack information on how Americans feel about the nuclear test ban simply because those few opinion polls that are available were carried out quite a while ago.[50] Moreover, in the years following the 1999 vote in the Senate, surveys on the issue have been commissioned and their results have been distributed by research institutions dealing specifically with international relations issues rather than by world-renowned polling organizations. Measuring public attitudes and letting the CTBT escape from the think tank world to the daily reality are two initial steps needed to revitalize the public debate.

Think tanks and academia can bring about this change. The competition for public attention is getting increasingly fierce, especially as the COVID-19 pandemic has sidelined other existential threats to humanity. The campaign for CTBT ratification should be a collaborative effort. No single research center can shoulder the entire burden of swaying public opinion and building momentum in the Senate. Public events, articles, and research projects dedicated to the nuclear test ban would be a good start. More elaborate efforts, including outreach to local communities suffering from the adverse consequences of nuclear testing, may follow later.

CTBT advocates should ensure definite support from National Laboratories and their technical specialists before discussing CTBT ratification in the Senate. Although there have been some clear indications that many lab experts endorse the CTBT today, we do not know yet whether they constitute a stable majority. In 1999, the false sense of support from the labs was crushed during Senate hearings. The U.S. administration cannot allow this to happen again.

Changing the Environment and Addressing Concerns

Although the CTBT ratification controversy is indeed embedded in U.S. domestic politics, other nuclear powers still have leverage over the ratification process. Some of the concerns raised by American legislators are directly linked to Washington's perceptions of Moscow's and Beijing's policies. In April 2021, Russian Foreign Ministry Spokeswoman Maria Zakharova

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[49] Robert D. Putnam, "Diplomacy and Domestic Politics: The Logic of Two-Level Games," International Organization, Vol. 42, No. 3 (Summer, 1988), 456.

[50] Alicia Sanders-Zakre, "Majority of Americans Still Support the CTBT," Arms Control Now, June 21, 2018, <https://www.armscontrol.org/blog/2018-06-21/majority-americans-still-support-ctbt>.

said that "the completely baseless charge that Russia is out of compliance with the nuclear test ban" is "nothing short of perplexing."[51] The charge, however, has appeared in the State Department's Adherence and Compliance Report for several years in a row under two different administrations, so it indeed reflects opinions held by responsible authorities and deserves attention. Quite a lot can be done by nuclear-weapon states jointly to mitigate U.S. concerns.

First, nuclear-weapon states may reaffirm their commitment to the zero-yield standard. The UN Security Council would probably be a wrong platform for this kind of reaffirmation, given the Obama Administration's experience of alienating the Senate in 2016. Therefore, nuclear-weapon states should pursue a high-level restatement within the framework of the P5 Process that would be considered credible by domestic audiences.

Second, the United States and Russia may develop test site transparency and verification measures using the experience of verifying the Threshold Test Ban Treaty, as proposed by Jeffrey Lewis.[52] Similar ideas have been voiced by a number of Russian experts, including Viktor Slipchenko.[53]

Third, the United States, Russia, and China could jointly conduct verification experiments modeled off the 1988 U.S.-Soviet Joint Verification Experiment. Such verification experiments would allow for the development of signatures that might help differentiate between permitted hydrodynamic testing and banned hydronuclear testing.[54]

Fourth, the United States, Russia, and China could use the P5 framework to negotiate a protocol to the CTBT that would clearly define a nuclear test explosion and include "a clear and precise definition of banned and permitted test activity," as suggested by the Perry-Schlesinger Commission.[55] Such a protocol should also include provisions for on-site inspections at testing sites prior to CTBT entry-into-force.

One may argue that if China and Russia agree to implement the above-mentioned steps, the United States will have no further incentives to seek ratification. Therefore, many of the proposed measures can be tied to the ratification process in the United States and China. One option would be to secure a legally binding commitment to those measures, while postponing their implementation until after the CTBT has been ratified.

CONCLUSION

Although the United States signed the CTBT in 1996, the U.S. Senate failed to provide its advice

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51 Comment by Foreign Ministry Spokeswoman Maria Zakharova on the US State Department's report 2021 Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments, April 21, 2021, <https://www.mid.ru/en/foreign_policy/news/-/asset_publisher/cKNonkJE02Bw/content/id/4697720>.

52 Jeffrey Lewis, "U.S.-Russia Test Site Transparency Measures: Avoiding a Return to the Arms Race," November 14, 2018, <https://www.nti.org/analysis/articles/us-russia-test-site-transparency-measures/>.

53 Viktor Slipchenko, "Some Considerations Regarding the Ratification of the CTBT by the United States," July 24, 2009, <https://carnegiemoscow.org/2009/07/24/some-considerations-regarding-ratification-of-ctbt-by-united-states-pub-40415>.

54 Frank N. von Hippel, "Commentary: Transparency for nuclear weapons test sites," *Physics Today*, 73, 5, 10 (2020), <https://physicstoday.scitation.org/doi/10.1063/PT.3.4463>.

55 "The Final Report of the Congressional Commission on the Strategic Posture of the United States," 87.

and consent to the Treaty three years later. Since then, both Democratic and Republican administrations have been unwilling to devote the political capital to change the status quo, even though Democrats are generally supportive of the CTBT. As indicated by our analysis, 29 current Republican Senators have either voted against or signed onto letters opposing the CTBT. It is indeed difficult to secure ratification under these circumstances.

Despite consistently opposing ratification of the CTBT, Republican administrations in the US have grown less hostile over time to the treaty and its constituent institutions, including the International Monitoring System and the International Data Center. Nonetheless, a vocal minority of Republican Senators remain fiercely opposed to the CTBT, going so far as to advocate for "unsigning" the treaty. For any progress toward ratification to take hold, an administration supporting the CTBT will have to address Republican concerns regarding the verifiability of the treaty, the lack of definition of nuclear explosion, and other nations' compliance with the zero-yield standard. Addressing these concerns could go a long way toward securing support for ratification among more moderate Republican Senators.

Yet, it would be fundamentally wrong to assume that uncertainty over the fate of the Treaty is in America's interest. A CTBT that has not entered into force creates no specific legal obligations, while the terms of national moratoria are determined domestically rather than internationally. The belief that a functioning CTBT would undermine U.S. security is also erroneous. Concerns about maintaining a reliable nuclear arsenal without testing have largely been addressed by the Stockpile Stewardship Program. Moreover, verification challenges have not prevented the U.S. from joining other important arms control and nonproliferation regimes.

A policy aimed at achieving U.S. ratification should be informed by an understanding that the ratification debate is embedded in U.S. domestic politics but still influenced by international developments. On the one hand, carefully crafted advocacy efforts are needed to sway public opinion and alter the existing dynamics on Capitol Hill. On the other hand, Russia, China, as well as other nuclear-weapon states can do quite a lot collectively to mitigate U.S. concerns.

It is crucial to bear in mind that securing the Senate's advice and consent to the CTBT is the only way to get the Treaty ratified by the United States. There is no way around this. Only the Senate can correct what Joe Biden called its "most serious mistake" in 1999.

THE POTENTIAL FOR US-CHINA COOPERATION ON CTBT ISSUES

A Historical Overview and Pathways Forward

■ Tianjiao Jiang ■ Jamie Withorne

ABSTRACT

Currently, the US and China face a serious trust deficit that has spilled over into nuclear issues, negatively impacting what little cooperation once existed. The Comprehensive Test Ban Treaty (CTBT) poses a unique avenue for potential cooperation in the nuclear realm, especially given that both China and the US have recently reported a willingness to engage one another in "discussion on strategic stability". This paper provides an overview of the two countries' past contributions to the CTBT, past examples of US-China nuclear cooperation, and potential pathways forward on CTBT challenges. We recommend that both countries should renew a positive and proactive attitude toward CTBT issues, create a better international security environment that can better support the ratification of the CTBT, and take broad actions to further facilitate the entry into force of the CTBT.

INTRODUCTION

In recent years, the need for entry into force of the Comprehensive Test Ban Treaty (CTBT) has grown ever more apparent. Since the adoption of the Treaty on the Prohibition of Nuclear Weapons (TPNW) at the UN General Assembly in 2017, non-nuclear weapon states (NNWS) and relevant non-governmental organizations have paid close attention to the issue of nuclear weapons testing. As these advocates of banning nuclear weapons testing have noted, if nuclear weapons tests were to resume, they would erode existing international arms control and disarmament regimes and endanger the health and safety of all mankind.[1]

Against this background, many countries believe that nuclear weapon states (NWS) bear the responsibility for the entry into force of the CTBT, as has been expressed by the member states of the non-aligned movement to the preparatory meeting for the Tenth Non-Proliferation Treaty (NPT) Review Conference. This sentiment demonstrates that if the rest NWS (i.e., China and the United States) choose to ratify the CTBT, they can establish a precedent, encouraging other countries from the Annex 2, to potentially also sign and ratify the treaty. The signature and ratification of the CTBT by all NWSs, in theory, has the potential to trigger a domino effect, wherein pending their action, NNWS and de-facto nuclear-weapons states

1 International Campaign to Abolish Nuclear Weapons, "ICAN Condemns U.S. Consideration of Resuming Nuclear Testing," May 23, 2020, <https://www.icanw.org/ican_condemns_u_s_consideration_of_resuming_nuclear_testing>.

will be encouraged to follow in their footsteps, resulting in a resounding positive impact of promoting the entry into force of the treaty.[2]

The entry into force of the CTBT is an essential step towards achieving the objectives of nuclear disarmament and nonproliferation. However, when it comes to ratification of the treaty, there appears to be a global standoff in which Annex 2 states are looking towards the US to "go first." China has previously told US officials that they would ratify "five minutes after" the US.[3]

Although China and the US have been facing trade disputes and strategic competition for some time, both Beijing and Washington realize the importance of maintaining strategic stability, as demonstrated by President Xi and President Biden's video call in November 2021.[4] Considering this, CTBT offers a unique opportunity for US-China cooperation to prevent further exacerbation of competition that has manifested itself in other domains. Both states have contributed substantially to the treaty and have a vested interest in its success. This paper argues that US-China cooperation on CTBT related issues can improve US-China nuclear transparency, thereby contributing to lowering the tensions between the two states and further promoting and nurturing a global nuclear arms control and disarmament agenda.

CHINA, THE US, AND THE CTBT

China has taken numerous efforts to promote the CTBT. Specifically, at the 11th conference on promoting the entry into force of the CTBT, the Chinese delegation put forward four proposals promoting the entry into force of the CTBT: 1) creating a universal international security environment and strengthening the foundation for the entry into force of the CTBT; 2) maintaining the international arms control and nonproliferation system and consolidating the institutional guarantee for the effectiveness of the CTBT; 3) supporting the goals and objectives of the CTBT and creating favorable conditions for the entry into force of the treaty and; 4) promoting the preparations for the implementation of the treaty and laying the capacity foundation for the entry into force of the treaty.[5] Since the presentation of these proposals, China has taken practical actions promoting these goals by: 1) solving regional security problems through dialogue and consultation to begin to help eliminate the root causes of nuclear weapons proliferation; 2) safeguarding the legitimacy of the international nonproliferation regime; 3) reducing the role of nuclear weapons in national security policy and; 4) actively promoting the domestic implementation preparations of the CTBT by building international monitoring systems (IMS) stations and participating in CTBTO seminars.

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2 United Nations, "Nuclear Testing, Working Paper Submitted by the Group of Non-Aligned States Parties to the Treaty on the Non-Proliferation of Nuclear Weapons," Preparatory Committee for the 2020 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, March 21, 2019, <https://documents-dds-ny.un.org/doc/UNDOC/GEN/N19/081/59/PDF/N1908159.pdf?OpenElement>.

3 These notes are from the author's interview with former director of the Los Alamos National Laboratory and affiliate of Stanford University, Dr. Siegfried Hecker.

4 Alex Leary, "Biden, Xi Open to Nuclear-Arms Talks, White House Says," The Wall Street Journal, November 17, 2021, <https://www.wsj.com/articles/biden-xi-open-to-nuclear-arms-talks-white-house-says-11637098592>.

5 外交部:《中国代表团团长傅聪在第十一届促进<全面禁止核试验条约>生效大会上的发言》, 2019年9月26日, <https://www.fmprc.gov.cn/web/wjb_673085/zzjg_673183/jks_674633/fywj_674643/t1702105.shtml>.

While there have been concerns about US commitment to the principles of the CTBT under the country's previous administration, the US has historically been committed to adhering to and promoting the objectives of the CTBT. Importantly, the US took a leading role in negotiations that established the CTBT, signed the CTBT in 1996, and has not conducted a nuclear weapons test since 1992. The CTBT's innate ability to prevent potential nuclear proliferation is of key interest to the US and its strategic goals. The US has officially stated that it "does not need to conduct nuclear explosive tests in order to ensure the safety, security and effectiveness of the nuclear forces (it) retains to deter nuclear attacks against the US, (its) allies and partners. Moreover, reinforcing the international norm against nuclear explosive testing is very much in the US national security interest."[6]

Although the US has not been able to ratify the CTBT, in large part due to domestic political restraints, it has made substantial contributions in the hope of ensuring the treaty's success. Over the years, the US has provided substantial funding to the CTBTO. According to recent budget reports, the US has provided 22.47% of the CTBTO's annual funding.[7] Similarly, the US has made several in-kind contributions to assist in the operation and maintenance costs of all IMS facilities located in the US, and has supported software development for the International Data Center, valued at around $9 million dollars.[8]

While the US has historically had difficulties ratifying the CTBT due to domestic constraints, it is possible that the Democratic administration under the leadership of President Biden might frontline nuclear weapons testing issues by pursing a more proactive approach regarding treaty ratification.[9]

PAST US-CHINA CTBT COOPERATION

The 1990s were a pivotal moment for both the CTBT and the US and China's respective foreign policies. Following the end of the Cold War, the US was primarily concerned with establishing itself in the "New World Order," focusing on issues in Europe and the Middle East, as well as on topics such as ethnic conflicts and genocide and the preservation of US economic and trade interests.[10] Around the same time, under the leadership of Deng Xiaoping and Jiang Zemin, China was primarily concerned with adopting a socialist market economy and opening China's economy to the world markets. From 1994, the UN Conference on Disarmament began formal negotiations on the CTBT, which opened for signature in 1996.

In the past, there was no formal cooperation between the US and China on CTBT issues, including with respect to nuclear programs or testing. However, in the mid- to late 1990s, there were several joint activities between the two countries' nuclear laboratories, as well as broader cooperative nuclear activities.

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6 US Department of State Archive, "Comprehensive Nuclear Test-Ban Treaty," <https://2009-2017.state.gov/t/avc/c42328.htm>.

7 Daryl Kimball, "US Support for the CTBTO Enhances US and Global Security," Arms Control Association, May, 2017, <https://www.armscontrol.org/Issue-Briefs/2017-05/us-support-ctbto-enhances-us-global-security>.

8 Ibid.

9 Meri Lugo, "Biden Makes the Case for CTBT; Reaffirms the Reliability of Nuclear Stockpile," Arms Control Association, February 18, 2018, <https://www.armscontrol.org/blog/2010-02-18/biden-makes-case-ctbt-reaffirms-reliability-nuclear-stockpile>.

10 US Department of State Archive, "The Post-Cold War Era," <https://2001-2009.state.gov/r/pa/ho/time/pcw/index.htm>.

Beginning in 1994, as the US was preparing to sign the CTBT, United States representatives from the Los Alamos National Laboratory visited a Chinese nuclear laboratory near Chengdu.[11] During that visit, officials held discussions on nuclear testing, including zero yield and hydro-nuclear experiments. Notably, at the time of these visits in the 1990s, while the US had previously pursued and conducted these types of nuclear tests, China had only conducted underground hydro-nuclear experiments and not full-scale device tests.[12]

Unfortunately, the 1999 Cox Report that accused China of stealing "design information on the United States' most advanced thermonuclear weapons" and illegally obtaining U.S. missile and space technology put an end to these interactions.[13] While this report has since been widely discredited, it severely offended China at the time of publication, ultimately leading nuclear cooperation to a standstill from 1999 to 2005. Around 2004-2005, the US tried to resume cooperation with China, but such cooperation was difficult to achieve. However, around 2005, as Beijing was preparing for the Olympics, limited nuclear cooperation between the countries resumed. This re-started cooperation had an emphasis on nuclear terrorism, with the main objective of ensuring the safety of Olympic participants and attendees, including intermediary assistance from the IAEA.[14]

Additional cooperation between the countries resumed under the Obama administration, where the US held several bilateral nuclear security meetings in the hope of continuing cooperation with China on nuclear issues. Since 2015, the main nuclear cooperation between the US and China has largely centered around analysis of North Korea's nuclear activities and discussions of potential diplomatic engagement[15], and reviving the Iran nuclear deal (JCPOA) as part of the Vienna talks, which started in April 2020.

ADDRESSING THE TRUST DEFICIT

It is crucial to note that the main source of tension between the US and China historically was not in the nuclear sphere, but rather in the ideology and international trade dimensions, with a recently added layer of regional and global security. Given the US policies and their effects on Chinese attitudes toward America, as well as the recent regional deterrence developments led by the US (including but not limited to the plans to deploy previously banned INF-range weapons and the creation of new military cooperation formats such as AUKUS), it is unlikely that relations between the two countries will warm soon. On the other end of the spectrum, over the years, the US has become significantly more concerned

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11 Author's interview with Dr. Siegfried Hecker.

12 Thomas Reed, "The Chinese nuclear tests, 1964-1996," Physics Today, Vol. 61, No. 9 (2008), <https://doi.org/10.1063/1.2982122>.

13 The report is commonly referred to as the Cox Report after Representative Christopher Cox, the Chairman of the committee that produced it. Select Committee on U.S.National Security and Military/Commercial Concerns of the People's Republic of China, Report of the Select Committee on U.S. National Security and Military/Commercial Concerns of the People's Republic of China (Washington, D.C.: U.S. Government Printing Office, 1999), ii, xii, <https://www.govinfo.gov/content/pkg/GPO-CRPT-105hrpt851/pdf/GPO-CRPT-105hrpt851.pdf>.

14 IAEA, "Press Briefing on IAEA Nuclear Security Assistance to Beijing Olympics," July 2008, <https://www.iaea.org/newscenter/mediaadvisories/press-briefing-iaea-nuclear-security-assistance-beijing-olympics>.

15 Doug Bandow, "Can China and the US Cooperate on North Korea?", Cato Institute, August 3, 2020, <https://www.cato.org/commentary/can-china-us-cooperate-north-korea>.

about China's nuclear program, including with respect to its arsenal size, and suspicions associated with the increasing sophistication of China's nuclear weapons systems.[16]

Ultimately, tensions in other domains (i.e., economic and conventional military) have the potential to impact whatever cooperation might occur in the nuclear sphere, including with respect to the CTBT and its ratification.

At the bilateral level, since the US first put forward its Pivot to Asia strategy in 2012, US-China strategic trust has remained at a relatively low level. Arguably, recent trends in the two countries' respective foreign policies would suggest that China views this strategy as a type of containment, whereas the US claims it helps ensure the regional interests of the US and its allies. Regardless, it is clear that this strategy has culminated in a series of events that have led the US and China to view each other as anything but partners.

China is worried by US reluctance to ratify the treaty (as it has explicitly stated in its past nuclear postures[17]) and the potential for the US to continue to develop advanced nuclear weapons systems. China's views are largely driven by their own desire for deterrence against an aggressive US foreign policy.[18] This, in turn, is similar to the US concerns about the potential growth of China's nuclear arsenal and the advanced weapons system build-up that has recently been revealed.[19]

Notably, China and the US share very different nuclear strategic thinking. In terms of the CTBT, China is used to approaching the issue vis-à-vis a broader security perspective. The Chinese government believes that nuclear weapons proliferation has a complicated foundation that needs to be addressed in a comprehensive manner. Similarly, on the issue of CTBT ratification, China also believes that nuclear testing issues cannot be considered in isolation. Rather, these issues must be linked to the development of global security and respective nuclear postures.

Over the past decade, the global security environment has not been optimistic. The US has invested heavily in the modernization of its nuclear weapons and missile defense systems, withdrawn from several nuclear arms control agreements, and engaged in military competition in East Asia. As mentioned above, the US is likewise concerned about China's nuclear posture and developments. It is clear that China has been developing and upgrading its nuclear weapons arsenal, as well as several advanced weapons systems, causing concern among US military planners.

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16 US Office of the Secretary of Defense, "Military and Security Developments Involving the People's Republic of China," 2021, <https://media.defense.gov/2021/Nov/03/2002885874/-1/-1/0/2021-CMPR-FINAL.PDF>.

17 United Nations, "Comprehensive Nuclear Test Ban Treaty, Working Paper Submitted by the Russian Federation," Preparatory Committee for the 2020 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, April 26, 2019, <https://documents-dds-ny.un.org/doc/UNDOC/GEN/N19/121/60/PDF/N1912160.pdf?OpenElement>.

18 Sha Zukang, "The Entry into Force of the CTBT: The Chinese Perspective," European Leadership Network, August 27, 2014, <https://www.europeanleadershipnetwork.org/commentary/the-entry-into-force-of-the-ctbt-the-chinese-perspective/>.

19 Joby Warrick, "China is building more than 100 new missile silos in its western desert, analysts say," Washington Post, June 30, 2021, <https://www.washingtonpost.com/national-security/china-nuclear-missile-silos/2021/06/30/0fa8debc-d9c2-11eb-bb9e-70fda8c37057_story.html>.

China and the US face a serious trust deficit. In order to make progress, and potentially yield collaborative efforts on nuclear issues like the CTBT, it is imperative that the US and China first address this basic mistrust guiding the two country's policies.

RECOMMENDATIONS AND PATHWAYS FORWARD

To begin to address this trust deficit, and potentially establish collaboration and cooperation instead of competition, especially on CTBT issues, we recommend the following:

1. The Biden administration should follow in the footsteps of Obama and renew a positive and proactive attitude toward CTBT issues. While it will take time for the US and China to heal their relationship, proposing potential collaboration on CTBT issues with China might begin to thaw some of these tensions. Both China and the US could suggest CTBT cooperation as one of the key topics at ongoing US-China world leaders' summits and strategic stability dialogues.
2. To create a better international security environment that can better facilitate the ratification of the CTBT, both the US and China could take action to reduce global tensions and improve transparency. The two states could provide details and explanations through unilateral transparency measures, including through public documents. The US could do so by clearly reducing the role of nuclear weapons in its national security strategy, and China could do so by publishing a nuclear strategy report that clearly expounds upon its strategy as well as nuclear principles and postures.
3. The US and China could jointly propose to amend the entry into force provision of the CTBT to require only half of the remaining eight Annex 2 countries' ratification. This could likewise establish whether China and the US are equally sincere about promoting the entry into force of the CTBT. Should the US and China both ratify, it would then create favorable conditions for the accession of the remaining Annex 2 states.
4. While potentially more difficult to achieve, US-China cooperation on CTBT issues could manifest itself as an access to each other's nuclear test sites to verify that all experiments taking place there are compliant with the CTBT. Because of China's history of allowing US inspectors at their test site, as an offer of good faith, the US could first invite Chinese officials to the test sites in Nevada. Doing so would improve bilateral transparency and help lower suspicions between the two states substantially. In turn, this has the potential to evolve into verification mechanisms, activities, and frameworks in other nuclear and security cooperative efforts (including missile development and advanced weapons systems).

CONCLUSIONS

Recent discussions between China and the US regarding the possibility of nuclear arms control are a promising development. However, as this paper has demonstrated, there is a substantial trust deficit between the two countries, and immediate cooperation of any kind, including on nuclear challenges, is not likely. At the same time, the CTBT poses a unique opportunity for US-China cooperation. The US and China have historical precedents of both nuclear-related cooperation and of supporting nuclear testing bans. Similarly, both countries have a key role to play in the CTBT entry into force. Ultimately, CTBT-related cooperation could be a driver towards improved nuclear transparency between China and the US; transparency that likewise has the potential to spill over into other domains, reducing the existing trust deficit.

ROUNDTABLE 'PAKISTAN-INDIA ENGAGEMENT ON CTBT: CHALLENGES AND OPPORTUNITIES'

■ Rizwan Asghar ■ Aparna Joshi ■ Pranav R. Satyanath ■ Sufian Ullah

Over the past two and a half decades, the Comprehensive Nuclear-Test-Ban Treaty (CTBT) has emerged as a crucial pillar of global nuclear disarmament and non-proliferation regimes. However, despite many efforts to outlaw testing of nuclear weapons, the treaty remains in a state of limbo. A deadlock exists because Article XIV of the CTBT, which makes the ratification by 44 states with commercial or research nuclear reactors included to the Annex 2 necessary for the treaty entry into force. Of those specified states, China, the DPRK, Egypt, India, Iran, Israel, Pakistan, and the US have not yet either signed or ratified the treaty. Focusing on Pakistan and India, this paper seeks to identify the challenges and opportunities for cooperation between both countries on CTBT-related issues. The rationale behind this proposal is that entry into force of the CTBT would directly contribute to global peace and security. Erecting a more substantial legal barrier against the resumption of nuclear testing in South Asia would lead to a more stable environment in the region.

Building on their assessment of the prevailing challenges and their existing knowledge of cooperation between the two countries, two Pakistani and two Indian experts share their points of view on the following questions:

– What should be the goals for India and Pakistan's engagement on the CTBT?
– What are the potential formats for such an engagement?
– What to expect from this dialogue in the mid-term and long term regarding the agreed positions, measures, and political decisions?

WHAT SHOULD BE THE GOALS FOR INDIA AND PAKISTAN'S ENGAGEMENT ON THE CTBT?

■ **Pranav R. Satyanath:** The biggest challenge that both states face is deciding the scope of cooperation and the preferable goals of such cooperation in the context of a test ban.Wishing both states to sign the CTBT or agree to some mechanisms within the Treaty's framework is impractical as India continues to reject the CTBT[1], and Pakistan's refusal to sign the treaty falls

1 Ministry of External Affairs, Government of India, "Foreign Secretary's Address at the UNSC meeting on "Non-proliferation of weapons of mass destruction: Comprehensive Nuclear Test Ban Treaty"," September 27, 2021, <https://mea.gov.in/Speeches-Statements.htm?dtl/34333/Foreign_Secretarys_Address_at_the_UNSC_meeting_on_Nonproliferation_of_weapons_of_mass_destruction_Comprehensive_Nuclear_Test_Ban_Treaty, accessed, November 10, 2021>.

squarely on India's decision to do the same.[2]

Hoping for a comprehensive bilateral nuclear agreement between the two states is also not viable, as cooperation on nuclear and risk-reduction measures has come to a near standstill in recent years. It is not the case that India and Pakistan are not interested in reducing risks. Rather, the confidence-building and risk-reduction measures (CBRMs) are overshadowed by non-nuclear and geopolitical concerns through the politics of linkages. Both sides have used linkages as a tool to either bargain or thwart negotiations on nuclear issues. Indian representatives, for example, urge that any talks on CBRMs must be preceded by talks on cross-border terrorism that originate from Pakistani soil. Indeed, some scholars have raised the possibility that India's case for an escalation might stem from a major cross-border terrorist attack originating from Pakistan, such that it crosses India's tolerance threshold.[3]

On the Pakistani side, the concerns are over supposed conventional asymmetry and India's ability to use conventionally superior forces to seize disputed territory.[4] More importantly, Pakistan views Kashmir as integral to its conception of national identity.[5] Therefore, the negotiation of CBRMs for Pakistan hinges on resolving the long-drawn Kashmir issue with India. Indeed, the commitment to resolve the Kashmir border dispute and solve cross-border terrorism was mutually agreed upon by India and Pakistan in 1999 in the Lahore Declaration.[6]

While these issues are indeed important and hold value in reducing escalation risks between the two states, they often act as an impediment to negotiating confidence-building measures and scientific cooperation that lie at the peripherals of controlling escalatory behaviours. India and Pakistan must therefore set more modest goals for the short and medium-term.

One such short-term goal could be the negotiation of an agreement to exchange seismic data from the nuclear test sites of each other's territories. The expected outcome of such an arrangement is to better understand each side's concerns over nuclear testing, create greater levels of transparency, and foster scientific cooperation between the two countries

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2 During the negotiations, Ambassador Munir Akram said that Pakistan would sign the CTBT only when the regional situation warranted. See, Rebecca Johnson, "Unfinished Business: The Negotiation of the CTBT and the End of Nuclear Testing" (Geneva: United Nations Institute for Disarmament Research, 2009), p. 124.

3 Vipin Narang, a South Asia expert and a scholar on nuclear strategy, has constructed such a scenario based on his reading of India's nuclear policy gray areas. See, Remarks by Vipin Narang, "Plenary: Beyond the Nuclear Threshold: Causes and Consequences of First Use," <https://carnegieendowment.org/2017/03/20/plenary-beyond-nuclear-threshold-causes-and-consequences-of-first-use-pub-64779>.

4 For example, this logic is used to justify Pakistan's possession of battlefield nuclear weapons, which India views as escalatory. See Mansoor Ahmed, "Pakistan's Tactical Nuclear Weapons and Their Impact on Stability,"
Carnegie Endowment for International Peace, June 30, 2016, <https://carnegieendowment.org/2016/06/30/pakistan-s-tactical-nuclear-weapons-and-their-impact-on-stability-pub-63911>.

5 Christine Fair, "Fighting to the End: The Pakistan Army's Way of War" (New Delhi: Oxford University Press, 2014), p.71.

6 Ministry of External Affairs, Government of India, "Lahore Declaration February, 1999," February 02, 1999, <https://mea.gov.in/in-focus-article.htm?18997/Lahore+Declaration+February+1999>.

on nuclear matters.[7] A bilateral data-exchange agreement could also act as a steppingstone to negotiate a more comprehensive regional or bilateral test ban treaty. Negotiating such a bilateral agreement could also help avoid some of the linkages that have hindered more complex forms of cooperation in the past. Further, such 'soft' arms control treaties might be more politically viable as they do not bind either state into making changes to their force posture or make costly political bargains that would block domestic support.[8]

Aparna Joshi: India and Pakistan should aim for a step-by-step development of cooperation on nuclear matters, including on CTBT-related issues, while confidence-building and peacebuilding should be the major goals of this process.

Rizwan Asghar: From Pakistan's perspective, the fact that the CTBT has yet to enter into force allows for the possibility that New Delhi may choose to resume nuclear testing without many consequences. The logical consequence of this possibility is that Pakistan should prefer a complete ban on nuclear testing through ratification of the CTBT to any perceived security benefits it may gain from choosing not to ratify the Treaty. Similar arguments could be made from India's perspective.

Therefore, the efforts to advance the entry into force of the CTBT serve both countries' security interests by increasing strategic stability and improving prospects for arms control in the region. Finding the political will to make this cooperation possible between the two countries is the key.

Sufian Ullah: Banning nuclear tests is considered a crucial step on the way to a comprehensive nuclear disarmament. Despite the decades-long focus on this aspect, it remains the hardest fought item on the disarmament agenda. The idealist and the realist schools of thought have differently analyzed the role of nuclear weapons in the national security strategies of different states. While the idealists consider nuclear deterrence a cause of an unending arms race, realists see it as a lynchpin of deterrence to ensure stability between strategic adversaries.[9] Hence, despite declared commitments to pursue disarmament, the two camps continuously fail to reach a mutually agreeable mechanism to achieve this endeavour.

The key reason behind the ongoing impasse on CTBT entry-into-force is the underlying confidence of nuclear-armed states in the deterrence power of nuclear weapons, which is a guarantee against possible nuclear weapons use. Mutually Assured Destruction (MAD) has ensured military stalemate among adversaries by generating a fear that nuclear war shall

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7 Scientific cooperation between states can help resolve disagreements and create long-term benefits. The role of the Group of Scientific Experts (GCE) in the CTBT negotiations in one such example. See Ola Dahlman, Frode Ringdal, Jenifer Mackby, and Svein Mykkeltveit, "The inside story of the Group of Scientific Experts and its key role in developing the CTBT verification regime," Nonproliferation Review, Vol. 27, Nos. 1-3 (2020), pp. 181-200. For examples of bilateral scientific cooperation, see, Nancy Prindle, "US-China Lab-to-Lab Technical Exchange Program," Nonproliferation Review, Vol. 5, No. 3 (1998), pp. 111–18.

8 The US-Soviet cooperation on accidents measures is an example of how soft arms control treaties are politically viable forms of adversary cooperation. See Andrew Bennett, "The Accidents Measures Agreement," in Albert Carnesale and Richard N. Haass, Superpower Arms Control: Setting the Record Straight (Cambridge, MA: Ballinger Publishing Company, 1987), pp. 41-64.

9 Stephen J. Cimbala. "Nuclear Proliferation in the Twenty-First Century: Realism, Rationality, or Uncertainty?," Strategic Studies Quarterly, Vol. 11, No. 1 (2017): 129-146.

be equivalent to mutual suicide.[10] This is evident from the South Asian strategic situation where the two adversaries have mutually recognized nuclear deterrence as a factor of stability, making the situation more prone to deterrence force modernization instead of pursuing disarmament.[11] Both Pakistan and India have declared unilateral moratoria but are not part of any legally binding mechanism to ban nuclear testing. The preferable goal of engagement between the two states should be to resolve outstanding disputes and identify the threats posed to strategic stability in the region.

What are the potential formats for such an engagement?

Aparna Joshi: The format of engagement on prohibiting nuclear testing as discussed by colleagues prior to me should be at a variety of levels, moreover, it should be a gradual process beginning with the level of research and analysis, followed by tactical engagement at the level of military and then lastly, at a political level. This could be through a series of binding bilateral treaties or a single bilateral accord that is mutually binding in nature.

Pranav R. Satyanath: The format for CTBT engagement in South Asia can be discussed at two levels. First, the engagement between India and Pakistan itself, which takes precedence. And second, India and Pakistan's engagement with third countries. My recommendations for both these situations are provided below.

Keeping up with the theme of modest diplomacy, India and Pakistan must initiate discussions at the semi-official level, namely, a Track 1.5 and Track 2 dialogue. Such a format will not only allow a more open exchange of views, but it may also provide younger professionals with opportunities to interact and exchange ideas. Based on the tone of these discussions, both India and Pakistan must take every initiative to move to formal negotiations at the Foreign Secretary level and establish relevant working groups to work out the details of a seismic, as well as other CTBT-related data exchange agreement.

Concerning engagement with third countries, India and Pakistan could welcome third countries such as France, Russia, and the United Kingdom as observer states.[12] Further, inviting Sri Lanka and Bangladesh, the non-nuclear-weapon states in the region, as observer states would also signal India's and Pakistan's sincerity in negotiating a bilateral test ban-related agreement. Involving third parties in formal negotiations would only complicate matters, as both India and Pakistan are not party to the NPT, and formally engaging with nuclear-weapon states (NWS) could raise questions about the legal status of India's and Pakistan's nuclear arsenals. Hence, a bilateral negotiation format with third parties present as observers would best serve the purposes of the two South Asian states.

Sufian Ullah: It is important to engage and resume meaningful and comprehensive

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10 Ministry of External Affairs, "Joint Statement, India-Pakistan Expert Level Talks on Nuclear CBMs,", 20 June 2004, <https://www.mea.gov.in/press-releases.htm?dtl/7593/Joint_Statement IndiaPakistan_ExpertLevel_Talks_on_Nuclear_CBMs>.

11 Ministry of External Affairs, "Joint Statement, India-Pakistan Expert-Level Talks on Nuclear CBMs," 20 June 2004, <https://www.mea.gov.in/press-releases.htm?dtl/7593/Joint_Statement_IndiaPakistan_ExpertLevel_Talks_on_Nuclear_CBMs>.

12 The three countries have historically had a stake in South Asia's regional dynamics. Further, any action taken by the United States and China in regard to the CTBT will strongly impact the decision-making in India and Pakistan.

dialogue for resolution of ongoing disputes in South Asia. Given the political tensions between Pakistan and India, the CTBT-related engagement can be useful. However, any discussion on exploring the prospects of cooperation merit an assessment of prevailing challenges. A set of factors that hinder prospects of engagement between Pakistan and India on CTBT include possible resumption of thermonuclear tests by India, New Delhi's evolving strategic posture that follows aggressive trajectory, and discriminatory approaches at global level that give India access to nuclear market. The exceptional Nuclear Suppliers Group (NSG) waiver granted to India signified that the U.S. preferred geopolitical considerations, particularly countering China, over broader non-proliferation and disarmament agenda, which directly undermined the rule-based non-proliferation regime.[13] Ashley J. Tellis, who is well known for his leading role in Washington's nuclear policy towards New Delhi, advised integrating India into the non-proliferation regime order without asking it to cap the size of its nuclear forces. Hence, the exceptional waiver allowed New Delhi to reap the benefits offered to NPT member states, like securing international assistance for its civilian nuclear reactors, without signing the CTBT, committing to freezing production of weapons-grade fissile material or legally committing to pursue disarmament. Prime Minister Manmohan Singh declared in parliament in 2006 that India would retain its right to conduct nuclear tests in the future.[14] Conversely, the deal allows India to achieve domestic energy independence and produce larger quantities of fissile material for nuclear weapons production.

It signifies the NSG members states' lack of interest in urging India to legally commit to disarmament measures and sign the CTBT, or in preventing India from conducting a thermonuclear weapon test. These concerns directly shape Islamabad's threat perception and consequently undermine the prospects of engagement on CTBT. Thus, despite broad international support for the Treaty, its future in South Asia remains bleak because of the factors discussed above.

Rizwan Asghar: One of the most effective means of ensuring that both India and Pakistan sign and ratify the CTBT is the formation of public opinion in both countries rallied around the idea that a complete ban on nuclear testing serves both countries' strategic interests.

The logic underlying my argument is that making the public more aware of the dangers associated with a world without a comprehensive ban on nuclear testing would help us counter certain domestic institutional biases in both countries in favour of this ban. This is consistent with lessons that emerge from the record of the past fifty years of efforts for arms control: namely, that domestic political factors have often been a greater hindrance than genuine security interests of states.

Since the public in both countries has largely remained uninterested in foreign policy and security issues, this has allowed more space for their governments to adopt policies that may not necessarily serve national interests. By creating public opinion in favour of the signing and ratification of the CTBT, that space can be taken back.

What to expect from this dialogue in the mid-term and long term regarding the agreed

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[13] William C. Potter, "India and the New Look of U.S. Nonproliferation Policy," Nonproliferation Review, Vol. 12, No. 2 (2005): 347.

[14] Nuclear Threat Initiative ,"Indian Nuclear Chronology", <https://media.nti.org/pdfs/india_nuclear.pdf>.

positions, measures and political decisions?

Aparna Joshi: To find a long-lasting solution to the issue of the CTBT, it is crucial to take a systemic approach towards the signing of the CTBT at several levels, and to isolate the acceptance and universality of the CTBT from domestic conflicts and geopolitical points.

To sign the CTBT, India would need to be assured of non-aggression from its neighbouring territories. To achieve this goal, if the Indian and Pakistani governments were to take up a multi-tiered approach, the conflicts would be resolved with more ease. The two governments would initially require grass-root level coordination and de-escalation in rhetoric towards each other.

The second step would be at the national level to involve the major stakeholders within the regions under nuclear threat and areas of nuclear power production. These stakeholders would be members of the local governance structures, who would be aware of the potential costs and risks of nuclear war.

Thirdly, both India and Pakistan should involve nuclear scientists alongside diplomats and nuclear non-proliferation experts to inform the discussions from a scientific and technological point of view.

Fourthly, two armed forces members could be involved on a rotational basis to reduce the tactical threats and assess the potential flashpoints.

Lastly, two impartial observer states could be chosen, outside the P5 members of the UN, reflecting a new power dynamic and reducing the risk of influence by vested interests. These observers would hold office for one year, on the recommendation of the governing body of the non-proliferation board. Though the role of major international powers such as the USA and China cannot be overruled in the region, it is essential to note that the regional dynamics with the region as well as the role of vested interests of major powers may lead to a potential stalemate, rather than an effective resolution to the interaction on the subject of the CTBT or other non-proliferation measures.

Pranav R. Satyanath: The most important long-term goal for India and Pakistan must be to prevent the resumption of nuclear testing in South Asia. Irrespective of whether the two states become party to the CTBT, it is paramount that the two countries uphold the global norm against nuclear testing.

The second long-term goal for the two countries, as I mentioned earlier, would be to strive for a mutually verifiable bilateral test ban agreement. Such an arrangement, for example, could involve India and Pakistan agreeing to install seismic monitoring stations inside each other's territories, with some provisions for on-site inspections.

Indeed, such an arrangement is less preferable than full assertion to the CTBT. However, a bilateral test ban agreement would allow India and Pakistan to adhere to the principle and spirit of the CTBT, even while avoiding some politically costly bargains. One could foresee a scenario where India and Pakistan could sign and ratify the CTBT if China and the United

states were to complete their ratification process.[15] But this is unlikely to take place any time soon.

Rizwan Asghar: The medium- to long-term goals should aim at more well-informed public opinion and involvement in both countries in favour of the CTBT. Both electronic and print media can play a critical role in this direction. Once public is more actively involved as a result of increased awareness of the benefits of the CTBT, it will be harder for the governments to hold back from ratifying the treaty because of their strategic myopia.

Sufian Ullah: Islamabad's consistent policy approach and continued support for the CTBT hint at the possibility of engagement on nuclear non-testing between Pakistan and India.

Islamabad's proposals to New Delhi about simultaneous adherence to the CTBT and converting unilateral moratorium into a bilateral agreement offer avenues of bilateral cooperation between the two states. Hence, a verifiable, legally binding bilateral and region-oriented approach may gradually lead towards the desired objective. In 2001, General Pervez Musharraf, then President of Pakistan, remarked that "we are ready to formalize a bilateral treaty with India for a mutual test ban".[16] Likewise, in 2016, Islamabad reiterated this proposal to consider a bilateral agreement to refrain from nuclear testing that signifies positive intent towards promoting restraint in South Asia. However, New Delhi's non-willingness to sign CTBT or enter into a bilateral arrangement on non-testing with Pakistan directly affects Islamabad's policy choices because of the perceived security threats from its eastern neighbour. Pakistan consistently maintains that it shall not be the first to resume nuclear testing in South Asia.[17] Given the regional security environment in South Asia, Islamabad's position on CTBT remains dependent on evolving nuclear posture of India.

In South Asia, the prospects of bilateral engagement remain limited due to prevailing strategic instability and India's unwillingness to engage in bilateral arms control measures with Pakistan. Progress on CTBT may be pursued by raising mutual trust between the two nuclear rivals, addressing the unresolved disputes, and building regional strategic stability. The future prospects of universalization of CTBT and its success in South Asia are also directly linked to major powers' policy decisions and approaches towards nuclear non-proliferation and disarmament agenda. Besides major powers' own failure to fulfil their obligations to seriously pursue nuclear disarmament under Article VI of the NPT, the future of the CTBT is also shaped by preferring narrow geopolitical interests over broader non-proliferation objectives.

Although arms control has struggled to establish a strong foothold in South Asia because of India's unwillingness to engage with Pakistan bilaterally, the two states have cooperated on

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[15] Jaswant Singh, the then Minister for External Affairs, described the U.S. Senate's failure to ratify the CTBT as "the last sting" in India's decision towards signing the CTBT. Jaswant Singh quoted in Yogesh Joshi and Frank O'Donnell, India in Nuclear Asia: Evolution of Regional Forces, Perceptions and Politics (New Delhi, Orient Blackswan, 2018), p. 207.

[16] The Hindu, "Ready to Formalise N-Test Ban Treaty with India: Musharraf," 12 November, 2001, quoted in Malik Qasim Mustafa, "CTBT: A Critical Evaluation from a Pakistani Perspective," Strategic Studies, Vol. 33, No. 3/4 (Autumn & Winter 2013): 60.

[17] Shervin Taheran, "Pakistan Reiterates Pledge to Not Resume Testing," Arms Control Association, 05 June 2015, <https://www.armscontrol.org/blog/2015-06-05/pakistan-reiterates-pledge-not-resume-testing>.

certain confidence-building measures (CBMs) to reduce the risks of nuclear warfare. Some of the bilateral nuclear risk reduction measures between Pakistan and India include the following:[18]

- Agreement on the Prohibition of Attack against Nuclear Installations and Facilities (1988);
- Agreement on Pre-Notification of Flight Testing of Ballistic Missiles (2005);
- Agreement on Reducing the Risks from Accidents Relating to Nuclear Weapons (2007);
- Hotline between Foreign Secretaries to Avoid the Cyber Attacks and Nuclear Risks (2004).

Although the scope of these agreements remains limited, they signify the intent on both sides to reduce the dangers of a possible nuclear exchange. The two states declare unilateral moratoria on nuclear testing, which are not legally binding and could be withdrawn unilaterally. Given the prevailing mutual mistrust and their divergent strategic aspirations, the prospects of Pakistan and India's adherence to CTBT remain bleak.

CONCLUSION

In South Asia, the prospects of bilateral engagement remain limited due to prevailing strategic instability and India's unwillingness to engage in bilateral arms control measures with Pakistan. Progress on CTBT may be pursued by raising mutual trust between the two nuclear rivals, addressing the unresolved disputes, and building regional strategic stability. The prospects of universalization of CTBT and its success in South Asia are also directly linked to major powers' policy decisions and approaches towards the nuclear non-proliferation and disarmament agenda. Besides major powers' own failure to fulfil their obligations to seriously pursue nuclear disarmament under Article VI of the NPT, the future of the CTBT is also shaped by preferring narrow geopolitical interests over broader non-proliferation objectives.

[18] Zafar Nawaz Jaspal, "Nuclear Confidence-Building Measures between India and Pakistan: Possible Alternatives," in The Politics of Nuclear Weapons in South Asia, ed. Bhumitra Chakma (London: Routledge, 2011), 16.

THE CTBT AND THE MIDDLE EAST: A LONG ROAD TO A NUCLEAR TEST-FREE REGION

■ Amina Abdelkhayer ■ Hussain Alhowaidi ■ Tom Hickey
■ Gregory Kobzar ■ Inna Rodina

ABSTRACT

What could be done to encourage the Middle Eastern states to move forward in creating a nuclear-testing-free zone in the region? What are the challenges the international community faces in this regard? This research paper analyses both internal and external factors influencing the position of the five Middle Eastern states – Egypt, Iran, Israel, Saudi Arabia, and Syria – which have not signed/ratified the Comprehensive Nuclear-Test-Ban Treaty (CTBT). Case studies facilitate the understanding of the complications existing in the region and shed light on the differing national and regional perspectives on the CTBT. While most of the states in the region are members of the key non-proliferation treaties and agreements, contributing to their ratification of the CTBT is a challenging but important task. In this regard, this research paper provides some practical recommendations to promote CTBT ratification in the region.

INTRODUCTION

The proliferation challenges in the Middle East are numerous, and represent a major security dilemma for regional states and the international community. From the ambiguity of Israel's nuclear weapons capability to Iran's nuclear threshold status, the risk of further regional nuclear proliferation remains a constant concern. The region is uniquely full of both non-proliferation successes and failures.

Nascent nuclear weapon development programmes in Iraq and Libya were dismantled, and most countries in the Middle East have joined the major non-proliferation and disarmament instruments, including the Nuclear Non-Proliferation Treaty (NPT), Chemical Weapons Convention (CWC), Biological Weapons Convention (BWC), and Comprehensive Nuclear-Test-Ban Treaty (CTBT). Several countries are part of the nuclear-weapon-free zone in Africa under the Treaty of Pelindaba, and the conference to discuss the establishment of a Middle East WMD-free zone (MEWMDFZ). The International Atomic Energy Agency (IAEA) supports a number of regional states to develop civil nuclear technology, and most of the states have adopted the IAEA's Additional Protocol (AP) – a strong guarantor of nuclear non-proliferation.

The regional proliferation failures are equally numerous: Iran's nuclear programme has expanded far beyond the parameters of the crumbling Joint Comprehensive Plan of Action (JCPOA), the Israeli nuclear programme is a source of serious regional discomfort, Syria has an unresolved nuclear proliferation legacy, and a number of states have yet to sign or ratify the CTBT, including three Annex 2 states which are necessary for the treaty to enter into force. As a reflection of the tense security landscape and proliferation risks, attacks on nucle-

ar facilities, the assassination of nuclear scientists, proliferation of missiles, drones, dual-use technologies, and non-state actors all contribute to regional insecurity and conflict.

At a global level, the CTBT seeks to act as a stepping stone towards nuclear disarmament by acting as a reliable international tool to monitor any potential instance of nuclear weapon testing, and establishing a qualitative cap on nuclear weapon development. Today, eight Annex 2 countries are left to ratify the CTBT and enable the treaty to enter into force. Three are from the Middle East: they are Egypt, Iran, and Israel. Though they supported the treaty by signing it, the political will and regional conditions to ratify it are absent. Today's dynamic of political challenges in the Middle East is very different from two and a half decades ago when the CTBT was opened for signature. Examples of significant developments in the recent decades include conflicts in Iraq, Libya, Syria, and Yemen, the Arab Spring, the emergence of new terrorist groups, Iran's expanded nuclear activities and proxy conflicts with Arab neighbours, stagnation of Israeli-Palestinian peace talks, and normalisation between Israel and Arab states.

Ratification of the CTBT is further complicated and influenced by these developments, which at the same time also underline the importance of the treaty's entry into force for the Middle East: the CTBT offers the region an unmatched opportunity to de-escalate tensions around the region-wide security challenge of nuclear proliferation, through supporting disarmament, strengthening confidence-building measures, mitigating the risk of conflict escalation, encouraging cooperation between international partners, and promoting regional dialogue. The pathway to achieving a Middle East nuclear-test-free zone is long, and will require a robust regional effort and the participation of Annex 2 states, as well as Saudi Arabia and Syria. Understanding the distinct set of circumstances of each of the states in the region is critical to determining the prospects and supporting the entry into force of the CTBT.

COUNTRY CASE STUDIES

Egypt

Although signing and ratifying the NPT was a sign of disinterest in having nuclear weapons, CTBT ratification requires additional efforts. A high-level political objective of Egypt for many years has been the establishment of a comprehensive legal regime in the Middle East that would prohibit the development and possession of weapons of mass destruction. Since the 1990s, Egypt, which is one of the Annex 2 countries, has refused to sign any nuclear-related treaties unless regional countries first accede to the main non-proliferation and disarmament treaties. Egypt has signed the BWC, yet it has not signed the CWC. The country has been an IAEA member state since 1957[1], and it has signed and ratified the IAEA safeguards agreement[2]. Egypt has a 1961 vintage 2 MWt Russian research reactor, which is currently in shutdown, and a 22 MWt Argentinian research reactor (ETRR-2)[3].

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1 IAEA, "List of Member States", June 08, 2016, <https://www.iaea.org/about/governance/list-of-member-states>.

2 IAEA, "The Text of the Agreement Between Egypt and the Agency for the Application of Safeguards in Connection With the Treaty on the Non-Proliferation of Nuclear Weapons," June 30, 1983, <https://www.iaea.org/publications/documents/infcircs/text-agreement-between-egypt-and-agency-application-safeguards-connection-treaty-non-proliferation-nuclear-weapons>.

3 World Nuclear Association, "Nuclear Energy in Egypt: Egyptian Nuclear Electricity," <https://world-nuclear.org/information-library/country-profiles/countries-a-f/egypt.aspx>.

Despite its acknowledgement of the importance of the CTBT, Egypt has not ratified the treaty yet, to draw attention to its strong position and diplomacy in achieving a MEWMDFZ. Years have passed by, and the country's Foreign Ministry always expresses the same strong opinion. Nonetheless, Egypt supports the CTBT objectives, and was one of the first countries to sign the treaty in 1996. Under the CTBT, Egypt is expected to host two seismic stations – one primary in Luxor and one auxiliary in Kottamaya.[4]

On September 23, 2016, the UN Security Council adopted a resolution on the CTBT,[5] and Egyptian Foreign Minister Sameh Shoukry stated that it is unfair and unacceptable to put countries that have nuclear weapons on an equal footing with those that do not. He expressed that it would have been more relevant to prioritise nuclear disarmament and emphasize the importance of signatory countries and all state parties promoting and effectively engaging in any discussion related to the treaty.[6]

After all, Israel signing and ratifying the NPT would be a crucial key in Egypt's CTBT ratification, while it doesn't look as a realistic option for the foreseeable future.

Iran

Iran is one of the three Middle Eastern Annex 2 states, which has signed but not ratified the CTBT. A series of interconnected issues, including tensions with regional countries, hostile rhetoric with the United States and economic sanctions, impacts Iranian perception of the necessary steps to take in the security field. That being said, Iran does not seem to consider the CTBT ratification as a top priority. At the same time, the Iranian authorities consistently express their support for the CTBT objectives and principles – but link any progress towards the treaty's entry into force to general progress on disarmament.

After Iran's clandestine nuclear infrastructure was revealed in 2002, the country admitted to running a covert nuclear program for almost two decades. Iran ratified both the BWC and the CWC, and supported the NPT's indefinite extension. Under the JCPOA, Iran committed to adopting the IAEA AP, but the U.S. withdrawal from the Iranian deal suspended the implementation of the Additional Protocol.

There are several reasons for Iran's non-ratification of the CTBT, including Israeli nuclear ambiguity and Saudi non-signatory status of the CTBT. Iran's Supreme National Security Council expressed concern regarding IMS stations on Iranian territory, which could be "a way for Western states to obtain Iranian military security data".[7] Despite these fears, Iran's activities can be tracked from monitoring stations in other countries, even if Iran does not ratify the CTBT. Thus, Iranian refusal to install monitoring stations would leave the country without access to global IMS data, while its military secrets would not be preserved.[8] Another negative

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4 CTBTO, "Country Profiles - Egypt: CTBTO Preparatory Commission," <https://www.ctbto.org/the-treaty/country-profiles/?country=54&cHash=653d3fa82ea07d20ce309b24d2d41e77>.

5 CTBTO, "UN Security Council adopts historical resolution on CTBT," <https://www.ctbto.org/press-centre/highlights/2016/un-security-council-adopts-historical-resolution-on-ctbt/>.

6 State Information Service, "Statement of Egypt's FM on Resolution on the Comprehensive Nuclear Test Ban Treaty," <https://www.sis.gov.eg/Story/106059?lang=>.

7 Хасан Рухани, "О процедуре межведомственного согласования позиции Ирана в отношении продления ДНЯО и подписания ДВЗЯИ," [Hassan Rouhani, "On the procedure for Iran's interdepartmental coordination on the NPT extension and the CTBT signing] Ядерный клуб, №1-2, 2015, p.38.

8 Ibid.

factor blocking progress towards the CTBT ratification in Iran is its leadership's indifference towards the treaty: Iranian authorities do not consider the CTBT ratification an essential or significant element of the country's security. So, the advantages of full-scale cooperation with the CTBTO should be constantly stressed out to the Iranian authorities so as to encourage the country to ratify the treaty.

Under the CTBT, Iran is supposed to host five monitoring stations in its territory.[9] While some stations were constructed, they were shut down in 2002-2006 for unspecified reasons, and conditions for their reactivation are vague. As of December 2021, Iran owes the CTBTO around 6.5 million dollars in unpaid dues, including 275,464 dollars for 2021.[10] That is why Iran's voting rights remain suspended. The Iranian debt to the CTBTO could illustrate its indifference towards participation in the CTBTO work. At the same time, economic sanctions affect Iran's ability to pay, and that factor should not be ignored.

Iran would benefit from the CTBT, as it gives access to equipment that can be used for scientific purposes, and within the CTBTO, Iranian scientists would be able to exchange data on various verification techniques. Also, Iran would receive information from other countries' monitoring stations. Although Iran will not move toward ratification of the CTBT without progress on the JCPOA, as well as normalization of bilateral relationships with the United States and the Middle Eastern countries, the CTBT ratification could be presented as a voluntary step that "responsible nations pursue,"[11] and it would be a way "to assuage Western concerns and demonstrate its peaceful intentions."[12] The Iranian authorities have never publicly expressed dissatisfaction with the CTBT or its objectives – if goodwill and multilateral compromises, including on the JCPOA, are demonstrated, there could be hope for Iran's ratification.

Israel

Since the establishment of the State of Israel, the country has faced many complex security challenges. For a long time, the main threat was presented by a military coalition of Arab States, which aimed to destroy Israel using large-scale conventional military operations. However, considering the dynamics of the changing situation in the Middle East, new security challenges have arisen, primarily related to guerrilla warfare and terrorism, cyber threats, advances in missile technology,[13][14] and efforts to achieve nuclear military capabilities. These changes are reflected in Israel's security strategy and perception of contemporary threats. Thus, the main security challenges have shifted to unconventional methods of warfare and possible nuclear threat.

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9 CTBTO, "Country Profiles – Iran (Islamic Republic of): CTBTO Preparatory Commission," <https://www.ctbto.org/the-treaty/country-profiles/?country=81&cHash=c783371ceaff26e3477b721f0906c0fe>.

10 CTBTO, "Member States' payments as of 12 December 2021: CTBTO Preparatory Commission," <https://www.ctbto.org/member-states/honour-roll/>.

11 Liviu Horovitz & Robert Golan-Vilella, "Boosting the CTBT's Prospects in the Middle East," Bulletin of the Atomic Scientists, November 2015, <https://www.tandfonline.com/doi/full/10.2968/066002002?scroll=top&needAccess=true>.

12 Deepti Choubey, "Don't Wait for the United States," CTBTO Spectrum 12, 2009, <https://www.ctbto.org/fileadmin/user_upload/pdf/Spectrum/2009/Spectrum12_final_web2.pdf>.

13 Jeffrey Lewis, "Middle East Missile Mania: It's Not Just Iran," NTI, October 22, 2021, <Middle East Missile Mania: It's Not Just Iran - The Nuclear Threat Initiative (nti.org)>.

14 Carnegie Endowment for International Peace, "Ballistic Missile Capabilities in the Middle East," April 26, 2002, <Ballistic Missile Capabilities in the Middle East - Carnegie Endowment for International Peace>.

In order to counter possible threats and acquire a military advantage, in the 1950s the Israeli government initiated a nuclear program, which nowadays is the mainstay of the military doctrine and consists of two main pillars, namely the direct development and possession of nuclear weapons, as well as the use of any methods to counter the proliferation of nuclear weapons in other states in the Middle East.[15]

Considering its "non-signatory" status of the NPT but membership of the IAEA, Israel is one of three states in which the Agency applies item-specific safeguards agreement INFCIRC/66/Rev.2[16,17] Israel has neither signed the BWC nor ratified the CWC. In this case, it is worth noting that Israel's position is influenced by the position of Egypt, which hasn't signed the CWC, and the breaches of the treaty by Syria, despite being a CWC state party.[18,19,20] The interconnected status of the various non-proliferation and disarmament mechanisms in the region further complicates the prospects for CTBT ratification. Israel signed the CTBT on September 25, 1996, but still has not ratified it. Israel hosts two auxiliary seismic stations and one radionuclide laboratory.[21] In June 2016, Lassina Zerbo, then CTBTO Executive Secretary, met with the Israeli Prime Minister to discuss prospects for Israeli ratification. While Prime Minister Netanyahu underlined Israel's support for the treaty, he emphasised that it was dependent on the regional context, and a matter of appropriate timing.[22]

Taking into account such factors that Israel cannot count on direct military support in the event of a national threat, and also that formal dialogue between Israel and some Middle Eastern countries is impossible due to the lack of diplomatic relations, the most realistic way out of this situation is cooperation with international organizations and institutions.

The new country's leadership is actively showing its desire and readiness for dialogue.[23] Perhaps this is the right time for the CTBT to organize a new visit to Israel and remind it of the benefits of international cooperation.

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15 Amos Yadlin, "The Begin Doctrine: The Lessons of Osirak and Deir ez-Zor," Institute for National Security Studies, March 21, 2018, <The Begin Doctrine: The Lessons of Osirak and Deir ez-Zor | INSS>.

16 IAEA, "More on Safeguards agreements," <https://www.iaea.org/topics/safeguards-legal-framework/more-on-safeguards-agreements>.

17 IAEA, "IAEA Safeguards Now Applied in 183 States Worldwide – Safeguards Statement 2019," June 26, 2020, <https://www.iaea.org/newscenter/news/iaea-safeguards-now-applied-in-183-states-worldwide-safeguards-statement-2019>.

18 David Cole-Hamilton, Ehud Keinan, "Why ratifying the Chemical Weapons Convention is in Israel's best interest," The Conversation, September 8, 2016, <https://theconversation.com/why-ratifying-the-chemical-weapons-convention-is-in-israels-best-interest-63889>.

19 Statement by Tamar Rahamimoff-Honig, Director, Arms Control Department, Ministry of Foreign Affairs, to the 19th session of the Conference of States Parties to the Chemical Weapons Convention, December 2, 2014, <https://www.opcw.org/sites/default/files/documents/CSP/C-19/en/Israel.pdf>.

20 Emily Landau, "Egypt and Israel in ACRS: Bilateral Concerns in a Regional Arms Control Process," Jaffee Center for Strategic Studies, June 2001, <FILE1190277853-1.pdf (inss.org.il) >.

21 CTBTO, "AS048, Eilath, Israel," <https://www.ctbto.org/verification-regime/featured-stations/types/auxiliary-seismic/as048-eilath-israel/>.

22 CTBTO, "Working on the "when" of Israel's ratification," June 21, 2016, <https://www.ctbto.org/press-centre/highlights/2016/working-on-the-when-of-israels-ratification/>.

23 Shimon Stein, Oded Eran, "The EU and Israel: At Least on Speaking Terms," INSS Insight No. 1500, Institute for National Security Studies, July 21, 2021, <https://www.inss.org.il/publication/israel-eu/>.

Saudi Arabia

Saudi Arabia's non-accession to the CTBT is a matter of current regional political conditions. Iran's progress in nuclear technology and its potential to develop nuclear weapons are among the top Saudi regional security concerns. For Saudi Arabia, Iran's possession of nuclear weapons would mean a radical shift in the balance of power, especially around the Gulf. Such a development would exacerbate regional tensions, make concessions in the nuclear security field practically impossible, and lead to an inevitable nuclear arms race. Therefore, a Saudi decision to sign the CTBT depends principally on the regional nuclear security domain's status, considering two main factors. The first necessary factor is a JCPOA+ that goes beyond the current JCPOA and involves the issue of Iran's missile program, nuclear activities, and regional behaviours.[24] The second factor is Israel's accession to the NPT as a non-nuclear-weapon state.

Saudi Arabia is a state party to the major non-proliferation agreements, including the NPT, BWC, and CWC. The Saudi government has ambitious plans to develop nuclear reactors for peaceful uses to meet the country's growing energy demand. Saudi Arabia has multiple nuclear cooperation agreements with different countries, and it is an IAEA member state with a Small Quantities Protocol (SQP) in force. However, the IAEA underlines the necessity to rescind the SQP and conclude an Additional Protocol.[25]

Saudi Arabia is a proponent of establishing a MEWMDFZ.[26] By scrutinizing Saudi Arabia's international stance towards nuclear proliferation, it is clear that the country supports the CTBT's primary objective, but the regional political situation prevents it from joining. Under the CTBT, Saudi Arabia hosts two seismic stations but the facility agreement is yet to be concluded.[27] Saudi Arabia attended the first Conference on Facilitating the Entry into Force of the CTBT held in 1999 in Vienna as an observer.[28] The lack of a U.S. ratification, and the low number of attendees (92 out of 154[29]) have caused Saudi Arabia to regard the treaty as a secondary priority. Therefore, it didn't participate in subsequent meetings.

Today, Saudi Arabia has the necessary resources to lead regional initiatives. By promoting the CTBT regionally, Saudi could benefit politically from dispelling all accusations about the nature of its nuclear program, and scientifically by the data it would receive from the

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24 The Guardian, "Iran nuclear deal: Saudi Arabia says Gulf states must be consulted if US revives accord: Prince Faisal bin Farhan warns kingdom and its regional allies' involvement is only way to achieve 'sustainable' outcome," Dec 6, 2020, <https://www.theguardian.com/world/2020/dec/06/iran-nuclear-deal-saudi-arabia-says-gulf-states-must-be-consulted-if-us-revives-accord>.

25 IAEA, "Agreement between the Kingdom of Saudi Arabia and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons," Report by the Director General to the Board of Governors, Mohamed ElBaradei INFCIRC/746, February 24, 2009.

26 United Nations, "Statement of The Kingdom of Saudi Arabia During the work of The United Nations Conference to Negotiate a Legally Binding Instrument to Prohibit Nuclear Weapons with a view to Complete Elimination," Delivered by Head of the Negotiating Delegation Saad Abudllah Al-Saad, <https://www.reachingcriticalwill.org/images/documents/Disarmament-fora/nuclear-weapon-ban/statements/27March_SaudiArabia.pdf>.

27 CTBTO, "Country-Profiles - Saudi Arabia," <https://www.ctbto.org/the-treaty/country-profiles/?country=151&cHash=ac6b191eb33e5b75b28290cec8a4b190>.

28 Rebecca Johnson, "Comprehensive Test Ban Treaty (CTBT): SPOTLIGHT OF THE CTBT" REPORT OF THE CTBT ARTICLE XIV CONFERENCE," The Acronym Institute, 2003, <http://www.acronym.org.uk/old/archive/ctbt/ctbtrep.htm>.

29 Ibid

CTBTO for its scientific institutions. Saudi Arabia can leverage international platforms such as the Tenth NPT Review Conference or similar conferences to promote accession to the CTBT while highlighting the treaty's significance in advancing the region's security, peace, and stability. Due to its regional influence, Saudi ratification of the CTBT would enhance regional confidence-building measures, improve bilateral relations between rivals at a time of growing friction, and influence the decisions of the remaining Annex 2 countries and Syria to consider advancing the CTBT regionally.

Syria

Syria is one of only two States in the Middle East which have not signed the CTBT, although it is not an Annex 2 State. As a country, Syria faces enormous challenges, largely caused by the ongoing conflict which has lasted for more than a decade. The complexity of the crisis means that Syria is unlikely to be in a position to consider ratification of the CTBT in the near future, at least until there is a decisive end to the conflict. Even then, the priority will be on reconstruction and reconciliation efforts, and restoring relations with states in the region — only then could a ratification of the CTBT even be considered.

Syria has a dubious proliferation record, with high profile cases of chemical weapons use, despite it's ratification of the CWC in 2013. Neither has Syria ratified the BWC, which it signed in 1972. Syria has been a State Party to the NPT since 1969. On nuclear safeguards, the IAEA suspended verification activities since 2013 due to the ongoing conflict. Syria does not implement the Additional Protocol, and the Agency has serious unresolved concerns about the country's past nuclear activities. In 2007, the Israeli air force destroyed a suspected nuclear reactor under construction at the Al-Kibar site, supposedly to be used for the production of plutonium.[30] IAEA inspectors were only allowed access to the site in 2008 after pre-existing structures had been demolished, and in 2011 the Agency released a report stating that it was "very likely" that the facility had been a nuclear reactor.[31]

At the UN General Assembly vote on the CTBT in 1996, Syria was one of a handful of countries which abstained, criticising the treaty for its perceived inability to effectively bring about disarmament in nuclear weapon states, and the lack of guarantees against the threat of use of nuclear weapons.[32] Syria also cited Israel's nuclear programme as a clear obstacle to disarmament in the region, including for the establishment of a MEWMDFZ.

Nevertheless, given Syria's position in the region and its proliferation legacy, a Syrian ratification of the CTBT would be an essential step in achieving region-wide adoption of the treaty. Even if Syria's ratification is tied to geopolitics in the region, signing the treaty would be a positive interim step which Syria could pursue without preconditions, as a confidence-building measure between Syria, the neighbouring countries, and the international community.

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30 Amos Harel and Aluf Benn, "No Longer a Secret: How Israel Destroyed Syria's Nuclear Reactor," Haaretz, March 23, 2018, <https://www.haaretz.com/world-news/MAGAZINE-no-longer-a-secret-how-israel-destroyed-syria-s-nuclear-reactor-1.5914407>.

31 IAEA, "Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic," Report by the Director General to the Board of Governors, GOV/2011/30, 24 May 2011.

32 United Nations, General Assembly 50th Session, 125th Plenary Meeting, A/50/PV.125, 10 September 1996. <https://www.un.org/ga/search/view_doc.asp?symbol=A/50/PV.125>.

Table 1. Key Non-proliferation Treaties Status in the Middle East

Country	**NPT**	**CWC**	**BWC**	**CTBT**
Egypt	Ratified 1968	Not signed	Signed 1972	Signed October 14, 1996
Iran	Ratified 1968	Ratified 1973	Ratified 1973	Signed September 24, 1996
Israel	Not signed	Signed 1993	Not signed	Signed September 25, 1996
Saudi Arabia	Acceded 1988	Ratified 1996	Ratified 1972	Not signed
Syria	Ratified 1968	Acceded 2013	Signed 1972	Not signed

RECOMMENDATIONS

With an understanding of the domestic and regional conditions which influence CTBT dynamics in the Middle East, there is a wide range of potential steps to strengthen engagement with the CTBT and its objectives. While CTBT ratification by the remaining regional countries faces several challenges, constructive efforts can be made under three broad categories, namely Awareness and Advocacy, Cooperation and Capacity-Building, and Policy and Promotion.

Awareness and Advocacy

A key component of any non-proliferation and disarmament mechanism is the presence of a robust civil society dialogue, something which is largely absent in the Middle East. While nuclear proliferation risks are a concern for several states in the region, to date there has been limited discussion of the CTBT's capacity to further non-proliferation in the region. States can work with international partners to invest in and facilitate civil society discussion, both at national and regional levels. Even if there is currently limited political appetite to consider CTBT ratification or signature, a robust Track 2 and Track 1.5 dialogue can create a solid foundation of knowledge and awareness of the CTBT and associated issues, which can help formal Track 1 dialogue and negotiations when political conditions are optimal.

The broader engagement of people from diverse backgrounds in the region is also a key catalyst for the CTBT's success in the Middle East. While arms control, non-proliferation, and disarmament discussions have traditionally been the exclusive purview of small groups of diplomats, military officers and policymakers, a greater societal dialogue should be developed. Nuclear testing is something which affects everyone, and involving young people, indigenous populations, women and scientific and technical experts in the discussion is an important step in understanding the challenges for, and benefits of, the CTBT from a diverse range of perspectives.

In this regard, organisations such as the CTBTO Youth Group (CYG) offer young people the platform to engage with the topic of nuclear testing — something they may never have learned about or considered in the regional context. The CYG has a small but growing group of members from the Middle East who will be essential pioneers in their societies for raising

awareness about nuclear testing. The CTBTO and Youth Group could support such efforts in the region by helping local members to create regional CYG chapters at universities, which would engage more members, and create a relatable awareness of the CTBT in the context of the Middle East.

The CTBTO's Young Professionals Network (YPN) is another organisation aimed at creating a global community of young scientists and technical professionals working on areas related to the CTBTO's IMS. Membership of the YPN should be more widely publicised in the Middle East, and could offer affiliate membership to people from non-ratifying or non-signatory states to enhance regional networking, and to raise the profile of the scientific applications of the CTBT in the region. The Middle East Next Generation of Arms Control Specialists (MENACS) Network is another example of involving young research and policy professionals in networking and discussions related to regional security and non-proliferation, including the CTBT.

Of particular importance to engagement efforts should be the translation of official documents related to the CTBT, digital communication campaigns, and research reports into the major languages of the Middle East, particularly Arabic, Farsi, and Hebrew. Multilingualism can greatly extend the reach of the CTBTO's message and objectives far beyond a limited group of English-speakers in the region, and will be essential to generating domestic discussions in the Annex 2 states in particular. Social media and digital communication have been critical to the success of any social or political movement in the region. In this regard, the CTBTO and partner organisations can create region-specific digital campaigns to educate the local population on the CTBT related issues and to raise awareness of the risks of nuclear testing.

Cooperation and Capacity-Building
Enhancing scientific and technical cooperation in the region is another important area the CTBT could facilitate. There is a growing interest in the applications of nuclear technologies in the Middle East, from using nuclear power to move away from fossil fuels and combat climate change, to developing nuclear isotopes for use in medicine, and sterilisation of pests to reduce disease and boost agricultural output. The CTBTO can take advantage of this interest to advertise its capacity to ensure that nuclear technology is used only for peaceful purposes.

While the primary role of the IMS is the detection of nuclear testing, the earth sciences data compiled in the IDC, collected from an unparalleled global network of sensors, is a remarkable scientific and technical asset to any country. In the past, the IMS data has been used to predict tsunamis and earthquakes, estimate the impact, and prepare the appropriate emergency response to such incidents. The CTBTO should also develop closer partnerships with the IAEA, and organise regional scientific and technical forums and conferences, to include the scientific applications of the CTBTO's IMS data. On a similar note, the IAEA, in cooperation with international partners such as the UN or P5, could host a regional Nuclear Security Forum, part of which could highlight the CTBT as a vital tool to ensuring nuclear non-proliferation in the region.

Cooperation through joint educational initiatives is another opportunity for regional states to strengthen nuclear non-proliferation efforts in the Middle East. Joint degree programmes in nuclear sciences and non-proliferation would allow students to study in different countries in the region to understand the distinct perceptions and challenges related to

non-proliferation and disarmament, including the CTBT. For degree programmes in nuclear engineering or science, the CTBTO could invite students from the region to Vienna for a tour of the CTBTO's facilities, with talks from technical experts.

The CTBTO could also offer to host visiting fellows with technical or scientific backgrounds from regional states, including Annex 2 countries. Visiting fellows could contribute to the work of the CTBTO technical staff through their own research projects, while gaining exposure and understanding of how the CTBTO operates. The CTBTO has a long-running internship programme, but could ensure that specific internship positions are reserved for young people from Annex 2 and other non-ratifying states in the region.

The creation of a dedicated regional task team in the CTBTO would help to strengthen the organisation's efforts to develop targeted scientific, technical, and political engagement and gain a better understanding of the political sensitivities associated with the Treaty in the Middle East. In support of these efforts, states could agree to increase their contributions to the CTBTO's annual budget.

Policy and Promotion
While civil society and educational efforts are important to enhance the CTBT's prospects in the region, ultimately this is a decision to be taken at a political level. To initiate a high-level dialogue on the role of the CTBT in the region, the CTBTO should seek to develop cooperation with important regional organisations such as the League of Arab States (LAS), the Organization for Islamic Cooperation (OIC), and the Gulf Cooperation Council (GCC). As part of a campaign to increase political engagement in the region, the CTBTO's Executive Secretary Dr. Rob Floyd could make a trip to the Middle East to meet with officials and indicate his commitment to better understanding the challenges facing the CTBT.

Additional actions also could be taken through the Article XIV conferences, where the CTBTO could invite participation from non-ratifying and non-signatory states as observers, allowing states to engage with the process without requiring a binding political commitment. On the same note, states which have yet to join the treaty could offer to host IMS stations on an ad-hoc basis, allowing the CTBTO and the international community to benefit from the data collected. An example of this is Israel, which hosts two IMS stations and a radionuclide laboratory — other states in the region could be invited to do the same. The CTBTO should engage with states such as Iran, which are concerned about the data collected on their territory, and reassure them of the integrity and usage of that data. Thus, even if there is no political will or conditions to join the CTBT at this time, states in the region can still take positive steps towards strengthening the treaty and non-proliferation regime in general.

Moreover, CTBT entry into force would be an undoubtable victory for the NPT regime more widely; therefore, there is room for initiatives from the CTBTO side on the sidelines of NPT Review Conferences. For instance, the CTBTO could partner with the EU or P5 to host a side event on the role of the CTBT, including its implementation in the Middle East. The UN's annual conference on establishing a MEWMDFZ would be another platform through which the CTBTO could demonstrate its importance to the region. Even though not all regional states have participated in or endorsed the aims of this conference, in any future MEWMDFZ the CTBT would likely be a key component as part of a broader regional monitoring and non-proliferation structure. The CTBTO could also explore the role of the CTBT in other established nuclear weapon-free zones around the world, creating lessons learned and best practices for the Middle East.

Another way to raise the profile of the CTBT at a political level would be to have a high-level non-binding political declaration on the negative impact of nuclear testing from governments or former officials. While achieving such a statement from all countries in the region could be challenging, it would be a positive step to build a solid basis for future political consultations on the CTBT. On the non-governmental side, religious leaders play a major role in the region, and their endorsement would be viewed through the lens of an apolitical moral obligation to protect society from the harmful effects of nuclear tests. There are already some existing precedents in the form of Iran's fatwa against nuclear weapons. An official condemnation of nuclear testing by the religious leaders of the Middle East would have a powerful effect, and would bring the message of the CTBT to many people who may never even have heard of the CTBT, or know about the legacy of nuclear tests.

The nuclear weapons states have a special responsibility to promote the CTBT in the region. France in particular could take a lead role in this effort, given the history of French nuclear testing in Algeria. The P5 should make greater efforts to address their nuclear testing legacy, especially in cases where indigenous communities suffered negative consequences without adequate support or compensation from the authorities. While the impetus to ratify the CTBT in the Middle East must come from the states of the region, the P5 needs to set a good example in this regard. US and China's ratification would further bolster efforts to secure a nuclear testing-free zone in the Middle East.

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Table 2. Recommendations to promote CTBT ratification in the Middle East

Awareness and Advocacy	
Short-term (up to 5 years)	1. Initiate Track 2 and Track 1.5 dialogue on CTBT issues. 2. Translation of official documents related to the CTBT, digital communications campaigns, and research reports into the major languages of the Middle East. 3. Increase involvement and engagement from young research, technical, and policy professionals from the Middle East, through organisations such as the CYG, CTBTO YPN, and MENACS.
Medium-term (5-15 years)	1. Sustain discussions through Track 2 and Track 1.5, and facilitate Track 1 dialogue. 2. Create region-specific digital campaigns to educate people about the risks of nuclear testing, and the important role played by the CTBT.
Long-term (15 years +)	1. Combination of all three Tracks - 1, 1.5, and 2. 2. For the CTBTO and regional states: to keep mechanisms established under Short- and Medium-term goals working.
Cooperation and Capacity-Building	
Short-term (up to 5 years)	1. Enhance cooperation between the CTBTO and the IAEA through a Cooperation Agreement, to promote the CTBT as a vital tool to ensure nuclear non-proliferation in the region as more states adopt nuclear technologies. 2. Creation of visiting fellowship opportunities for early-mid career professionals from the region to participate in the CTBTO's work.
Medium-term (5-15 years)	1. The CTBTO, in cooperation with the IAEA, should organise regional scientific and technical forums and conferences, to highlight the scientific applications of the CTBTO's IMS data. 2. Establishment of dual degree programmes between the states of the region, focusing on nuclear technology and non-proliferation. 3. Create a dedicated regional task force in the CTBTO to lead on scientific, technical, and political engagement in the Middle East.
Long-term (15 years +)	1. For the CTBTO, IAEA, regional states and international facilitators: to keep mechanisms established under Short- and Medium-term goals working.
Policy and Promotion	

Short-term (up to 5 years)	1. The CTBTO's Executive Secretary should make a trip to the Middle East to promote high-level engagement with the Treaty. 2. The CTBTO should facilitate the broader participation of non-ratifying and non-signatory states in the Article XIV conferences as observers. 3. The EU or P5 could host a side event on the role and importance of the CTBT at future NPT Review Conferences. 4. Host a side event at the UN's annual conference on establishing a MEWMDFZ to underline the role of the CTBT in other established NWFZs around the world, and create lessons learned and best practices for the Middle East. 5. The states of the region could make high-level non-binding political declarations on harmful effects of nuclear testing, and maintain the regional moratorium on nuclear testing. 6. Religious leaders in the Middle East could publicly condemn nuclear testing, and spread the message of the CTBT to a larger audience.
Medium-term (5-15 years)	1. The CTBTO should conclude Cooperation Agreements with the LAS, OIC, and GCC to focus its work in the region through established organisations. 2. Non-ratifying or non-signatory states could agree to host IMS stations on an ad-hoc basis. 3. The P5 should work to substantively address their legacy of nuclear testing, ensuring adequate support for affected communities. With its history of nuclear testing in the Middle East, France should lead in this regard.
Long-term (15 years +)	1. For the CTBTO and regional states: to keep mechanisms established under Short- and Medium-term goals working. 2. Ratification of the CTBT by the remaining Annex 2 States, and the US and China in particular.

CONCLUSION

Although the obstacles for a region-wide endorsement of the CTBT are numerous, and the conditions for a formal political process may take many years to materialise, the CTBT needs to be recognised as an indispensable component of non-proliferation and disarmament efforts in the Middle East. While current political conditions are far from optimal, there is a range of positive steps that the states of the region and the international community could take to strengthen the position of the CTBT. Low-hanging fruit such as creating educational opportunities and raising awareness of nuclear testing are realistic goals which can be implemented in the short-term. Making the messages of the CTBT more accessible through engagement with traditionally under-represented communities and providing a region-specific context and focus are applicable not just to the Middle East, but also to other regions with non-ratifying states.

With a solid foundation of support and engagement, in the medium-term, states can develop concrete mechanisms for collaboration on the scientific and technical applications of

nuclear technologies to address the pressing challenges facing the region. The CTBTO can support these efforts by engaging with communities of technical experts and offering relevant educational and professional development opportunities. In the long term, a political level endorsement of the CTBT can only be possible through structured gradual coordination between the CTBTO and the region. In this regard, the international community has a vital role to play in stimulating and promoting political engagement, in part by living up to their obligations under the CTBT and other international non-proliferation and disarmament mechanisms.

Even if a Middle East nuclear test-free zone proves impossible to achieve in the long-term, the process of engagement between the states of the region and international actors could be a beneficial step in generating a genuine dialogue on security challenges and perceptions among the different states. The CTBT and its monitoring regime will not resolve the complex security, non-proliferation, and disarmament challenges in the region. Rather, the CTBT is part of a larger framework of interlinked and mutually reinforcing mechanisms to promote transparency, accountability, and inalienable security for the region as a whole.

HOW PUBLIC OPINION AFFECTS CTBT PROSPECTS

■ Antonios Eskander ■ Laura Varella ■ Laveen Safary[1]

ABSTRACT

This paper addresses the role public opinion and civil society can play in national and international disarmament efforts and proposes some recommendations as to how public opinion could be used to facilitate and expedite the entry into force of the Comprehensive Nuclear-Test-Ban Treaty (CTBT).

INTRODUCTION

The Comprehensive Nuclear-Test Ban Treaty (CTBT) prohibits "any nuclear weapon test explosion or any other nuclear explosion" anywhere in the world. This treaty was opened for signature in September 1996. It has been signed so far by 185 nations and ratified by 170 nations. However, the treaty cannot enter into force until its ratification by 44 specifically designated states (so called Annex 2 states); 8 of those states are yet to do so: China, DPRK, Egypt, India, Iran, Israel, Pakistan, and the United States[2]. The DPRK, India and Pakistan have not even signed the CTBT.

The list of CTBT signatory and ratifying states continues to grow. The Union of the Comoros and Cuba have become the most recent states to ratify the Treaty in February 2021. But there has been no breakthrough in changing the stalled situation with respect to Annex 2 states. This calls for reflection by all sides, including the civil society, about the need for additional efforts and new approaches that may have a potential for change[3].

In this paper, the authors attempt to explore some possible approaches to addressing this task. They look at historical experience, where civil action has been helpful in putting the cessation of nuclear testing as a priority issue for international negotiations in late 1950s – early 1960s and in late 1980s – early 1990s, as well as at the history of successful work by the civil society on a much wider issue of a complete ban on nuclear weapons, namely, much more recent elaboration and entry into force of the Treaty on the Prohibition of Nuclear Weapons (TPNW). The selected historical experiences are, of course, relevant but not exhaustive. Ideally, other areas of disarmament also require similar examination because different subject matters notwithstanding, they can also offer useful lessons for the work aimed at the finalization of the task of implementing a global ban of nuclear tests.

[1] The authors thank Amb. Sergey Batsanov, Director (Geneva Office) and Member of Pugwash Council, Pugwash Conferences on Science and World Affairs, and Vladislav Chernavskikh, CENESS Research Associate, for their generous assistance with preparing the article.

[2] UNODA Workshop, CTBTO: Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization Preparatory Commission, 57th session (tent.), 10-12th November 2021, 57th Session* (tent)

[3] United Nations Office for Disarmament Affairs, "Civil Society Engagement in Disarmament Processes. The Case for a Nuclear Weapons Ban", 2016, <https://digitallibrary.un.org/record/1319265?ln=en>.

BRIEF LOOK INTO THE HISTORY

Antinuclear movements and nuclear testing in South Pacific

Between 1946 and 1996, about 315 atomic and hydrogen nuclear tests were conducted across the South Pacific by the United States, the United Kingdom, and France.[4] The tests had severe and long-lasting humanitarian consequences for the local population – many residents of the areas which were affected by the nuclear fallout suffered serious and lethal adverse health effects, while the test sites and the surrounding areas have incurred significant environmental damage.[5] As a result of the testing, six islands in the region were destroyed completely and fourteen others were left uninhabitable due to contamination[6].

Table 1. Nuclear Tests in Oceania

Country	Period	Tests	Locations
U.S.	1946–1962	105	Bikini and Enewetak atolls (Marshall Islands); Christmas (Kiritimati) Island; Johnston (Kalama) Atoll
UK	1952–1958	21	Australia; Monte Bello Islands; Christmas (Kiritimati) Island; Malden Island
France	1966-1996	193	Moruroa and Fangataufa atolls (French Polynesia)

As the above table demonstrates, nuclear testing in the region can be roughly divided in two periods: the first, which ended in the early 1960s, when the testing was performed by the US and the UK, and the second, lasting from the mid-1960s till the mid-1990s, when only France was conducting nuclear test explosions in the region.

The destructive nature of the nuclear tests generated widespread local and international opposition from civil society movements, which mounted public pressure campaigns advocating a ban on nuclear testing. These campaigns are often cited as one of the powerful factors that led to the development and adoption of several important elements of the global nuclear nonproliferation regime, including the Partial Nuclear Test Ban Treaty (PTBT) of 1963, the South Pacific Nuclear Free Zone Treaty (Rarotonga Treaty) of 1985, and the CTBT itself.

The first protests against nuclear testing in the South Pacific can be traced back to the first half of the 1950s, when residents of Western Samoa, the Cook Islands, and the Marshall Islands on several occasions expressed strong opposition to the U.S. and UK decisions to carry out atmospheric nuclear tests in the area.[7] Of note is the fact that, at the time, New Zealand

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4 ICAN, "Prohibiting Nuclear Weapons. A Pacific Islands Priority," 2017, <https://icanw.org.au/wp-content/uploads/Pacific-Report-2017.pdf>.

5 Patricia O'Brian, "75 years after nuclear testing in the Pacific began, the fallout continues to wreak havoc," The Conversation, 6 April 2021, <https://theconversation.com/75-years-after-nuclear-testing-in-the-pacific-began-the-fallout-continues-to-wreak-havoc-158208>.

6 Environmental Justice Atlas, "Nuclear Colonialism (US atomic bomb tests in Bikini and Enewetak Atolls, Marshall Islands)," 2018, <https://ejatlas.org/conflict/nuclear-colonialism-in-marshall-islands>.

7 Nic Maclellan, "The Nuclear Age in the Pacific Islands," The Contemporary Pacific, Vol. 17, no. 2 (2005): 363–72, <https://www.jstor.org/stable/23722064>.

supported Western nuclear testing in the South Pacific, consistently backing the U.S. and the UK on nuclear issues.[8] That position would later change, in large part due to a shift in public opinion.

In 1954, the U.S. tested a 15-megaton hydrogen bomb on the Marshall Islands, which spread radioactive fallout across a 50,000-square-mile area, including inhabited atolls where the population was not evacuated.[9] That incident provided a strong impetus to a formation of a worldwide antinuclear movement supported by the global scientific community, which pointed out environmental and physical harm caused by atmospheric testing[10]. According to U.S. Secretary of State John Foster Dulles and President Dwight Eisenhower, that public pressure was one of the factors that forced the U.S. to adopt a unilateral moratorium on testing in 1958 after the Soviet Union did it earlier that year. In a similar manner, in 1961, U.S. ambassador to the UN Adlai Stevenson pointed out the difficulty of testing on the U.S. site on the Marshall Islands caused by public pressure[11].

The Partial Nuclear Test Ban Treaty (PTBT), which prohibited all test detonations of nuclear weapons except for those conducted underground, was signed by the U.S., the UK and the Soviet Union and entered into force in 1963. Jerome Wiesner, a White House Science Advisor, and McGeorge Bundy, the U.S. National Security Advisor, remarked that the Treaty was achieved in large part due to public advocacy by an assortment of civil society groups such as the National Committee for a Sane Nuclear Policy, Women Strike for Peace, and other religious, scientific and workers' union organizations.[12]

France, however, did not sign the PTBT and started its own nuclear testing program in French Polynesia in 1966. This greatly intensified the antinuclear movements in Oceania, which took to practical political action. Activists launched massive demonstrations, boycotted French products, and sent civilian ships to block French nuclear testing sites.[13] The Labour Governments of Australia and New Zealand, which were elected largely through campaigning on the promise to end nuclear testing in the region, together with the Government of Fiji took the issue to the International Court of Justice, which called on France to end testing.[14] The governments of Fiji, New Zealand and Papua New Guinea had additionally co-sponsored a UN resolution calling for a South Pacific Nuclear Weapon Free Zone. By 1975, this pressure resulted in France abandoning atmospheric nuclear testing but continuing with underground tests.

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8 Kate Dewes, "Legal Challenges to Nuclear Weapons from AOTEAROA/New Zealand," Disarmament and Security Center, <http://legacy.disarmsecure.org/publications/papers/legal_challenges_to_nuclear_weapons_from_aotearoa_new_zealand.php>.

9 Michelle Keown, "Waves of destruction: Nuclear imperialism and anti-nuclear protest in the indigenous literatures of the Pacific, Journal of Postcolonial Writing," 54:5, 585-600, 2018, <https://www.tandfonline.com/doi/full/10.1080/17449855.2018.1538660>.

10 Pasadena Star-News, "Pauling Petition Asks U.N. Stop A-Tests," January 14, 1958, Oregon State University, <https://scarc.library.oregonstate.edu/coll/pauling/peace/newsclips/peace5.007.22.html>.

11 Laurence S. Wittner, "The Power of Protest," Bulletin of the Atomic Scientists, Vol. 60, Issue 4, 2004, p. 20-26, <https://journals.sagepub.com/doi/full/10.2968/060004008>.

12 Ibid.

13 Laurence S. Wittner, "Nuclear Disarmament Activism in Asia and the Pacific, 1971-1996," Asia Pacific Journal, Vol.7, Issue 25, Number 5, 15 June 2009, <https://apjjf.org/-Lawrence-S.-Wittner/3179/article.html>.

14 Michael Hamel-Green, "Antinuclear Campaigning and the South Pacific Nuclear-Free Zone (Rarotonga) Treaty, 1960-85," Australian Society for the Study of Labour History (Melbourne branch), <https://labourhistorymelbourne.org/antinuclear-campaigning-and-the-south-pacific>.

The period of 1975–1985 saw a further rise of antinuclear grassroots NGOs and NGO coalitions, such as the Nuclear Free and Independent Pacific Movement, all across the Pacific, as well as a rapid growth of regional antinuclear campaigns, with some national rallies drawing up to 250,000 people.[15] This led to the reelection of Labour governments in New Zealand and Australia, which started coordinating their efforts with the other Pacific states to establish a South Pacific Nuclear Free Zone (SPNFZ).

New Zealand additionally banned all nuclear armed ships from entering its ports, refusing entry even to U.S. ships. The effect of antinuclear campaigns could be seen in public opinion polls: between 1978 and early 1984, polls found that opposition to allowing nuclear-armed ships into New Zealand ports rose from 32% to 57%. And once the government issued an official ban and refused U.S. Navy ships entry in its ports, opposition grew to 76%[16]. On the national legislation level, New Zealand additionally proclaimed its territorial sea, land and airspace a nuclear-free zone in 1987.

The Treaty of Rarotonga, which established an SPNFZ in the region, entered into force in 1986. Protocol III of the Treaty prohibits the testing of any nuclear devices within the Treaty zone – but it was not signed by the U.S., the UK or France at that time. French tests continued until 1996, when, after six months of worldwide antinuclear protests, the French president announced the "definitive end" of the nuclear testing program[17]. That year, all three protocols were signed and ratified by the UK and France, and signed - but ultimately, still not ratified - by the U.S.

It can be argued, therefore, that the protest movement in the South Pacific had achieved its objectives through its ability to sensitize at least some of the local governments, as well as civil society in the Western nuclear weapon states, by using primarily humanitarian and environmental arguments. The history of nuclear testing in the South Pacific presents a compelling case that demonstrates the significant effect which robust antinuclear civil society movements and sustained public pressure can have on nuclear policy, both regionally and internationally.

Nevada-Semipalatinsk experience

Between 1949 and 1989, the USSR had conducted 456 nuclear weapon tests at what used to be is first and most important nuclear test range in eastern Kazakhstan, near the city of Semipalatinsk (now Semey). That number included 116 atmospheric tests (before 1963) and 340 underground tests. For a long time, especially during the phase of atmospheric testing, little attention was paid to the protection of public health and the environment, which couldn't but have grave consequences. However, information about those consequences was not available to the public. That created a strong protest potential, but in the Soviet political system prevailing until the 1980s, there were no open protests or criticism – neither locally, nor in the big political centers of the country.

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15 Laurence S. Wittner, "Nuclear Disarmament Activism in Asia and the Pacific, 1971-1996," Asia Pacific Journal, Vol.7, Issue 25, Number 5, 15 June 2009, <https://apjjf.org/-Lawrence-S.-Wittner/3179/article.html>.

16 Ibid

17 The Guardian, "France stops nuclear test programme – archive, 1996," <https://www.theguardian.com/world/from-the-archive-blog/2021/jan/27/france-stops-nuclear-test-programme-pacific-1996>.

The situation started to change with Mikhail Gorbachev's democratization reforms. In early 1989, Olzhas Suleymenov, a popular Soviet Kazakh poet who went into politics, initiated a powerful popular campaign against nuclear testing. The movement rapidly gained support from citizens of Kazakhstan demanding the closure of the Semipalatinsk testing site. Thousands of people united in campaigns against nuclear weapons testing. Several meetings and peace marches were organized that year, receiving attention from the highest levels of government in the Soviet Union. The antinuclear protests were nonviolent, and the authorities made no attempt to suppress them. Indeed, the Kazakh Soviet Socialist Republic authorities appeared to be generally supportive of the peace marches.

In addition to new political atmosphere in the country, three factors contributed to this campaign gaining traction: the popularity of Mr. Suleimenov, his close contacts with high-level officials both in Kazakhstan and in Moscow, and his success in establishing relations and partnership with anti-nuclear protesters in the US state of Nevada, home to the most important US nuclear weapons laboratories and test range. This partnership, which became known as the Nevada Semipalatinsk Antinuclear Movement (NSAM) was, somewhat ironically, facilitated by the Joint Verification Experiment (JVE), conducted by the US and the USSR in 1988 first in Nevada and then in Semipalatinsk with the view to jointly testing verification techniques during real nuclear tests at both facilities. This allowed the protest movement in Kazakhstan to develop a broader agenda that included a general prohibition of nuclear tests (not just in Kazakhstan, but globally) – which combined both humanitarian and environmental concerns with appeals to improve international security through the prohibition of nuclear testing. This, in turn, made it easier for the campaign to develop better understanding of its objectives in Moscow and internationally.

In the meantime, similar protests arose in the United States at a nuclear testing site in Nevada, uniting religious groups and environmentalists. However, in contrast with the protesters in Kazakhstan, Nevada antinuclear activists struggled with state suppression: 687 people were arrested in 1989 during what activists called the Lenten Desert Experience protests. Despite that, on September 24th, antinuclear activists from the Nevada Desert Experience (NDE) surrounded the Department of Energy building in Las Vegas in order to display their solidarity with their Kazakh counterparts and to mark the 40th anniversary of the Soviet nuclear testing program[18]. The Nevada Desert Experience became a persistent group representing long-term antinuclear activism. Ultimately, the group, which started with simple protests at the end of the 1960s, evolved into an organization by the 1990s that was promoting the Test Ban Treaty concept at the legislative level.[19]

The above shows that the social society movements against nuclear testing in the USSR and Kazakhstan on the one hand, and in the US on the other, managed to capitalize on a range of popular concerns by leveraging and integrating environmental, public health, ideological and religious factors. They succeeded in creating a political environment conducive to the serious of unilateral moratoria on nuclear testing announced by most nuclear powers in early 1990s, and then to successful negotiations on the CTBT, culminating in 1996 with the adoption of the treaty and its opening for signature.

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[18] Nevada Desert Experience Official Website, "NDE's Historical Timeline," 2012 <http://www.nevadadesertexperience.org/history/timeline.htm>.

[19] Ibid

The International Campaign to Abolish Nuclear Weapons (ICAN) and its role in the Treaty on the Prohibition of Nuclear Weapons (TPNW)

A recent example of the essential role of civil society in the negotiations and adoption of a treaty is the work of the International Campaign to Abolish Nuclear Weapons (ICAN) regarding the Treaty on the Prohibition of Nuclear Weapons (TPNW), which was adopted by the UN General Assembly in 2017 and entered into force in January 2021. The treaty was a product of partnership between civil society, international organizations and non-nuclear weapons states that, over a period of seven years, were able to negotiate a binding instrument that banned the development, testing, production, manufacture, acquisition, possession, and stockpiling of nuclear weapons.

ICAN was launched in 2007 by several actors who were frustrated with the lack of results within the official arms control and disarmament institutions, particularly the Conference on Disarmament (CD) and the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). In those forums, nuclear-weapon states controlled the narrative by insisting that nuclear weapons were a guarantee of their own security and that of their allies, while demanding that all other states adhere to a non-proliferation regime.[20] Hence, according to their conclusions, for almost seventy years nuclear-weapon states had been refusing to make meaningful progress on nuclear disarmament - which encouraged other actors, who were systematically excluded from those discussions despite their interest in the agenda, to think of alternatives for achieving their goal of a global nuclear disarmament.

A bit earlier, two humanitarian disarmament campaigns achieved great success and strongly inspired the creation of ICAN: The International Campaign to Ban Landmines (ICBL) and the Cluster Munition Coalition (CMC). The Oslo Process began in 2007 and the Cluster Munitions Convention was signed in 2008.[21] ICAN was able to draw many lessons from those experiences.[22] One of those lessons was the fact that the treaty could be negotiated and adopted without the participation of nuclear-weapon states. The lack of consensus about the agenda was one of the reasons why no progress had been achieved over the previous decades, so ICAN decided to move forward, working with a small group of states and then pushing others to participate.[23] The nuclear-weapon states boycotted the negotiations and proclaimed their refusal to join, but the negotiations continued and some argue that the fact that the process could not be dominated and undermined by states opposed to its goals produced a new set of legal, political, and moral norms that are both clear and strong.[24]

Another lesson drawn by the landmine and cluster munitions campaigns was the need to make a stronger emphasis on humanitarian approach to the discourse of nuclear weapons. The narrative created by the nuclear-weapon states was largely developed around the

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20 John Loretz, "Banning the Bomb, Smashing the Patriarchy / The Treaty Prohibiting Nuclear Weapons: How It Was Achieved and Why It Matters," Medicine, Conflict and Survival, Vol. 27, Issue 4, 2021, <https://doi.org/10.1080/13623699.2021.1973357>.

21 The Convention on Cluster Munitions, Dublin, Ireland, May 30, 2008.

22 Motoko Mekata, "How Transnational Civil Society Realized the Ban Treaty: An Interview with Beatrice Fihn," Journal for Peace and Nuclear Disarmament, Vol. 1, Issue 1, 2018, pp. 79-92, <https://doi.org/10.1080/25751654.2018.1441583>.

23 Ibid.

24 John Loretz, "Banning the Bomb, Smashing the Patriarchy / The Treaty Prohibiting Nuclear Weapons: How It Was Achieved and Why It Matters," Medicine, Conflict and Survival, Vol. 27, Issue 4, 2021, <https://doi.org/10.1080/13623699.2021.1973357>.

argument of nuclear deterrence, in which nuclear weapons were necessary for the protection of their people through the prevention of wars. The TPNW – and the process that produced it – changed this discourse by placing the catastrophic consequences of nuclear weapons at centre stage. Thus, the discussion around nuclear weapons became a discussion on the physical and psychological consequences experienced by people, and the effect on the environment, which inevitably brought the public closer to the debate.[25] In this regard, the role of climate scientists and the International Physicians for the Prevention of Nuclear War (IPPNW) was fundamental in providing evidence that even a limited nuclear war would result in a nuclear winter that would threaten the food security of billions of people.[26]

The change of narrative also gave voice to groups of stakeholders who were not traditionally engaged in the nuclear weapons disarmament debate, such as the organizations that work with humanitarian affairs, human rights, emergency relief and the environment[27]. By broadening the community, ICAN diversified the actors and the arguments around nuclear disarmament, which was key to achieving a positive outcome. As stated by Acheson: "We actively sought to break down barriers, build up capacity, and bring people along, particularly those not normally engaged in thinking or acting against nuclear weapons."[28]

Therefore, the success of the campaign can be credited to its efforts in democratizing the debate. First, because it moved the discussion from forums where nuclear-weapon states have more influence to places such as the General Assembly, where each country has one vote and numbers make a difference in negotiations. Second, because it amplified the discussion on nuclear weapons by framing it under a humanitarian approach, increased transparency during the negotiations and made the language more accessible to the general public, which facilitated the work of local groups in applying pressure domestically to their governments. Finally, the campaign broadened the scope of actors that participated in the treaty negotiations, bringing an important transformation in the field of international law-making. Thus, the role played by civil society as an active participant in the TPNW negotiations was key to achieving a positive outcome for nuclear disarmament and to demonstrating the potential that civil society has in treaty negotiations, which will certainly impact other movements in the years to come.

One caveat must be made here: the successful work of ICAN has not (at least, not yet) brought about a fundamental change of attitude towards the TPNW in the nuclear-weapon states, and this is precisely the category of states which deserves particular attention from the CTBT NGO community (despite the fact that France, Russia and the UK have ratified the CTBT).

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25 Alexander Kmentt, The Treaty Prohibiting Nuclear Weapons: How It Was Achieved and Why It Matters (Routledge, 2021).

26 John Loretz, "Banning the Bomb, Smashing the Patriarchy / The Treaty Prohibiting Nuclear Weapons: How It Was Achieved and Why It Matters," Medicine, Conflict and Survival, Vol. 27, Issue 4, 2021, <https://doi.org/10.1080/13623699.2021.1973357>.

27 Motoko Mekata, "How Transnational Civil Society Realized the Ban Treaty: An Interview with Beatrice Fihn," Journal for Peace and Nuclear Disarmament, Vol. 1, Issue 1, 2018, pp. 79-92, <https://doi.org/10.1080/25751654.2018.1441583>.

28 Ray Acheson, Banning the Bomb: Smashing the Patriarchy (Rowman & Littlefield, 2021), p. 232 apud John Loretz, "Banning the Bomb, Smashing the Patriarchy / The Treaty Prohibiting Nuclear Weapons: How It Was Achieved and Why It Matters," Medicine, Conflict and Survival, Vol. 27, Issue 4, 2021, <https://doi.org/10.1080/13623699.2021.1973357>.

Several practices employed by ICAN to promote a ratification of the TPNW by a number of states, which enabled its relatively quick entry into force, may be of relevance for the civil society work to promote the CTBT. Among them are:

- Active engagement with a variety of think tanks, including those whose agenda may differ from the goal of a complete nuclear disarmament;
- Well-orchestrated and well targeted approaches to national and local politicians, members of parliaments and state officials, including individual letters and appeals signed by famous personalities and opinion leaders from various walks of life;
- Good formulation of arguments appealing to politically active groups and based on serious public opinion research, in parallel with research of governmental policies in a variety of countries;
- Active work on the sidelines of various inter-governmental and non-governmental conferences and meetings, not necessarily devoted to the total prohibition of nuclear weapons;
- Ability to identify and engage individual state officials and high-level diplomats in order to promote the TPNW course.

CONCLUSION AND RECOMMENDATIONS

The three above-mentioned examples provide serious food for thought about what civil society could do. Of course, those examples cannot be simply transplanted onto the current situation and civil society work to expedite the entry into force of the CTBT. Times are changing and concepts are changing with them. Thus, ICAN succeeded in playing a much more direct role in multilateral diplomatic negotiations and in formulating and bringing to the attention of many countries its own narrative about their progress. It has also earned credentials as a powerful force, stimulating countries to ratify the treaty they negotiated.

The current situation should be duly taken into account. Today it seems necessary to concentrate efforts on the treaty ratification by the two remaining permanent members of the UN Security Council: the US and China. That alone would not bring the treaty into force, but it would fundamentally change the situation. China has indicated that should the US ratify the treaty, Beijing would quickly follow suit. Therefore, and given Washington's declared interest in engaging China in nuclear-weapons negotiations, one should consider promoting US-China contacts and discussions on this issue. It is also necessary to help develop new argumentation as to why the entry into force of the CTBT would be in US interests from the military and strategic perspectives (taking into account the current US allegations of the imminent build-up of Chinese strategic nuclear forces). Given the sensitivity of these and other related issues, the civil society organizations should first try to introduce them through Track 2 discussions. And, in general, there is a need for more non-governmental meetings.

Recommendations could also address the need:

- To strengthen the focus on energizing civil society and public opinion in the United States in order to encourage the ratification of the CTBT.
- To encourage civil society to promote histories of negative impacts of nuclear testing on people and land in the United States and elsewhere.
- To further a humanitarian discourse by disclosing data about the consequences of nuclear tests and include victims from nuclear testing in meetings with relevant players and events for the general public;
- To better include the victims' perspectives and amplify their experiences in order to raise awareness about nuclear testing and the importance of the CTBT.

- To increase academic and popular interest in the stories of downwinders and the effects of testing in American communities through the commissioning of historians and providing downwinder communities platforms to share their experiences.
- To increase public participation in the decision-making process by sharing all governments positions regarding the entry into force of the CTBT and by promoting discussions around nuclear tests in accessible language and format (website, videos, podcasts) targeted at different audiences that could support the agenda (environmental activists, youth, academics, peace activists, etc.).
- To create materials about the CTBT verification mechanism, its importance in monitoring nuclear tests and its effectiveness in preventing other types of harm.
- To make arrangements for more active participation in processes devoted to various "trending" issues, such as climate change. In this regard, civil societies have a wider freedom of maneuver compared to the CTBT preparatory Commission and its Provisional Technical Secretariat (PTS), although some caution and discretion would be in order.
- To establish closer cooperation with ICAN and other civil society organizations working on nuclear disarmament (without sacrificing priority to issues of nuclear testing).
- To make a better use on the growing emphasis on and attention to environmental and climate change issues. These are complex issues, including society, economic, transition to green economy and other issues. Both the CTBTO Preparatory Commission and the pro-CTBT civil society groups should be more present and visible at important conferences and meetings on these subjects.
- To promote further studies on the role of civil society in various, including non-nuclear, issues of arms control, nonproliferation and disarmament.

EUROPE AND THE CTBT: AT WIT'S END?

Benjamin Fernando Daniel Leichte

ABSTRACT

The Comprehensive Nuclear Test-Ban Treaty (CTBT) enjoys support from the vast majority of states, including in Europe. However, eight more states have to sign or ratify it to enter into force. While the CTBT is in limbo, its verification system is robust and nearly complete, and there exists a de-facto moratorium on nuclear tests. Despite this, the full potential of the verification system can only be implemented once the treaty has entered into force. The urgency of doing so was highlighted by the Trump administration's consideration of resuming nuclear testing. Accomplishing entry into force is a key objective of the EU members and the UK, which have been among the top supporters of the CTBT: all of them have signed and ratified it. They have been pushing for its entry into force in diplomatic initiatives and providing extra-budgetary contributions. Having exhausted its domestic and diplomatic means, we argue that Europe can further the CTBT by increasing civil society involvement.

INTRODUCTION

It has been 25 years since the Comprehensive Nuclear Test-Ban Treaty (CTBT), the adoption of which would ban nuclear weapons tests of any kind, opened for signature. Despite assent from the vast majority of the world's states, it will only enter into force once eight further 'Annex 2' countries have signed and/or ratified the treaty.

Nonetheless, the CTBT has in some ways been successful irrespective of this. There is a de facto moratorium on conducting nuclear tests, which only North Korea has violated in this century. These tests were registered by the International Monitoring System – the CTBT's verification tool, that is now more than 95% complete[1].

Despite these achievements of the CTBT, its entry into force is necessary. Even though the IMS is mostly set up, the verification regime remains incomplete without entry into force: raw data transmission to the International Data Centre is voluntary. There are no on-site inspections or consultations.[1] Moreover, the DPRK nuclear tests and the fact that the previous US administration had considered resuming nuclear testing highlight the need to move beyond a mere norm toward a legal prohibition of nuclear tests.[2] Finally, the CTBT is a central pillar of the nuclear non-proliferation regime. The conclusion of negotiations of the

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1 Francesca Giovannini, "The CTBT at 25 and Beyond", September 2021, <The CTBT at 25 and Beyond | Arms Control Association>.

2 John Hudson and Paul Sonne, "Trump administration discussed conducting first U.S. nuclear test in decades," May 22 2020, <https://www.washingtonpost.com/national-security/trump-administration-discussed-conducting-first-us-nuclear-test-in-decades/2020/05/22/a805c904-9c5b-11ea-b60c-3be060a4f8e1_story.html>.

CTBT was a vital component of the decision to extend the NPT indefinitely in 1995.[3] The 13 Steps agreed upon in the 2000 NPT Review Conference entailed an early entry into force of the CTBT.[4] Likewise, the 2010 Action Plan views the CTBT as a cornerstone of the nuclear disarmament and non-proliferation regime.[5] The entry into force of the CTBT will further strengthen this regime.

A EUROPEAN PERSPECTIVE

From a European perspective, progress toward universal adoption of the CTBT presents something of a conundrum. On the one hand, Europe[6] has always had a particularly important role to play in nuclear negotiations. For the first three decades of the atomic age, it was the only continent home to more than one nuclear power; its constituent members have historically been the first states to call for strategic arms control measures. Today, the European Union is a key stakeholder in other nuclear negotiations (for example, the Vienna talks on a restoration of the Joint Comprehensive Plan of Action with Iran).

On the other hand, all European countries signed and ratified the CTBT some time ago – and have abided by its provisions, despite its current legal nullity. In terms of domestic government action, there is nothing the European nations can do to advance the enforcement of the CTBT directly. Nonetheless, European financial, technological, and diplomatic initiatives cannot and should not be overlooked. We begin by summarising some of these contributions to date before suggesting what more could be done.

The IMS and Scientific Research

The International Monitoring System (IMS) is the technical backbone of the CTBT, used to monitor compliance through a sophisticated system of scientific instruments designed to detect nuclear weapons tests. It consists of over three hundred seismic, hydroacoustic, infrasound and radionuclide stations designed to locate, identify, and characterise any illicit nuclear explosion.

Today, the IMS is almost fully operational, and this is in large part due to contributions by European nations[7]. Around 15% of seismic stations and a third of radionuclide detectors are hosted by European nations, at a density significantly higher than the global average.

Historical legacies also make the overseas territories of European nations – especially the UK, France, and Portugal – of particular value to the IMS. Stations located on remote island chains (the UK's St Helena and Tristan de Cunha, France's Kerguelen and the Crozet Islands, and Portugal's Azores, for example) provide valuable coverage in otherwise under-surveilled

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3 Daryl G. Kimball and Randy Rydell, "The NPT in 1995: The Terms for Indefinite Extension," May 2020, <https://www.armscontrol.org/act/2020-05/features/npt-1995-terms-indefinite-extension>.

4 2000 NPT Review Conference Final Document, June 2000, <https://www.armscontrol.org/act/2000-06/2000-npt-review-conference-final-document>.

5 2010 NPT Review Conference 64-point action plan, February 05, 2020. <https://www.international.gc.ca/world-monde/issues_development-enjeux_developpement/peace_security-paix_securite/action_plan-2010-plan_d_action.aspx?lang=eng>.

6 For the purpose of this article we define Europe as the EU, its members and the UK.

7 VERTIC, Final report of the Independent Commission on the Verifiability of the CTBT, 2000 <http://www.vertic.org/media/assets/CTBT%20Commission%20Final%20Report.pdf>.

areas[8]. This is particularly useful in the context of hydroacoustic data collection, where the vast size of the oceans presents significant monitoring challenges.

The involvement of European researchers and institutions is not limited to the collection of raw data. Several regional centres of excellence are involved in nuclear forensics research aligned with the aims of the CTBT Preparatory Commission (CTBTO). Among these 'National Data Centres' are the UK's Atomic Weapons Establishment (Blacknest), France's Atomic and Alternative Energy Commission, Germany's Federal Institute for Geosciences and Natural Resources, Romania's National Institute for Earth Physics, the Netherlands' Meteorological Institute, and Norway's NORSAR.

While initial notification of suspected nuclear tests (such as that carried out by the DPRK in 2017) is undertaken by the CTBTO, much of the scientific research underpinning these models, such as synthetic seismic simulations, is being conducted by these national organisations. Both they and the CTBTO also routinely highlight the potential of IMS data to be used for other purposes as well: from locating the site of the sunken Argentinian submarine ARA San Juan in 2017[9] to using IMS data to study the dynamics of volcanoes[10] and the migrations of whales[11].

Financial Contributions

European states also contribute significantly to the CTBTO in financial terms. In 2021, EU members and the UK provided roughly 30% of the CTBTO's budget, which is disproportionate relative to their populations.[12] The European grouping is also unusual in that all members have paid their dues for the current year, whereas only just over half (101 of 185) of the total CTBTO membership have already done so.[13] The delaying of payments and the resulting accumulation of debt have hindered the proper functioning of the CTBTO for some time.

In addition to these regular budgetary payments, the EU has provided significant voluntary funds from its Common Foreign and Security Policy framework. Since 2006, it has allocated a further €29M for verification, academic exchange and research, and supporting the CTBTO's Science and Technology conference in 2021[14]. This included supporting the CTBTO's Youth Group.

Much of the funding earmarked for infrastructure and research has involved spending on core IMS systems, for example, the development of new radioisotope sampling methods[15]

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8 Annual report of the CTBTO Preparatory Commission, 2020 <https://www.ctbto.org/fileadmin/user_upload/pdf/Annual_Report_2019/English/00-CTBTO_AR_2019_EN.pdf>.

9 J. Vergoz et al., "Analysis of hydroacoustic signals associated to the loss of the Argentinian ARA San Juan Submarine," Pure and Applied Geophysics, 2021 <https://doi.org/10.1007/s00024-020-02625-7>.

10 H. Matsumoto et al., "Interpretation of detections of volcanic activity at Ioto Island obtained from in situ seismometers and remote hydrophones of the International Monitoring System," Scientific Reports, 2019 <https://doi.org/10.1038/s41598-019-55918-w>.

11 R. Le Bras and P. Nielsen, "Range estimates of whale signals recorded by triplets of hydrophones," AGU Fall Meeting, 2017.

12 CTBTO, "CTBTO Member States' Payments," November 7, 2020, <https://www.ctbto.org/fileadmin/user_upload/treasury/45_7_Nov_2021_Member_States_Payments.pdf>.

13 Ibid.

14 CTBTO, "Report: The European Union's special effort in support of the CTBT", 2020.

15 Council Decision on Union support for the activities of the Preparatory Commission for the CTBTO, 2020 <https://data.consilium.europa.eu/doc/document/ST-6651-2020-INIT/en/pdf>.

and capacity building in developing nations. This is particularly important given the under-representation of monitoring systems in many parts of the developing world.

Political and Diplomatic Initiatives

It is the stated EU policy to push for the entry into force of the CTBT and its universalization.[16] To this end, the EU as well as the UK have participated in many diplomatic efforts to urge other countries to sign and ratify the CTBT. This involves regularly raising CTBTO-related issues in bilateral talks with states that have yet to sign or ratify the treaty.[17]

EU members and the UK have consistently voted in favour of the yearly UN General Assembly resolutions calling for the signing and ratification of the CTBT[18]. The EU also sends coordinated demarches to countries that have not signed or ratified the treaty, urging them to do so.[19] Every two years, a Joint Ministerial Statement is issued, which calls on states to sign and ratify the treaty. Since the first Statement in 2002, the Netherlands has been a coordinating country, with other European countries joining in and supporting the initiative.[20]

WHAT MORE CAN EUROPE DO TO BRING ABOUT THE ENTRY INTO FORCE OF THE CTBT?

As the previous section showed, European states have nearly exhausted their domestic options to support the CTBT: all states have signed and ratified the treaty, they provide a significant portion of the organization's budget as well as additional voluntary funds, and they host a considerable share of the IMS. Internationally, the EU promotes entry into force and universalization through diplomatic initiatives. The ultimate goal is to get all eight "Annex 2" states to sign and ratify the CTBT. The accession of any state – whether "Annex 2" or not – increases pressure on the states that refuse to join.

Increasing the Visibility and Import of the CTBT

Academic and public awareness of the CTBT is currently limited, perhaps due to the length of time that has elapsed since it opened for signature. Refocussed attention may provide an impetus to non-signatories or non-ratifiers to do so, especially if moved from a civil society perspective.

This applies to states that have not gotten around to ratification or signature and those countries that refuse to do so for political reasons. European states should increase scholarly attention by further expanding their support for research and development on CTBT-related issues. Academics writing about the CTBT may give policy-makers objective reasons to join the Treaty in their home countries.

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16 Statement by H.E. Mr Josep Borrell, High Representative of the European Union, on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty, September 23, 2021.

17 "Activities undertaken by signatory and ratifying states under measure (k) or the final declaration of the 2017 conference on facilitating the entry into force of the treaty in the period June 2017- May 2019," delivered in the Conference on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty, New York, September 25, 2019.

18 UN General Assembly Resolution, A/RES/72/70, December 13, 2017.

19 According to an EU diplomat familiar with the subject.

20 UN General Assembly Resolution, A/57/586, November 4, 2002.

Civil society has played an important role in paving the way for the CTBT negotiations in the 1990s[21]. It can play an equally important role in bringing it into force. Fostering civil society awareness and involvement can be done by increasing the amount of information available about the importance of the CTBT – something that is best done by the organisation itself.

However, the CTBTO's communication strategy is suboptimal. It is only active on Facebook, Twitter, and YouTube. The majority of its content is only available in English and geared towards members of the arms control community, so that someone not familiar with nuclear tests will find the content insipid and cryptic. The organisation could enhance awareness about its import by expanding to new platforms, such as Instagram and TikTok,[22] by revamping their website and producing content in other languages, especially those of countries that are still to join the CTBT. European states should call on the CTBTO to implement these recommendations and provide the funds. The next generation must know the relevance of the treaty. In addition, members of this generation advocate for ecological sustainability, meaning that their governments should expect more scrutiny.

Diplomatic Initiatives

This support should not be limited to Europe but extend specifically to those countries that are not members and the developing world. Through public diplomacy, Europe could increase domestic pressure on governments to accede to the CTBT. In cases where this direct approach would be diplomatically imprudent, allocating additional funding to the CTBTO for specific purposes relating to such diplomacy may be possible.

Given the changes in the European geopolitical landscape since 1996, efforts should be made to increase the treaty's reach by championing involvement from across the continent and not just those countries that have led this in the past. With the recent departure of the UK from the EU and the leading presence of non-EU nations within the IMS, these efforts must also extend past the EU political bloc.

European nations should continue to call for ratification of the treaty in bilateral and multilateral settings, especially in the upcoming Tenth NPT Review Conference.

Financial and IMS Support

Countries should also pay special attention to the maintenance of the IMS. While waiting for the treaty to enter into force may take years, the IMS must be maintained and possibly upgraded in the future to ensure verification problems do not dissuade countries from joining when political conditions are favourable.

CONCLUSIONS

It is unlikely the CTBT will enter into force in the foreseeable future and Europe's ability to make it more likely is limited. Nevertheless, Europe can ensure that the treaty remains on the agenda by continuing its diplomatic efforts and involving civil society. Moreover, European nations must do what it takes to ensure that the treaty's verification system remains up to date so that when countries do decide to join the CTBT, it is fit for purpose.

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[21] Rebecca Johnson, Unfinished Business: The Negotiation of the CTBT and the End of Nuclear Testing (Geneva, Switzerland: UNIDIR, 2009), pp. 33-39.

[22] You may know these platforms for trivial dances and cat videos, however, the hashtag 'science' has 16.1 billion views on TikTok.

BRINGING MIDDLE EASTERN COUNTRIES CLOSER: A SESAME CASE STUDY AND THE CTBT

■ Eve Cuenca ■ Nour Eid
■ Tibyan Gadalla Naeem Mustafa ■ Sanem Topal

ABSTRACT

The Synchrotron-light for Experimental Science and Applications in the Middle East, or SESAME, is the first synchrotron light source in the Middle East among 60 synchrotrons worldwide. As a significant intergovernmental project, it gathered eight countries of the Middle East and was founded under the auspices of the United Nations Educational, Scientific and Cultural Organization (UNESCO). It was proposed in the early 1980s by widely known scientists and diplomats, among them the Pakistani theoretical physicist and Nobel Prize Laureate Mohammad Abdus Salam; the German physician Herwig Franz Schopper, Director of the European Organization for Nuclear Research (CERN); and Director-General of UNESCO Frederico Mayor. Inaugurated in May 2017 in Jordan, its name itself referring to the "door opener", the project encompasses diverse cultures and symbolizes the promotion of peace and cooperation. This article intends to highlight the lessons learned from this challenging foundation, proving that Middle Eastern nations can cooperate and reach scientific excellence while promoting the entry into force of the CTBT. Seminars, workshops, fellowships and simulations are among the main tools for bringing these nations together in the scientific field.

CONTEXT: LACK OF TRUST BETWEEN THE STATES

The Middle East and North Africa region (MENA) is known for its lack of trust within each individual country (between the public and government) and perhaps more importantly, between the countries. Therefore, one must think of innovative ways to bring the countries of the region closer to one another. This paper will tackle the Synchrotron-light for Experimental Science and Applications in the Middle East (SESAME) project, as it has already been established since 2003 and has been agreed upon by several key countries, namely Egypt, Iran and Israel. Thus, by bringing together countries under a scientific and technological umbrella, the level of trust incrementally increases, enabling better communication levels between the interested parties and the reestablishment (or creation) of diplomatic relations.

SOLUTION: THE SESAME INITIATIVE

Scientific Background
SESAME is a "third-generation" synchrotron light source, also considered an "accelerator." The synchrotron is basically a cyclotron in which relativistic charged particles are forced to follow curved trajectories under applied magnetic fields, and due to such motion, they emit electromagnetic radiations (infrared to hard X-rays) known as synchrotron radiations.

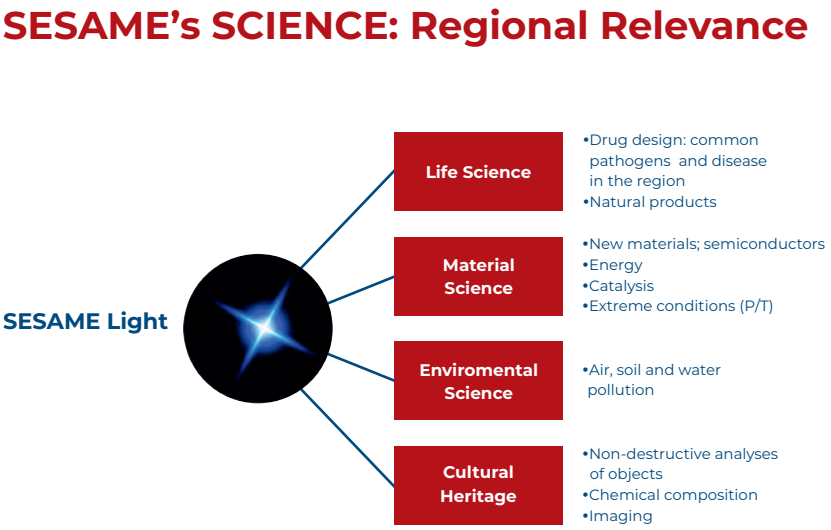

Fig. 1. – Examples of possible research domains for SESAME.

A challenging establishment: Role of international organizations and experts
The foundation of the international SESAME synchrotron laboratory stems from a long political process, culminating in creating a scientific program that aims to bring together scientists and politicians from the Middle East. The lack of research facilities in this region motivated the initiative, first proposed in the early 1980s in Jeddah (Saudi Arabia) and later reviewed during a CERN-based Middle Eastern Scientific Collaboration (MESC) roundtable, built to promote Arab-Israeli collaboration.

The highly challenging birth process of the facility underlined the significance of personalities such as scientists and diplomats, as well as informal conversations. The Project was inspired by the European Organization for Nuclear Research (CERN), the largest center of particle physics in the world, established in the context of post-1945 Europe to overcome its division and the subsequent brain drain. Taming divisions, reducing conflicts, and promoting peace in the Middle East are the three key ideas that cross the history of SESAME. In this troubled context, it was apparent that such an initiative had to follow the procedure of the CERN creation closely, and thus required the framework provided by UNESCO. This international organization held a key role in ensuring the completion of the foundational processes, starting with the consultancy meeting in June 1999, during which an Interim Council (IC) was set up, consisting of 12 members[1]. In 2004 The SESAME research center formally came into existence.

[1] The 12 members were Armenia, Bahrain, Cyprus, Egypt, Greece, Iran, Israel, Jordan, Morocco, Oman, Palestinian Authority and Turkey. After the determination of the site's location, Armenia, Morocco and Oman left the interim council.

The current Members of SESAME are Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, Palestine, and Turkey. The initiative was also opened to states in and outside the MENA region as observers. Current Observers are Brazil, Canada, China, EU, France, Germany, Greece, Italy, Japan, Kuwait, Portugal, Russian Federation, Spain, Sweden, Switzerland, the United Kingdom, and the United States of America.

During the various phases of the Project, Dr. Schopper played a key role, notably as the Chairperson of the IC, along with Koichiro Matsuura, succeeding Dr. Mayor at the head of UNESCO. An important step was taken when the components of the synchrotron light source were shipped from Berlin via Hamburg in June 2002 and were stocked in the Zarqa Free Zone in Jordan. The official foundation was supervised and led by UNESCO: as a new international organization, it had to be approved by the General Conference involving 195 governments, and submitted to and recommended by the Executive Committee with more than 50 member delegates.

Given the success of the CERN, its statute was replicated and adapted for SESAME, with only minor changes. However, despite a broad agreement around the SESAME project, several political and technical problems arose, all linked to the characteristics and the conflicts undermining the stability of the MENA region. The first one was linked to the name of "Palestine", and an agreement was reached to use the official denomination of "Palestinian authorities on behalf of the PLO". After the consensual approval by all the SESAME Members, the Executive Board approved it. The UNESCO decision became effective when at least six governments submitted official letters to the Director-General of UNESCO declaring their intention to join SESAME. SESAME was officially founded on the 6th January 2003.

Another challenge that SESAME faced concerned its enlargement, namely by adding Morocco, Iraq, Saudi Arabia and Yemen. Their integration process was stopped given the complex political ramifications, which was also reflected in the decision to name Jordan to become the host country of the Project, offering free access by all scientists. Lastly, the complex dynamics in the region made it impossible to create a shared financing strategy. The Interim Council decided to allow the host state (Jordan) to finance the site preparation, building and infrastructure, while the other members contribute to the annual operating budget. External states, organizations and members donate or finance specific projects or components. Last but not least, the training of technicians and scientists is financed by the IAEA, the USA, and other donors. It was not until May 2017 that SESAME was inaugurated as the construction phase was finalized, opening a promising future of cooperation between member states.

LESSONS AND RECOMMENDATIONS

The Middle East is often perceived as a troubled region, yet the SESAME initiative proves that Middle Eastern nations can work together to reach scientific excellence. This Project can be a stepping stone, enabling further confidence-building and deepening diplomatic relations in the years to come. However, the lack of security and intense rivalry in the MENA region significantly complicate the process of the region's countries joining the Comprehensive Nuclear-Test-Ban Treaty, which aims to put an end to nuclear testing around the globe. In effect, while Iran, Yemen and Israel have signed the Treaty, they have not ratified it, while Saudi Arabia and Syria have not yet signed it. Even though most of those countries do not have nuclear energy facilities, the lack of cooperation is upsetting the regional balances and relations with the West. SESAME is a great way to enhance international technical collaboration, leaving the political dimension aside. Thus, by developing the SESAME initiative, the consequences will inevitably reflect on the CTBT.

For the CTBT to enter into force, it needs a certain amount of ratifications, which it has not reached for the time being. This is where SESAME and the Middle Eastern member states come into play, as they could be part of the shifting balance towards the entry into force of the Treaty. The SESAME initiative also increases the prospects for countries of the region cooperation with the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO).

Nonetheless, SESAME on its own cannot be sufficient; the CTBTO Preparatory Commission needs to make use of its stance as an international organization to launch and promote other projects of regional cooperation. A prominent example would be establishing a regional technical training center to provide young scientists with basic knowledge on the four technologies that the CTBTO uses in its monitoring processes. Seminars, workshops and fellowships could be delivered to young professionals, exposing them to a multicultural environment and ultimately bringing them closer to one another. Thus, it can be stated that education and training are some of the most effective tools for informing the population and bridging the divides between the people across the region. Alongside technical training, professionals can also be given simulations and workshops on the importance of diplomacy when solving crises, rather than resorting to the use of force. In other words, by highlighting the importance of diplomacy, one can only hope that the importance of efficient communication and cooperation will be better displayed and convince the target audience, ultimately enabling serious discussions on the development of a Nuclear-Weapon-Free Zone in the Middle East, a topic that has been on the table for decades but which has yet to be implemented.

Lastly, the CTBTO could make a contribution to progress on the issue of gender equality in the Middle East, and provide women with a variety of opportunities to attend training programs and workshops both in the technical and political realm.

BLOCKCHAIN AND THE CTBTO: BUILDING TRUST AND ENHANCING VERIFICATION

Jasmine Auda

ABSTRACT

The rapid pace of technological advances presents numerous implications for global security and nonproliferation that may manifest as either challenges or opportunities. The exploration of these emerging technologies in the context of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) is critical to ensuring that the Treaty can continue to uphold and eventually enforce a global moratorium on nuclear testing. Pending entry into force of the CTBT, the Treaty can be promoted and strengthened through diverse means including awareness-raising and enhancing the operational capability of the Treaty. Blockchain technology is one prospective solution to strengthen the CTBT's verification regime by further strengthening the security, confidentiality, and surety of data gathered through its monitoring systems, which is a core obligation of the CTBTO to its Member States. In turn, this may create a greater sense of trust and confidence in the regime and contribute, in part, to its universalization and entry into force.

TRUST AND GLOBAL SECURITY

The trust that states and individuals place in existing systems and institutions, especially those that are tasked with the ambitious mission of making our world a safer place, is critical to ensuring their continued success and fulfillment of their mandate. The Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), which seeks to instate a global ban on nuclear explosions underground, underwater, in the atmosphere, and on the Earth's surface, is an institution where trust plays a critical role. As all CTBTO Member States have equal access to the data gathered through its monitoring system, and given that it does not pass final judgements with regard to the nature of any event,[1] the Comprehensive Test Ban Treaty (CTBT) is considered to be both democratic and non-discriminatory,[2] which is not always the common perception of global nonproliferation regimes. Despite the exhibited level of confidence and trust in this framework, however, the CTBT has not yet met the conditions required for its entry into force.

The elusive issue of trust is especially important to consider when it comes to arms control and verification, as these areas and their associated frameworks can be viewed through a primarily technical lens. In the context of arms control, it is generally acknowledged that

[1] CTBT, Protocol I, Paragraph 18.

[2] Randy W. Bell, "CTBTO Science and Technology for a Safer World", In: Maiani L., Abousahl S., Plastino W. (eds) International Cooperation for Enhancing Nuclear Safety, Security, Safeguards and Non-proliferation–60 Years of IAEA and EURATOM, 2018.

absolute certainty in the implementation of any verification system is not possible, and we therefore must go beyond the technical issues and acknowledge that the human factor, along with inherent perceptions of trust, can in fact influence verification outcomes.[3] This is especially true in instances where respective parties that may not traditionally trust each other may have concerns about the detection and verification of potential non-compliance. Exploring the different ways in which we can enhance our trust and confidence in such systems and institutions must therefore be a proactive endeavor to identify potential shortcomings and propose suitable solutions.

As this article will posit, Blockchain is one such solution that warrants further investigation in the context of its potential applications to the CTBT. Blockchain, which is referred to as "The Trust Machine," is a technology known to be based on transparent, verifiable, and tamper-proof mechanisms. The arguments set forth herein will present Blockchain as an innovative way to strengthen the operational capability of the Treaty. Blockchain is one way in which trust can be furthered, given a number of attributes inherent in the technology that align with the CTBT's monitoring and verification components to ensure the integrity and confidentiality of the data that is gathered and analyzed by the CTBTO and distributed to Member States as data and products.

In pursuit of the above, the article will begin by providing background and context to the CTBTO and the technological evolution of its current verification system, namely the International Monitoring System and the International Data Centre. It will go on to discuss the potential role of Blockchain in enhancing trust and confidence in the Treaty, and how this can be leveraged by the CTBTO in order to strategically plan for the Treaty's future. Next, the fundamentals of Blockchain will be introduced, along with the characteristics of the technology that could benefit the CTBTO. The article will then explore potential applications of the technology specifically for the CTBTO's verification regime and discuss how this would contribute to supporting the Treaty. Finally, the article will conclude by discussing challenges to implementation and recommendations on practical next steps.

CTBT AND THE PATH TO UNIVERSALITY

In September 2021, the CTBTO celebrated the 25th anniversary of the adoption by the UN General Assembly, and opening for signature, of the CTBT. While this undoubtedly represents a notable milestone for the global nonproliferation regime, the significance is further underscored by the fact that the Treaty has yet to enter into force, even though it is near-universal with 185 signatory states, 170 of which have ratified the Treaty.[4] One of the most unique features of the Treaty, which has also proven to be its biggest limitation, is the requirement for the "Annex 2" states to ratify the Treaty; this is a provision in the CTBT for the 44 states that were deemed nuclear-capable at the time the Treaty opened for signature, to ratify the CTBT before it can enter into force. Today, there are eight such states barring entry into force: five that have signed but not ratified, and three that are non-signatories[5].

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3 Wyn Q. Bowen, Hassan Elbahtimy, Christopher Hobbs, and Matthew Moran, Trust in Nuclear Disarmament Verification (Palgrave Macmillan, 2018).

4 CTBTO, <https://www.ctbto.org/the-treaty/status-of-signature-and-ratification/>

5 Non-signatories: DPRK, India, Pakistan; Signatories: China, Egypt, Iran, Israel, United States.

While the CTBT has been lauded for its ability to successfully establish a norm against nuclear testing, with only three states having conducted nuclear tests since its adoption in 1996[6], the Treaty will never be able to actualize its full potential if it is not on solid legal ground. With respect to the Annex 2 states, there are numerous political, domestic, and strategic reasons for why they have not ratified the CTBT to date. Official explanations for the lack of progress range from regional instability for states including Israel and Egypt, domestic considerations regarding maintaining a reliable nuclear arsenal for the United States, and perceptions about reinforcing inequalities among nuclear states by India.[7] Entry into force of the CTBT is critical to upholding the norm against nuclear testing, and to continuing to effectively monitor and verify such a ban. There is not much consensus amongst policymakers and analysts, however, regarding whether or not entry into force will materialize anytime soon; where there is agreement, is that the CTBT needs to continue to be defended, promoted, and strengthened through numerous pathways. The main actions that can be taken to strengthen the CTBT broadly fall under three main pillars – universalizing the Treaty, raising awareness about the Treaty, or enhancing the operational capability of the Treaty.[8]

As mentioned in the introduction, the remaining sections of this article will focus on innovative ways to strengthen the operational capability of the Treaty, particularly that of its verification regime, through innovation and the promotion and application of new technologies such as Blockchain. The CTBTO has been heralded for its technological prowess since its inception, but it needs to continue to innovate and explore new methods and technologies that keep pace with evolving challenges in order to complement and strengthen its verification efforts.

CTBTO VERIFICATION REGIME

The CTBTO's current system of monitoring and verification is one of the most inclusive multilateral arms control agreements in the world[9] in terms of its adherence, scope, and geographical coverage. The CTBT is a framework fundamentally based on science and technology, and it is this foundation that provides the basis for its verification regime. According to Article IV, Paragraph 1 of the CTBT, the verification regime consists of the following elements: (a) International Monitoring System; (b) Consultation and clarification; (c) On-site inspections; and (d) Confidence-building measures.[10] For the purposes of the article, this section will focus primarily on the International Monitoring System (IMS) and its related components, namely the International Data Centre (IDC) and the Global Communications Infrastructure (GCI).

The IMS is the central component of the CTBT's verification regime, and is comprised of a global network of monitors and sensors that utilize four main monitoring technologies: seismic, hydroacoustic, infrasound, and radionuclide monitoring.[11] When complete, the IMS will consist of 337 facilities across almost 100 countries, including 321 monitoring facilities and 16

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6 India, Pakistan, DPRK.

7 Francesca Giovannini, "The CTBT at 25 and Beyond," Arms Control Association, 2021 <https://www.armscontrol.org/act/2021-09/features/ctbt-25-beyond>.

8 John Carlson, "Comprehensive Nuclear-Test-Ban Treaty: Possible measures to bring the provisions of the Treaty into force and strengthen the norm against nuclear testing," Vienna Center for Disarmament and Nonproliferation, 2019.

9 Bell, R.W. (2018).

10 CTBT, Article IV, Paragraph 1.

11 CTBT, Article IV, Paragraph 16.

radionuclide laboratories. Today, the system is over 90% complete, with 302 facilities that are certified and operational and gather data from all around the globe. This data is then sent to the IDC via the GCI, a global satellite communications network that utilizes a combination of different communication technologies, where it is then automatically processed, interactively analyzed, and the products are distributed to Member States. The details regarding the collection and processing of the data are extensive and beyond the scope of this article; nonetheless, a few key characteristics of the data, its analysis, and distribution will be briefly recounted below given their relevance to the article's main hypothesis regarding how they could potentially benefit from Blockchain applications.

The data gathered by the monitoring facilities and laboratories forms the primary core of the CTBT's verification efforts. The IDC receives approximately 10 GB of data daily from the IMS stations, most of which is transmitted in near real-time on a continuous basis. Once this data is transmitted, it is processed through automatic station processing in order to determine the characteristics of a recorded event. According to Part I of the Protocol to the Treaty, the IDC is responsible for applying on a routine basis automatic processing methods and interactive human analysis to IMS data in order to produce and archive standard IDC products on behalf of all Member States, which should include the following: (a) Integrated lists of all signals detected by the IMS; (b) Standard screened event bulletins; (c) Executive summaries; and (d) Extracts or subsets of IDC products.[12] Member states are expected to be provided with open, equal, timely, and convenient access to all IMS data, whether raw or processed, in addition to any data in the archive of the IDC.[13]

The CTBTO Preparatory Commission's Provisional Technical Secretariat (PTS) is responsible for the operation and maintenance of these processes, and by extension, the associated security of all relevant data. The Commission oversees the continuous development, enhancement, performance monitoring, and testing of the IDC, which is in provisional operational status until the entry into force of the Treaty.[14] The IDC's Operations Centre, which was established in 2005 and recently updated in 2019[15], can ensure full redundancy of its computer network and availability of archived verification data covering more than 15 years.[16] Moreover, the PTS guarantees the security of the data by embedding it with digital signatures and ensuring that the data collected at IMS stations is signed and authenticated using a Public Key Infrastructure (PKI) software, operated by the PTS.[17] This approach, however, while fulfilling current requirements, is not sustainable in the long-run given that it represents a single point of failure, and may not continue to remain fit for purpose.

As with any technological system, the CTBTO's verification regime needs to remain relevant and effective if it is to continue providing utility and value to member states while

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12 CTBT, Protocol I, Paragraph 18.

13 CTBT, Protocol II, Paragraph 20.

14 CTBTO, "Annual Report 2019: Advancing Verification Capabilities. Provisional Technical Secretariat of the Preparatory Commission," 2019.

15 CTBTO, "Operations Centre and Computer Centre", <https://www.ctbto.org/verification-regime/the-international-data-centre/operations-centreand-computer-centre/>

16 CTBTO Annual Report 2019.

17 John Coyne, Dmitry Bobrov, Peter Bormann, Emerenciana Duran, Patrick Grenard, Georgios Haralabus, Ivan Kitov, and Yuri Starovoit, "CTBTO Goals, Networks, Data Analysis and Data Availability," - In: Bormann, P. (Ed.), New Manual of Seismological Observatory Practice 2 (Potsdam : Deutsches GeoForschungsZentrum GFZ, 2012), <https://gfzpublic.gfz-potsdam.de/pubman/item/item_43233>.

maintaining their trust and confidence in the system. Keeping pace with technological developments is critical to ensuring the system's relevance and identifying and exploring the ways in which these technologies could impact its operational capabilities, whether for better or for worse."[18] As for the efficacy of the system, it is generally agreed that the IMS in particular needs to be the focus of renewed attention as it is currently transitioning from the "build-up" phase to the "sustainment" phase of its facilities and associated technologies. When CTBTO Executive Secretary Dr. Robert Floyd was recently asked about some of the main challenges facing the organization, his response focused on the depreciation of the IMS, a US $1B asset, and the recapitalization that would be necessary to repair or replace components of the system as needed.[19]

ATTRIBUTES AND APPLICATIONS OF BLOCKCHAIN

Blockchain, which is a subset of Distributed Ledger Technology (DLT), is an emerging technology that has garnered exceptional attention for its revolutionary potential. While most commonly associated with cryptocurrencies, Blockchain applications are now ubiquitous across numerous industries beyond finance and include healthcare, supply chains, retail, insurance, and government, among others. Blockchain even has potential in supporting the UN Sustainable Development Goals due to its transformative and decentralized governance model that can help confront global challenges,[20] and because it addresses issues of inclusion, trust, and multilateralism from a technical perspective.[21] As far as nuclear nonproliferation is concerned, applications of Blockchain are still in the exploratory phase, but this nonetheless demonstrates the potential and relevance for the technology in this field. One such noteworthy example is the development of a DLT prototype to manage data and safeguards information sharing between nuclear regulators and operators in Finland.[22]

In the most basic sense, Blockchain is considered to be a distributed and timestamped data structure with "append-only" data that cannot be altered.[23] Blockchain networks can either be public (permissionless), or private (permissioned), and are thought of as systems that do not require an intermediary – in the case of the CTBTO, any application would most certainly be permissioned. One of the most comprehensive definitions of DLT states that it is a system of electronic records that: (i) enables a network of independent participants to establish a consensus around (ii) the authoritative ordering of cryptographically-validated ('signed') transactions. These records are made (iii) persistent by replicating the data across multiple nodes, and (iv) tamper-evident by linking them by cryptographic hashes. (v)

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18 Giovannini, Francesca (2021).

19 Arms Control Association, "Confronting the Comprehensive Test Ban Treaty Challenge: An Interview with New CTBTO Executive Secretary Robert Floyd," 2021, <https://www.armscontrol.org/act/2021-10/features/confronting-comprehensive-test-ban-treaty-challenge-interview-new-ctbto>

20 World Economic Forum, "Could blockchain be the key that unlocks the SDGs?," 2021, <https://www.weforum.org/agenda/2021/10/why-blockchain-is-the-key-to-meeting-the-sdgs/>

21 Cathy Mulligan, "Blockchain and Sustainable Growth," United Nations Chronicle, 2018, <https://www.un.org/en/un-chronicle/blockchain-and-sustainable-growth>.

22 Cindy Vestergaard, Edward Obbard, Edward Yu, Guntur Dharma Putra, and Gabrielle Green, "SLAFKA: Prototype Blockchain in Practice Program Demonstrating the Potential for Distributed Ledger Technology for Nuclear Safeguards Information Management," 2020, Stimson Center.

23 Fran Casino, Thomas K. Dasaklis, and Constantinos Patsakis, "A systematic literature review of blockchain-based applications: current status, classification and open issues," Telemat. Informatics., 36, 2019, pp. 55-81.

The shared result of the reconciliation/consensus process – the 'ledger' – serves as the authoritative version for these records.[24]

To give further context to the above definition, it is helpful to look at some of the main properties and attributes of the technology. The central properties of Blockchain are (i) consensus mechanisms, algorithms that establish agreement between participants in a given network about updates to the ledger and addition of new data; (ii) hashing, a process that creates a unique cryptographic code that makes it almost impossible to alter; (iii) public key cryptography, a cryptographically linked public key and private key that encrypt data and authenticate digital signatures; and (iv) distributed storage, which means that each node of the network maintains a complete and identical version of the ledger.[25] While there are other existing technologies that may utilize certain aspects of these functions, it is the combination and interaction of all these properties collectively in Blockchain that contribute to its attractiveness and inherent attributes that ensure data integrity, immutability, and transparency.[26]

In the context of the CTBTO, Blockchain is a way to address the challenge of secure data management, which could in turn create a greater sense of trust amongst member states in the verification regime. The CTBTO is an inextricable component of the global nonproliferation architecture, which means that perceptions of the regime and its prospects for achieving universality are heavily influenced by the prevailing situation in arms control, international cooperation, and geopolitics more broadly. The data collected and products generated that are verified by the CTBTO can be considered to be highly sensitive in nature, meaning that current hold-out states may also have reservations regarding the sharing of that data. Blockchain, which is thought to create a technical foundation for cooperation among parties that have a limited basis to trust each other,[27] could therefore potentially alleviate some of these reservations because of its assurances of data integrity, confidentiality, and security. As mentioned above, states' respective reasons for not ratifying the CTBT are numerous and complex. The expectation is not that strengthening the verification regime or giving greater assurances would suffice for eventual entry into force; rather, it would be one of the components required to contribute to their trust in the regime and confidence that it could in fact meet their national requirements and concerns.

The data that is collected globally, processed and analyzed at the IDC, and distributed to member states, is the CTBTO's most valuable asset. This value lies both in terms of the function the data serves in verifying compliance with the Treaty's provisions, as well as in the immense utility it holds for other civil and scientific applications such as climate change research and early warning systems. Therefore, the core obligation for the CTBTO to provide its member states with data surety makes the consideration of Blockchain a particularly relevant proposition. Data surety and integrity are essential to the CTBT, as its primary purpose is to provide meaningful data – this means that users need to have confidence regarding

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[24] Michael Rauchs, Andrew Glidden, Brian Gordon, Gina Pieters, Martino Recanatini, Francois Rostand, Kathryn Vagneur, and Bryan Zhang, "Distributed Ledger Technology Systems: A Conceptual Framework", University of Cambridge, UK, 2018, p. 19.

[25] Lyndon Burford, "The trust machine: Blockchain in nuclear disarmament and arms control verification," King's College London, 2020

[26] Vestergaard, C., Obbard, E., Yu, E., Putra, G., Green, G. (2020).

[27] Burford, Lyndon (2020).

the authenticity of the data, and confidence that it has not been tampered with in any way.[28] As such, the most suitable area in which a Blockchain application could benefit the CTBTO would be the main repository of this data, the IDC.

Blockchain could enhance the security and integrity of data at the IDC through the following means: (i) securing the data that flows from the IMS facilities to the IDC; (ii) securing data collected through eventual On-Site Inspections; and (iii) enhancing the IDC's processing, analysis, and distribution. The foremost benefit of Blockchain in this respect would be to reduce the possibility of a single point of failure. This is one of the most relevant aspects of the technology to the CTBTO, and given the decentralized nature of how the data would be stored, there would be a significant increase in the system's resilience. It is not beyond the realm of possibility that a malfunction in the IDC's physical or storage systems could happen that would compromise data archives or certificates. Emerging technologies such as Blockchain could prevent such incidents from occurring in the future – current PKI frameworks, as mentioned above, represent a centralized point of failure, and it is envisioned that next-generation PKI solutions will likely utilize Blockchain technology.[29] Given that the IDC is tasked with the responsibility of continuously improving the quality, reliability, and cost effectiveness of its services and products over time,[30] such scenarios highlight the need for the active pursuit of solutions fit for the future.

Another way that Blockchain could contribute to increasing the trust and confidence in the CTBTO's verification regime is by enhancing cybersecurity more broadly. The IDC, which collects a wealth of data on a daily basis, and maintains a large archive of historical data, could be susceptible to either accidental data loss or intentional data breaches. Cybersecurity risks are growing in volume, nature, and sophistication, and it is now believed that we are in the middle of a 'cyber pandemic,' with cyberattacks on critical infrastructure in particular on the rise.[31] If the CTBTO is targeted in the future, this would not only put the data repositories at the IDC at risk, but would also significantly undermine member states' confidence in the system and in the confidentiality of their respective data. While Blockchain would not completely eliminate the possibility of an attack on or tampering with the existing databases, it would make it extremely difficult to do so, and immediately apparent if it does happen.

CHALLENGES AND WAY FORWARD

Notwithstanding the conceptual benefits that could be provided by Blockchain applications for the CTBTO's verification regime, there would undoubtedly be numerous challenges to implementation revolving around feasibility, scalability, and cost. Further research and development on applications of Blockchain in the nonproliferation sphere are necessary in order to validate the utility and value of the technology in this regard. For the CTBT, issues of Blockchain's compatibility with the Treaty's technologies would be one of the most dominant concerns; if the CTBTO can look into preliminary research on Blockchain and explore

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28 U.S. Department of Energy, "Comprehensive Test Ban Treaty Research and Development: Plans and Accomplishments," 1998, <https://www.osti.gov/servlets/purl/651817>.

29 Medium, "Why Next-Generation PKI Will Reside on the Blockchain," 2019, <https://medium.com/remme/why-next-generation-pki-will-reside-on-the-blockchain-44befcd2af3a>.

30 CTBTO Introductory Curriculum, International Data Center.

31 World Economic Forum, "Protecting critical infrastructure from a cyber-pandemic," 2021, <https://www.weforum.org/agenda/2021/10/protecting-critical-infrastructure-from-cyber-pandemic/>.

how it could be integrated with existing systems and processes, this would be a constructive first step to engaging with the technology and possibly harnessing its power in the future.

In its path toward universality and entry into force, the CTBTO should continue to demonstrate its relevance and effectiveness, and the exploration of emerging technologies to enhancing the operational capacities of the Treaty is one such way of doing so. The CTBTO is considered a pioneer when it comes to exploring new technologies and their applications to further nonproliferation objectives, as evidenced by the four treaty-bound monitoring technologies stipulated in the CTBT. While it is unlikely for there to be any fundamental changes in this regard before the Treaty enters into force, when it comes to technologies that can enhance the verification and analytical processes, the spirit and provisions of the CTBT would not only allow, but in fact encourage such pursuits.