

Diplomatic momentum and the Comprehensive Nuclear Test-Ban Treaty

Hugh Chalmers

State signatories to the Comprehensive Nuclear Test-Ban Treaty (CTBT) gathered at the UN in New York at the end of September 2023 for the 13th Conference on Facilitating Entry into Force of the CTBT. Opening the Conference, the Executive Secretary of the Comprehensive Nuclear Test-Ban Treaty Organisation (CTBTO) celebrated eight new ratifications to the Treaty. But by the start of November, the Executive Secretary was lamenting the “very disappointing and deeply regrettable” decision by the Russian Federation to formally withdraw its ratification to the Treaty. Russia remains a signatory to the Treaty and has retained national legislation related to CTBT implementation. But is it still fair to say—as the Executive Secretary did back in September—that “diplomatic momentum is in favour of the Treaty”? And if so, how can that momentum be sustained until it enters into force?

The CTBT was adopted by the UN General Assembly nearly 30 years ago but is not yet in force. The treaty prohibits States Parties from carrying out nuclear weapon test explosions. It detects and deters non-compliance through a verification regime that comprises, among other things, an International Monitoring System (IMS) and on-site inspections. The IMS has largely been established by the CTBTO Preparatory Commission and consists

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In this issue . . .

Lead article	1–4
Diplomatic momentum and the Comprehensive Nuclear Test-Ban Treaty	
Verification Watch	5–7
Elimination of the US chemical weapons stockpile: a milestone moment	
The 2023 First Committee and nuclear disarmament verification	
Recent activity at the Experimental Light Water Reactor, North Korea	
Implementation Watch	8–9
Man convicted in the UK for building drone to carry chemical weapons: Lessons learned for national implementing legislation	
Compliance watch	10–12
Indonesia seizes Iranian tanker carrying out ship-to-ship oil transfer	
Crisis avoidance: Preventing dangerous maritime incidents and unintended escalation in the Asia-Pacific	
Science and Technology Scan	13–14
Recent developments and applications of additive manufacturing	
Centre News	15–19
National Implementation Measures; Verification and Monitoring; Compliance Mechanisms and Measures	

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of over 300 monitoring stations located throughout the world. It has detected all six nuclear tests conducted by North Korea. However, the Treaty itself, and key mechanisms such as on-site inspections, will only enter into force after all 44 of its 'Annex 2' states have ratified it.¹

The impact of Russia's withdrawal of ratification

Russia deposited its instrument of ratification with the UN Secretary-General (the depository for the Treaty) on 30 June 2000, having passed [domestic legislation](#) a month earlier ratifying the treaty and providing the basis for implementing its related obligations. Since signing the Treaty, Russia has collaborated with the CTBTO to install 32 monitoring stations on its territory.² It now hosts the second largest segment of the Treaty's monitoring system, second only to the segment hosted by the United States. However, Russia has now amended its domestic legislation to remove reference to its ratification of the Treaty, and informed the UN Secretary General of the [decision to withdraw its instrument of Treaty ratification](#). Russia now joins seven other Annex 2 states that have not ratified the Treaty: China, India, Iran, Israel, North Korea, Pakistan and the United States.

What impact will this have on the diplomatic momentum towards entry into force? Russia continues to assert its support for the CTBTO, [saying](#) "We will transmit our [IMS] data, receive other people's data. The [testing] moratorium remains in place. We're just withdrawing ratification. That's it". Russia is bound by [Resolution CTBT/MSS/RES/1](#) (November 1996), establishing the Preparatory Commission and capturing the decision of CTBT signatories "to take all necessary measures to ensure the rapid and effective establishment of the future Comprehensive Nuclear-Test-Ban Treaty Organization", including through financial support and engagement in the Preparatory Commission's work to establish the CTBT verification system. Russia has also retained provisions in its domestic ratification legislation that assign domestic roles and responsibilities regarding the Treaty and provide privileges and immunities to the CTBTO Preparatory Commission. As a party to The Vienna Convention on the Law of Treaties (which codifies customary international law), Russia—as a signatory to the CTBT—is also required to "refrain from acts which would defeat the object and purpose" of that treaty prior to its entry into force.

This legal framework still ties Russia to the future of the CTBT, but Russia has demonstrated how quickly it can

sever some of those ties. The obligation to refrain from acts which would defeat the object and purpose of the CTBT is conditional on the Treaty's entry into force not being "unduly delayed". As John Carlson (former Director General of the Australian Safeguards and Non-Proliferation Office) [has pointed out](#), there is little guidance or consensus on what constitutes an undue delay. Russia has portrayed the withdrawal of its ratification as a response to the absence of US ratification, with the Russian Ministry of Foreign Affairs [arguing](#) "the Americans have been evading ratification of the CTBT for almost a quarter of a century. This cannot go on forever".

This raises the question: what might Russia see as an undue delay? Sustaining diplomatic momentum towards entry-into-force will save the international community from finding out the hard way. Public statements by state signatories in the wake of Russia's de-ratification have been universally supportive of the Treaty and its entry-into-force, and the Executive Secretary of the CTBTO has been vocally advocating for entry-into-force of the Treaty, which he sees as a "bright spot" in an otherwise gloomy multilateral landscape.³ But the cheerleading belies the fact that Russia's actions have taken the wind out of the Treaty's sails, and it looks more vulnerable than before to bad multilateral weather.

Prospects of US ratification

So, what can be done to sure up the Treaty? Taking Russia's complaints about the US at face value, what are the chances that the US might ratify the CTBT? The current US Government has vocally supported the Treaty, expressing their "[strong and enduring commitment](#)", including a commitment to [achieving its entry into force](#). But neither the Biden Administration, nor the three administrations preceding it, have put the Treaty to the US Senate for ratification. The only time the Treaty was put to the Senate for ratification (in October 1999), it was rejected by Senators on the grounds of the ban's impact on US nuclear weapon reliability and concerns about verifying compliance with the Treaty.

Today, however, the Senate should have more confidence in the reliability of its nuclear arsenal: it has been receiving annual joint letters from the Department of Energy (which maintains the arsenal) and Department of Defense (which would use that arsenal), arguing that there is no need to return to testing. The Senate should also now have more confidence in the verifiability of the Treaty. Roughly 90 per cent of the IMS stations are up and running, and via the

accompanying International Data Centre, data has been collected and analysed to successfully identify all known nuclear tests by North Korea. Yet the Senate's concerns are still strong enough to dissuade the current US Administration from pursuing ratification.

Some of those concerns (which are shared by the US Government) relate to the stockpile stewardship activities undertaken by other nuclear-armed states to assure themselves of the reliability of their nuclear arsenals. Questions arise as to whether those activities align with the restrictions of the CTBT and existing unilateral moratoriums on nuclear testing. All nuclear-armed signatories to the CTBT are carrying out these activities and all of them (including the United States) argue that their activities are within the confines of the CTBT and respect its object and purpose. But mutual distrust in this regard presents a risk to the future of the CTBT and the norm against nuclear testing. The United States, for example, [has argued](#) that Russia has conducted nuclear weapons-related experiments that do not adhere to the US understanding of compliance with the CTBT. The US has also expressed "concerns" about China's activities, given Beijing's "lack of transparency". Russia in turn [has argued](#) that the US is preparing to re-start nuclear tests.

Transparency and confidence-building measures

The United States has invited international observers to its nuclear testing site to explore options for confidence-building measures and [has proposed to work with others to develop a reciprocal regime in this regard](#).⁴ This is a welcome step towards transparency and confidence-building. [One proposal](#) from outside government is to establish reciprocal monitoring of explosive tests to ensure they respect the confines of the CTBT and the existing testing moratoriums. This monitoring arrangement would measure the "fission energy released by very-low-yield nuclear tests carried out in containment vessels". If such measurements can demonstrate that tests comply with an agreed metric of compliance (such as a permissible amount of fission energy, or permissible fission reaction rates) then such arrangements would provide valuable assurance on the nature of testing activities by nuclear-armed signatories. [A compilation of statements](#) by nuclear-armed signatories in this regard suggests some coherence around a "zero yield" threshold, but it is unclear whether there is an agreed and measurable metric to demonstrate that the threshold has been respected.⁵

Broader transparency—such as declarations or consultations on stockpile maintenance activities at nuclear sites—could help nuclear-armed signatories understand how they limit their testing activities and if they set different limits, gauge the significance of any differences. Such an exchange between nuclear-armed signatories would be very sensitive: from a proliferation perspective, a political perspective (given Russia's illegal invasion of the Ukraine), and from a diplomatic perspective. The CTBT does not contain any obligations regarding nuclear test sites or stockpile maintenance activities short of explosive nuclear tests, any encroachment of the treaty into that area might make nuclear-armed signatories less (rather than more) eager to ratify it. On the other hand, discussions of how to interpret the fundamental prohibition on nuclear weapon tests will be of interest to all state signatories, and not just those that are nuclear-armed.

Utilising the consultation and clarification mechanism

The CTBT anticipates that ambiguities or uncertainties may cause concern about possible non-compliance with the Treaty. Article IV Part C of the Treaty establishes a consultation and clarification mechanism that State Parties may use to clarify and resolve such ambiguities or uncertainties. It presents opportunities for routine, working-level transparency and confidence-building that would be integral to the health of the CTBT once it enters into force, and a framework in which to explore such measures until that time.

The consultation and clarification mechanism appears to have received relatively little attention while the Preparatory Commission developed other components of the CTBT verification regime, despite it being an indicative area of work for the Preparatory Commission in CTBT/MSS/RES/I. There are valuable lessons to learn about consultation and clarification from other international arms control agreements. Article IX of the Chemical Weapons Convention (CWC) encourages State Parties to consult on "any matter which may cause doubt about compliance" or "which gives rise to concerns about a related matter which may be considered ambiguous". Within the CWC, State Parties regularly consult with each other through these mechanisms, both formally and informally. In some cases, the simple willingness to engage in dialogue and demonstrate transparency helped to address concerns. While the CTBT Preparatory Commission prepares for the 2025 on-site inspection integrated field exercise in Sri Lanka, it could consider also exercising the consultation and clarification

mechanisms that the Treaty encourages State Parties to pursue before requesting on-site inspections.

As John Carlson [has pointed out](#), Article XIV.2 of the CTBT also empowers ratifying states to “consider and decide by consensus what measures consistent with international law may be undertaken to accelerate the ratification process in order to facilitate the early entry into force” of the Treaty. The 13th Conference on Facilitating Entry into Force of the CTBT was convened in September to do this. A controversial idea discussed by John Carlson is that ratifying states in these ‘Article XIV conferences’ could ‘waive’ the strict entry-into-force requirements of the Treaty and bring it into force despite the absence of ratification from all Annex 2 states. Carlson rightly stresses the need to maintain consensus among ratifying states in any such effort. While Russia can still participate in these conferences it has now surrendered its status as a ratifying state, and will take a back seat alongside the United States in any consensus final declaration produced by ratifying states.

Conclusion

The Executive Secretary of the CTBTO is right to point out that Russia’s decision to withdraw its ratification is very disappointing and deeply regrettable. While there is still positive diplomatic momentum towards the Treaty’s entry into force, that momentum has been slowed and shaken by Russia’s decision. Signatory states should consider what actions can be taken, both inside and outside the auspices of the Treaty, to build the confidence needed to bring the Treaty into force. And while their numbers have been diminished by one, ratifying states should consider what they can do at the next Article XIV conference to facilitate its entry into force.

Endnotes

- 1 Annex 2 states are those that had nuclear power or research reactors at the time of the treaty negotiations.
- 2 Of these stations, 31 are fully certified for operation, and the final station is due to be certified by the end of 2023.
- 3 See, for example, Russia’s withdrawal from the Conventional Forces in Europe (CFE Treaty), the US withdrawal from the Intermediate-Range Nuclear Forces Treaty, the withdrawal of both the US and Russia from the Treaty on Open Skies, and the US withdrawal from the Iran nuclear deal.
- 4 While the US has discussed the concept of reciprocal transparency measures bilaterally with both Russia and China, no specific proposals, plans or invitations have been made.
- 5 For example, the monitoring proposal points out that US subcritical tests aim to restrict the energy yield produced by fission to about 0.6 Joules – making them technically “very low yield [but not zero-yield] nuclear tests”.

Verification Watch

Elimination of the US chemical weapons stockpile: a milestone moment

Hailey Wingo

On 7 July 2023, the Organisation for the Prohibition of Chemical Weapons (OPCW) [confirmed](#) the destruction of the final munitions in the US chemical weapons stockpile. This completed the full destruction of all chemical weapons stockpiles declared by States Parties to the Chemical Weapons Convention (CWC). Neutralisation and explosive destruction were used to dismantle the final munition, a [sarin-filled M55 rocket](#), at the Blue Grass Army Depot in Kentucky. This marked the end of a decades-long, [\\$31 billion](#) effort by the United States to verifiably destroy over [30,000 tons](#) of chemical warfare agents. In doing so, the United States met the OPCW's 30 September 2023 deadline for full destruction of its declared stockpiles.

The OPCW had extended an earlier deadline of 29 April 2012 and called for destruction of the remaining stockpiles in "[the shortest time possible](#)" after Libya, Russia and the United States failed to meet it. All [destruction of declared stockpiles](#) took place under the supervision of the OPCW's Technical Secretariat, which did not specify destruction [methods](#), but [prohibited](#) sea dumping, open-pit burning and land burial. The United States opted for a combination of incineration and neutralisation.

[Incineration](#) was the approach preferred by the US Department of Defense, and it was endorsed by the US National Research Council in 1984 as a safe method. It converts chemical warfare agents into combustion products through controlled ignition. [About 90%](#) of the US stockpile was destroyed in this way. Although nearby communities were [not exposed](#) to harmful levels of chemicals, many citizens living near the destruction sites were [concerned about potential](#) leaks, and formed citizen's advisory commissions to advocate against incineration. Instead, these activists encouraged the use of neutralisation technologies, and successfully campaigned against incineration at Pueblo Chemical Depot and Blue Grass Army Depot. These were the [last two](#) US sites left with undestroyed stockpiles when the initial 2012 deadline passed.

[Neutralisation](#) was used at a total of four US sites, and involved draining the chemical agent from munitions before

mixing it with hot water and sodium hydroxide. This process causes hydrolysis, which decomposes the chemical agent into smaller molecules via a reaction with water. At Pueblo, the neutralised hydrolysis product was further biotreated with live organisms to break down any remaining traces of chemical warfare agents, while Blue Grass used supercritical water oxidation. The empty munitions and metal parts were decontaminated at high temperatures in a process similar to incineration.

Inspectors from the Technical Secretariat were on site at facilities for the full duration of the destruction process. In addition to their physical presence, they also monitored operations with closed-circuit television (CCTV) and had access to documentation and records. These [verification measures](#) are performed by expert inspectors and provide confidence among States Parties that stockpile destruction has been complete and irreversible.

The complete destruction of all chemical weapons stockpiles took a significant amount of effort on the part of the OPCW and States Parties. It is well worth celebrating this milestone and the extensive resources and time dedicated to verifiably destroying all declared stockpiles. Nonetheless, there is still work to be done to permanently eliminate all chemical weapons. State Parties to the CWC should be fully transparent and honest in their declarations, and multilateral pressure for verification and destruction of suspected stockpiles should be applied in response to the ongoing threat of activities prohibited by Article I of the CWC, such as [Russia's use of nerve agents](#) in assassination attempts or the [continued use of chemical weapons in Syria](#). There remains a need to improve national implementation of the CWC and mitigate the threat of non-state actors acquiring and using chemical weapons. States Parties should also strive to achieve universalisation of the CWC by encouraging the accession of the [four remaining hold-outs](#) (Egypt, Israel, North Korea and South Sudan) and [preparing to verify their declarations upon accession](#). Finally, the OPCW's Technical Secretariat must maintain its capacity for verification of stockpile destruction ([including abandoned stockpiles](#)) and investigation of alleged treaty violations in addition to routine inspections and monitoring of scheduled chemicals.

State Parties to the CWC have demonstrated support for a world free of chemical weapons by committing extensive

resources to the safe and transparent destruction of all declared stockpiles. They can now continue to do so by ensuring the OPCW is empowered to continue its verification activities, support national implementation efforts, and prevent the re-emergence of chemical weapons.

The 2023 First Committee and nuclear disarmament verification

Noel Stott

The UN Disarmament and International Security Committee (First Committee), one of six main committees at the UN General Assembly, meets annually to discuss disarmament, global challenges and threats to peace. The latest session, its seventy-eighth, took place from 2 October to 3 November 2023 at the UN Headquarters in New York.

The non-governmental organisation, Reaching Critical Will, which has been reporting and analysing on the First Committee since 2002, [describes](#) it as providing “a space for UN Member States to discuss their positions on disarmament-related matters, and . . . to build consensus on the issues, reach common understandings and principles and agree on norms of behaviour”. These discussions often translate into the adoption through either consensus or by a majority vote of some 50 resolutions to be put before the General Assembly for consideration.

The 2023 session, chaired by Ambassador Rytis Paulauskas of Lithuania, was no different with a significant number of resolutions being adopted—despite the international context being fraught with geopolitical tensions and regional conflicts impacting on international peace and security.

Many of the general statements by UN member states focussed on this international context, including the Russia–Ukraine war and the armed attack on the citizens of Israel on 7 October and its aftermath, as well as the pressures being experienced by the global nuclear disarmament and non-proliferation architecture. These pressures include, but are not limited to, the [failure](#) of the first Preparatory Committee of the 2026 NPT Review Cycle to agree on a consensus report; an increase in [rhetorical threats](#) to use nuclear weapons; the increased [role of nuclear weapons in military doctrines](#) and security policies; upgrading and [modernisation](#) of nuclear arsenals; no progress being made to negotiate the complete, verifiable and irreversible [denuclearization of the Korean Peninsula](#); and the continued failure to bring the Comprehensive Nuclear-Test-Ban Treaty (CTBT) into force—exacerbated by

Russia’s [withdrawal](#) on 2 November of its ratification of the CTBT in order to “re-establish strategic parity with the United States of America”.

Other prominent issues impacting on discussions in the First Committee included efforts to prohibit and regulate the development and use of [autonomous weapon systems](#), the growing significance of cyber and other digital threats, the ethical, legal, and humanitarian concerns raised by the [proliferation and use of armed drones](#) and the growing risks of an [arms race and conflict in space](#).

Among at least 20 draft resolutions on nuclear weapons discussed at the First Committee in 2023, one covered the issue of nuclear disarmament verification, and that is the focus of this article.

Nuclear disarmament verification

The Group of Governmental Experts (GGE) on Nuclear Disarmament Verification established by General Assembly’s Resolution 74/50 (A/RES/74/50) published its consensus [report](#) on 23 June 2023. The report encouraged the international community to further consider nuclear disarmament verification issues, including, *inter alia*, the concept of a Group of Scientific and Technical Experts (GSTE). Many UN member states welcomed its work, including a [joint statement](#) at the First Committee by 26 of them that encouraged states to “continue work on these issues, as well as on the concept of irreversibility”.

Some nuclear scholars had hoped that the First Committee would consider a new resolution calling on the UN Secretary-General to facilitate further consideration of nuclear disarmament verification issues, and in particular, the concept and potential mandate of an UN-led GSTE, as well as how best to advance capacity-building for nuclear disarmament verification. The resolution ([A/C.1/78/L.31](#)), sponsored by 37 states, set out a more cautious response. While noting *inter alia* the contribution of representatives of civil society from the non-governmental, academic and research communities, the resolution:

1. Requests the Secretary-General to seek the substantive views of Member States on the GGE report and to report back to the General Assembly at its seventy-ninth session;
2. Invites Member States, as well as relevant bodies of the United Nations disarmament machinery, in accordance with their respective mandates, to consider the report of the GGE;

3. Encourages Member States to continue the discussion and work on nuclear disarmament verification issues, and to take appropriate measures to ensure equal opportunities for women and men to enable their full and meaningful engagement in nuclear disarmament efforts, including nuclear disarmament verification;
4. Welcomes continued efforts on capacity-building on nuclear disarmament verification, including through regional approaches, as appropriate.

The resolution was adopted with 175 in favour, none against and five abstentions (Congo, Iran, Mali, Russia and Syria). According to ‘explanations of vote’ cited by [Reaching Critical Will](#), “Iran said it abstained because the resolution takes a selective and limited approach to nuclear disarmament verification through the GGE, whose selection is based on political considerations rather than clear and agreed upon criteria”, while Russia’s position was that “the potential benefit from an in-depth discussion of the issue of nuclear disarmament verification at the present stage in the absence of prospects for reaching any agreement is significantly overestimated”.

Brazil, which at the GGE had championed the established of a UN-led multilateral GSTE, issued a [joint statement](#) with 38 other states (that included both nuclear weapon and non-nuclear weapon states) on the importance of continuing work on nuclear disarmament verification. According to the statement, these countries share “the conviction that the international community should now make progress on the idea of establishing such a GSTE, [and that] the work of the two GGEs gives a solid foundation to build on, together with other past and present experiences and initiatives working on the practical aspects of NDV”. The joint statement also invites all interested UN member states to engage in an informal dialogue on taking forward nuclear disarmament verification issues, with the Governments of Brazil and Norway indicating their readiness to facilitate such deliberations.

Civil society, and in particular organisations such as VERTIC and others, who on a day-to-day basis undertake research and other practical activities in this field, are also key stakeholders in this debate. In order to enhance the capacity of states and other stakeholders to participate in verifying nuclear disarmament, VERTIC stands ready to engage with both Brazil and Norway on how best to take such a dialogue forward.

Recent activity at the Experimental Light Water Reactor, North Korea

Grant Christopher

The Experimental Light Water Reactor (ELWR) is a North Korean reactor located at the Yongbyon nuclear complex ([T&V Issue 172](#)). The site around the reactor has become more active over the past 12 months with [large water outflows](#) observed in October by Centre for Nonproliferation studies analyst David Schmerler. The IAEA has stated that this is [consistent with commissioning](#) the reactor.

Much of what is assumed about the reactor is based on information provided to Stanford University professor Siegfried S. Hecker and his colleagues during their [2010 visit](#) to the site. Based on the reactor design provided to this delegation by the North Koreans, plutonium production estimates of the reactor are [30kg per year](#), which is roughly half the lifetime output of the 5MWe reactor. It is often [incorrectly assumed](#) that plutonium produced in a light water reactor is unsuitable for use in weapons.

Without verified design information, much about the purpose and potential annual plutonium production of the ELWR remains uncertain. The reactor, for example, may have a different fuel, moderator and thermal power design than has previously been assumed. There has been no on-site presence from the International Atomic Energy Agency or the United States at Yongbyon, other than managed visits by delegations, since the withdrawal of North Korea from the Six-Party talks [in 2009](#). Understanding the capabilities of the ELWR could be a priority of any new negotiated inspections.

The recently observed signature at the ELWR appears to be unlike previous observed water outflows. As the unusual signature attracts scrutiny, it may soon be possible to confirm if the reactor has begun operations and then to assess the implications for plutonium production.

Implementation Watch

Man convicted in the UK for building drone to carry chemical weapons: Lessons learned for national implementing legislation

Thomas Brown

Background to the case

On 28 September 2023, a 26-year-old man was convicted at Birmingham Crown Court for building a drone with the intention of supplying it to Islamic State of Iraq and the Levant (ISIL), also known as Da'esh, a proscribed terrorist group in the United Kingdom. This case raises a number of issues linked to the legislative implementation of the Chemical Weapons Convention (CWC) and related international legal instruments in the field of non-proliferation of weapons of mass destruction and terrorism prevention.

The man, a PHD student, specifically designed a drone, partly using a 3D printer at his home, to transport an explosive or chemical weapon for the terrorist group. When law enforcement officers raided his house, they found research into the development of chemical weapons. Whilst the man in question had studied mechanical and chemical engineering, it was evident that the chemical research was related to the use of chemicals as weapons rather than part of his studies. The convicted man will be sentenced in the near future, with a maximum potential sentence of life imprisonment.

Domestic and international legal framework

The CWC, which opened for signature on 13 January 1993 and entered into force on 29 April 1997, prohibits the development, production, acquisition, stockpiling, retention, transfer or use of chemical weapons by States Parties. The UK signed the CWC on 13 January 1993 and ratified the treaty on 13 May 1996. The primary legal instrument in the UK that implements the CWC is the Chemical Weapons Act 1996. Interestingly, however, in this case the man in question was not charged with a violation of the Chemical Weapons Act. Rather, the individual was prosecuted under Section 5 of the Terrorism Act 2006 covering *Preparation of terrorist acts*. Section 20 of the same law links the definition of acts of terrorism to the Terrorism Act 2000, including Section 1(5) which states that actions taken to the purposes of terrorism include action taken for the benefit of a proscribed organisation. Notably, Da'esh/

ISIL was proscribed in the UK in June 2014 by the Secretary of State, under the Terrorism Act 2000 (Proscribed Organisations) (Amendment) (No. 2) Order 2014.

This prosecution took place in the context of ongoing fears about the potential for non-state armed groups to use chemical weapons, especially as a result of their use by Da'esh/ISIL in recent years. According to officials from the United Nations Investigative Team to Promote Accountability for Crimes Committed by Da'esh/ISIL (UNITAD), during its “four-year reign of terror in Iraq, ISIL extremists developed at least eight chemical agents, tested them on humans, and carried out at least 13 attacks”. The group’s chemical weapons programme was further described by UNITAD as the “the most sophisticated programme developed by non-state actors so far”. In light of this repeated use of chemical weapons by Da'esh/ISIL and their significant weapons programme, this case is of particular concern and demonstrates the challenges posed by non-state armed groups to the CWC.

When considering how to address this challenge, it is important to look at effectively implementing the CWC and the related international legal framework at the national level. Notably, munitions or devices specifically designed to inflict harm or cause death through the release of toxic chemicals are included in the definition of a chemical weapon enshrined in Article II of the CWC, and therefore the prohibitions in Article I of the Convention are applicable in cases like this one involving a device to carry chemical weapons.

Moreover, UN Security Council Resolution 1540 (2004) requires states to adopt and enforce appropriate and effective national laws to prohibit and prevent any non-state actor from manufacturing, acquiring, possessing, developing, transporting, transferring or using chemical weapons and their means of delivery in particular for terrorist purposes. States must further put in place appropriate and effective national laws and enforcement measures to prohibit and prevent the misuse of related materials. The Resolution is a response to the threat caused by the proliferation of nuclear, chemical, and biological weapons, as well as their means of delivery, to non-state actors in particular for terrorist purposes. Means of delivery are defined as “missiles, rockets and other unmanned systems capable of delivering nuclear, chemical, or biological weapons, that are specially designed for such use”.

As such, the establishment of appropriate control and enforcement mechanisms in national legislation, in line with the relevant international legal framework, is key for timely preventing proliferation attempts such as the case in the UK. In this context, there are a number of important lessons that can be learned from this case.

Link between anti-terrorism and chemical weapons legislation

Firstly, anti-terrorism legislation can in certain cases be pertinent for the prosecution of chemical weapons related offences, when the actions or the actors involved fall under the scope of such legal instruments. When deciding the appropriate charges to select, prosecutors must take into account a number of factors, and anti-terrorism legislation can provide alternative options to secure a conviction in certain circumstances. However, CWC legislation remains essential for prosecuting offences in cases where there is no terrorist context to the conduct. Overall, it is important that there are clear interrelations and no contradictions between these various frameworks. In the case of the UK, Section 20 of the Terrorism Act 2006 refers to 'Convention offences', which include those established under implementing legislation for the CWC and other relevant treaties.

Importance of comprehensive prohibitions

Secondly, the case highlights the importance of including participatory offences in relevant legal instruments. Article VII of the CWC requires all States Parties to adopt the necessary measures to fulfil their obligations under the Convention, especially appropriate penal legislation. When drafting such penal measures is important to include a comprehensive set of measures, prohibiting and punishing relevant activities involving chemical weapons, the misuse of certain toxic chemicals and related materials, and also participation in such offences. The PHD student in question was arrested before he had the opportunity to supply the drone to Da'esh/ISIL, yet it was still possible to secure a prosecution for preparations to undertake a relevant offence. Furthermore, controls over the means of delivery are essential to counter the threat of chemical weapons. Legislation implementing UNSCR 1540 is important in this regard, to create a control regime for materials related to means of delivery and prevent their proliferation.

Impact of dual-use research and new technologies

Finally, this case, involving a PHD student, demonstrates the need to pay increasing attention to control measures for dual-use research, that is, research that has legitimate and beneficial purposes but that has the potential to be misused for malicious purposes. Researchers working with dual-use toxic chemicals and related materials may in some cases use their knowledge to support the proliferation of chemical weapons, as the individual in this case attempted to do. National controls of dual-use research can help authorities to ensure that such research is not used to further the proliferation of chemical weapons, whilst ensuring the societal benefits of peaceful research.

Furthermore, the use of 3D printing in the creation of the drone demonstrates the potential for misuse of new technologies for proliferation purposes, and the importance of establishing frameworks and tools to analyse and counter this threat. New technologies can provide malicious actors with new avenues to source materials of proliferation concern and may be of particular interest for non-state actors, who often lack the ability of states to acquire such materials in the necessary quantities. Overall, the case shows the continued relevance for states of being at the forefront of effective measures to prevent chemical terrorism and counter CBRN proliferation.

Compliance Watch

Indonesia seizes Iranian tanker carrying out ship-to-ship oil transfer

Roel Walravens

On 7 July 2023, Indonesia's Maritime Security Agency (also known as 'Bakamla'), seized the Iranian-flagged tanker ARMAN 114, which had been carrying out a ship-to-ship transfer of oil with the Cameroon-flagged tanker STINOS in Indonesia's Exclusive Economic Zone.

The activity was detected by Bakamla in collaboration with other agencies while the vessel in question was manipulating its automatic identification system (AIS) by falsely transmitting ('spoofing') its position from the Red Sea. When the Bakamla patrol vessel arrived at the scene, the two tankers were still engaged in the transfer, and both attempted to escape with the transfer hose still attached, spilling light crude oil in the process.

After ARMAN 114 fled into Malaysia's Exclusive Economic Zone, Indonesia's Bakamla cooperated with the Malaysian Maritime Enforcement Agency (MMEA) through the Association of Southeast Asian Nations (ASEAN) Coast Guard Forum to continue its pursuit of the vessel. The vessel was ultimately seized with the assistance of Malaysian troops and subsequently detained in Batam, Indonesia. The vessel STINOS escaped after it fled.

Following the seizure, Bakamla [announced](#) that given the facts at the scene, ARMAN 114 committed unlawful acts by turning off its AIS, engaging in AIS spoofing, using Indonesia's Exclusive Economic Zone as a "transshipment place", allegedly dumping oil, not having port clearance, and finally not flying the ship's flag. Bakamla also suspected that Indonesia's laws relating to the Indonesian Exclusive Economic Zone, shipping, protection of the marine environment, as well as other shipping laws and regulations had been violated by the ARMAN 114.

This case demonstrates that states may sometimes use otherwise unrelated measures and legislation to enforce their international sanctions obligations, in circumstances where they are unable to rely on specific sanctions enforcement measures. This specific enforcement action is also pertinent to maritime sanctions enforcement, given the similarity in the evasive maritime practices employed by sanctioned states, including North Korea.

As of late November 2023, the ARMAN 114 [continues to transmit](#) via AIS from Batam, Indonesia, where the vessel is being detained.

Crisis avoidance: Preventing dangerous maritime incidents and unintended escalation in the Asia-Pacific

Tanvi Kulkarni, Frank O'Donnell and Shatabhisha Shetty, APLN and Angela Woodward

VERTIC and the Asia-Pacific Leadership Network for Nuclear Non-Proliferation and Disarmament (APLN) recently completed a one-year joint project on [Maritime Incidents and Escalation in Asia-Pacific](#). The project sought to identify the risks of dangerous maritime incidents in the Asia-Pacific; evaluate the suitability of existing bilateral and multilateral arrangements to current strategic realities in the Asia-Pacific; bring forward new proposals to fill important gaps; and help promote effective mechanisms for managing and mitigating incidents and escalation at sea.

The project's final report titled '[Crisis Avoidance: Preventing Dangerous Maritime Incidents and Unintended Escalation in the Asia-Pacific](#)' was published on 5 December 2023.

Executive summary

The maritime regions of the Asia-Pacific – South Asia, Southeast Asia, Northeast Asia and the South Pacific – face complex dynamics and growing military competition between naval powers. Countries are modernising and expanding their naval capabilities, conducting more frequent multinational exercises, and making significant strides in naval power projection from the Western Pacific and South China Sea to the Indian Ocean. The past decade has witnessed a growth in encounters at sea and in the airspace above East and Southeast Asia's contested waters. As multiple maritime forces come into closer contact with one another, there is a growing risk of incidents and conflict escalation.

The United States has also increased its military activities and freedom of navigation operations (FONOPs) in the region since 2018, resulting in increased cases of military-to-military encounters with Chinese forces at sea and in the

airspace over the South China Sea. Between 2010–2022, most military-to-military encounters in Asia’s maritime and air domains took place between the United States and the People’s Republic of China. With tensions rising between the United States and China, any incident – whether intentional or through miscalculation, misunderstanding or mistake – risks escalating into serious conflict.

Six key factors were identified as contributing to the growing instability in the Asia-Pacific’s maritime environment:

- Growing grey zone incidents involving non-military vessels in violent encounters at sea;
- Different interpretations of the law of the sea and the selective interpretation of the 1982 United Nations Convention on the Law of the Sea (UNCLOS) by China relating to determination of jurisdictional zones and effects on navigation;
- Sovereign impunity of actors resulting from unenforceability of treaties and formal agreements;
- Great power rivalries overshadowing and compounding maritime challenges for smaller powers;
- Growing military and technological assets and capabilities of regional powers crowding the maritime and overhead air spaces in the Asia-Pacific; and
- Limited maritime domain awareness inhibiting regional actors from developing a shared understanding of maritime security threats.

Risk reduction mechanisms and maritime confidence and security building measures (CSBMs) to manage dangerous military activities and incidents at sea are rather limited. The challenge is further compounded by lack of transparency, paucity of data on the scale of the challenge, poor enforcement mechanisms for current CSBMs, and an absence of agreements/protocols for managing hazardous maritime incidents. These conditions, as they interact, have led to a normalisation of aggressive behaviour at sea.

Policy recommendations

To identify pathways forward to address these challenges, the APLN-VERTIC project conducted wide consultations with experts from countries across the Asia-Pacific, and published three scoping papers on the extant Asia-Pacific maritime CSBM context and areas for improvement. From these initial analyses, APLN-VERTIC identified existing gaps in the CSBMs architecture, which could be addressed by combinations of:

- the expansion of the geographical scope of existing arrangements;
- broadening the vehicle classes and civil/military statuses of vessels covered;
- the addition of new participating states;
- the expansion of agreements to include non-military maritime agencies such as coast guards;
- standardising and regularising information and data exchange processes; and
- reducing the selective interpretation of UNCLOS.

An overarching theme is the problem of impunity of action. In the absence of enforcement mechanisms for the violation of treaties or agreements, violators suffer only reputational costs, which they may be ready to bear to pursue their national interests and political objectives. A dedicated conversation is required on ways to ensure enforcement, verification, and compliance of maritime CSBMs and formal treaties.

Despite these challenges, there was strong support among experts and policy practitioners at two in-person Track 2 workshops for strengthening existing CSBMs and concluding new bilateral and multilateral initiatives.

Experts emphasised information sharing, data integration and greater maritime domain awareness as the most urgent and desirable area for confidence and security building among states. The proposal on *regional information-sharing centres to require mandatory incident reporting, to improve maritime transparency, avoid selective reporting, and create an incident database to support follow-on dialogue on establishing a single definition of ‘dangerous maritime incident’* was ranked as the overall top proposal by the group. Such a mechanism could allow various national and regional agencies to develop shared understandings of maritime security threats and strengthen the norm of supporting greater shared transparency of Indian Ocean and Asia-Pacific operating environments as a core characteristic of a responsible maritime actor.

This would, however, require CSBMs to encourage states to broaden and increase their reporting of incidents (and avoid selective reporting) including those involving military vessels, maritime law enforcement agencies, research and surveillance vessels, and non-military commercial vessels like merchant, fishing, and other commercial vessels. This data could then be consolidated with regional information-sharing centres, allowing for greater cross-verification and validation of claimed incidents, to enable consistent patterns of

transgressing states and non-state actors to be identified in a way that is not driven by great power competition dynamics. Participants also emphasised that while Chinese participation would be key in such mechanisms, its non-participation (while other states lodged incidents involving China) would normatively generate more costs for China. It would also build transparency for all states in terms of the trends and scale of maritime security problems in the region and propel a dialogue on defining a 'dangerous maritime incident'. However, participants also acknowledged the legitimate practical concerns regarding security and data protection, maintaining confidentiality and preventing sovereignty damage, especially as multiple nations with varying interests and technologies get involved in coordinating information.

CSBMs related to crisis communications were also prioritised by experts. Hotlines were noted to be reasonably effective mechanisms to review behaviour, curb violations and prevent escalation in case of crises. The proposal for a *regional dialogue on best practices for use of crisis hotlines, as partly informed by India-Pakistan experiences*, and a second proposal on *existing maritime hotlines in the region to be upgraded and regularised as channels for coordinating efforts during both crisis and non-crisis conditions* were both jointly ranked second. Given the poor record of the actual use of hotlines in Southeast Asia, and between the United States and China, a regional dialogue is recommended to clarify the function of naval and maritime hotlines and to agree to the modalities of using them.

The proposal for a *regional dialogue on inculcating a culture of safety in maritime encounters and maintenance of good order at sea throughout national sovereign fleet and flagged vessels, with consequences for breaches* was ranked overall third (jointly with *Track 2 dialogue on good conduct at sea*) indicating that regional experts attribute high priority to safety and accountability of sovereign and flagged vessels. Flag states must ensure that vessels under their jurisdiction comply with the 1972 Convention on the International Regulations for Preventing Collisions at Sea (COLREGs), and violation of these guidelines should be penalised in the form of sanctions or de-flagging of the vessel.

This report is the final report in the APLN-VERTIC project on [Maritime Incidents and Escalation in the Asia-Pacific](#). It is partly informed by two project regional dialogues and consultations with senior experts from across the region, and three expert scoping papers that were published as part of the project.

The first paper, [Assessing Military and Non-Military Incidents at Sea in the Asia-Pacific](#) by Dr Bec Strating, Director, La Trobe Asia, La Trobe University, Australia, was published on 11 July 2023.

The second paper, [Confidence and Security Building Measures in Southeast Asia's Maritime Domain](#) by Dr Collin Koh, Research Fellow at the Institute of Defence and Strategic Studies, S. Rajaratnam School of International Studies, Nanyang Technological University, Singapore, was published on 20 July 2023.

The third paper, [Confidence Building Measures in the Maritime Domain in Northeast Asia: An Analysis of Japan-China Maritime and Aerial Mechanisms](#) by Professor Kyoko Hatakeyama, Professor of International Relations at the University of Niigata Prefecture, Japan, was published on 28 August 2023.

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Science & Technology Scan

Recent developments and applications of additive manufacturing

Grant Christopher

Additive manufacturing, once a great source of risk and uncertainty for WMD-related manufacturing, ([T&V Issue 157](#)) has been eclipsed as an emerging risk by developments in AI, such as ChatGPT, and new areas of strategic competition, such as hypersonic boost glide vehicles. What is the status of additive manufacturing and is it still a relevant concern for WMD and military applications?

Additive manufacturing, or 3D printing, is the computer-controlled process of fusing smaller pieces of material together. Many different processes and materials are part of the family of 3D printing, and it can be built using, *inter alia*, metals, plastics, ceramics and resins.

The requirements and cost of printing varies depending on the materials, process, size and intended application. A hobbyist can purchase a home printer for about £500 that melts plastic filament or cures resin and would need only a craft knife, solvent and a file to tidy up the print. The same printer technology applied to print structures about the size of car would cost approximately £500,000 per printer. A printer fusing metal powder with lasers will also cost around £500,000 and require industrial heating, ventilation and air conditioning systems, plus specialized, costly, post-processing and inspection equipment. Inspection and testing of parts for aerospace and high-risk industrial applications also increases costs and development time.

There have been many eye-catching uses of additive manufacturing, including Canadian Nuclear Laboratories printing using [uranium dioxide](#), the US National Aeronautics and Space Administration adapting conventionally manufactured [aerospace materials](#) and the US company Relativity Space testing [3D printed rockets](#). It is not clear that these developments show a general trend towards a universal manufacturing capability with 3D printing – where anything, anytime, anywhere can be produced at the press of a button, in the manner of Star Trek's [Universal Replicator](#). Additive manufacturing is for the most part, a time-consuming process that is effective for [some applications but not others](#).

Military authorities in several states have taken a great interest in the potential of additive manufacturing. Armed forces are interested in this technology for four principal reasons. First, for the use in forward-deployed or remote manufacturing bases to produce [spare parts](#) in the field and potentially design and manufacture innovative battlefield systems. These could be used to support conflict zones or in remote bases, including aboard naval vessels. Second, [rapid prototyping](#), including advances in software modelling, could enable shorter development timelines for new systems to be deployed to the battlefield. Third, [3D printed concrete](#) could be used to rapidly build military bases. While not a game-changing advantage, there has been a great deal of interest in the use of concrete as a 3D printing material for use in civilian and military infrastructure. Fourth, lighter components could be built for [aerospace](#) by using new design techniques that allow complex geometries to be constructed with less material. Advances in so-called bio and [chemical printing](#) are also highly significant, but beyond the scope of this article.

For all the hype in the use of additive manufacturing by the military, applications in the public domain thus far have been limited to exercises testing the mobility of printers, a few cases of part replacement, and pilot studies for manufacturing bases. Replacement parts for supply chains that are no longer available due to dissolution of the supplier or unavailable expertise are an important application. But, as has been pointed out by [Liska Suckau](#), a researcher at the Peace Research Institute Frankfurt, where the supply chain is still active contractual obligations restrict the use of 3D printed replacement parts, since only the contracted supplier can ship the real part. This negates the key benefit of rapidly manufacturing replacement parts.

However, the Ukrainian military has [reminded us](#) that when it comes to the use of 3D printing, necessity is the mother of invention. As Uncrewed Aerial Vehicles (UAVs) have become [integral to the conflict](#), maintaining and adapting them has been vital for operations. In this culture of battlefield innovation, UAVs have been adapted to drop munitions, with the addition of 3D printed release catches and tail fins. To do this Ukraine has forward deployed manufacturing workshops, with plastic filament, resin and [metal](#) printers building

replacement parts to keep its forces, including the fleet of drones, in operation. To add to the supply, Ukraine has imported additional 3D printed components and asked for yet more from [crowdsourcing](#).

While cheap, mass produced 3D printed components have supported Ukraine in a multi-year attritional conflict with Russia, 3D printing has so far not involved complete UAVs or munitions. But could this be done in the future? And does it point to a future of warfare where mass produced 3D printed systems could overwhelm an opponent, countering their more expensive, harder to replace traditionally manufactured systems? David Walsh, an independent military analyst, has argued that this could play a role in [missile defences](#) but such general developments in 3D printed systems do not appear to be just over the horizon.

The United States pursuit of additive manufacturing is largely based on the economic benefits, including boosting domestic manufacturing, in addition to any military or strategic benefits. One argument for 3D printing is enabling manufacturing autarky, or resilience in the face of disrupted international supply chains. However, this assumes that 3D printing can be used as a replacement for nearly all other manufacturing processes and that it is a fast, repeatable manufacturing process for parts of all complexity, size and application.

Overall, the strategic benefit of additive manufacturing, despite the success shown in Ukraine, is unclear. It can make some things marginally faster, cheaper and lighter, but is not suitable for all manufacturing processes. It is another tool for solving manufacturing and engineering problems, not a replacement or substitute for all other established methods of manufacturing.

Centre News

National Implementation Measures

Yasemin Balci, Thomas Brown and Fanny Tonos

Since the last edition of *Trust & Verify*, the National Implementation Measures (NIM) team has continued to work across a number of projects to support the national implementation of international instruments focusing on chemical, biological, nuclear and radiological (CBRN) weapons and the security of related materials.

BWC National Implementation Measures Database

Together with the United Nations Disarmament Research Institute (UNIDIR), the team has continued working on a project funded by the US Department of State to develop a Biological Weapons Convention (BWC) National Implementation Measures Database. The database was officially launched on 15 August 2023 at a side event in the margins of the meeting of the Working Group on the strengthening of the BWC in Geneva, and further promoted at the third meeting of the Working Group in December. Work is now ongoing to complete country profiles for all 185 States Parties to the BWC.

Supporting the legislative implementation and universalization of the BWC, CWC and related international instruments

Implementation has begun on a new project funded by the Counter Proliferation and Arms Control Centre of the UK Foreign, Commonwealth and Development Office (FCDO). This project has several components, including awareness raising, legislative analysis, legislative drafting and universalisation support. The team is finalising updates to the [webpage](#) which addresses misconceptions related to the BWC and Chemical Weapons Convention (CWC).

NIM staff have also provided support for the implementation of both the BWC and CWC for interested states under this project, including providing legislative analysis and drafting support. For example, the NIM programme, with the support of the CMM team, held a BWC legislative drafting workshop with Sierra Leone in Freetown from 20–22 November 2023. This three day event discussed drafting approaches to implement the BWC in the country and the pathway forward to CBRN related legislation in the country.

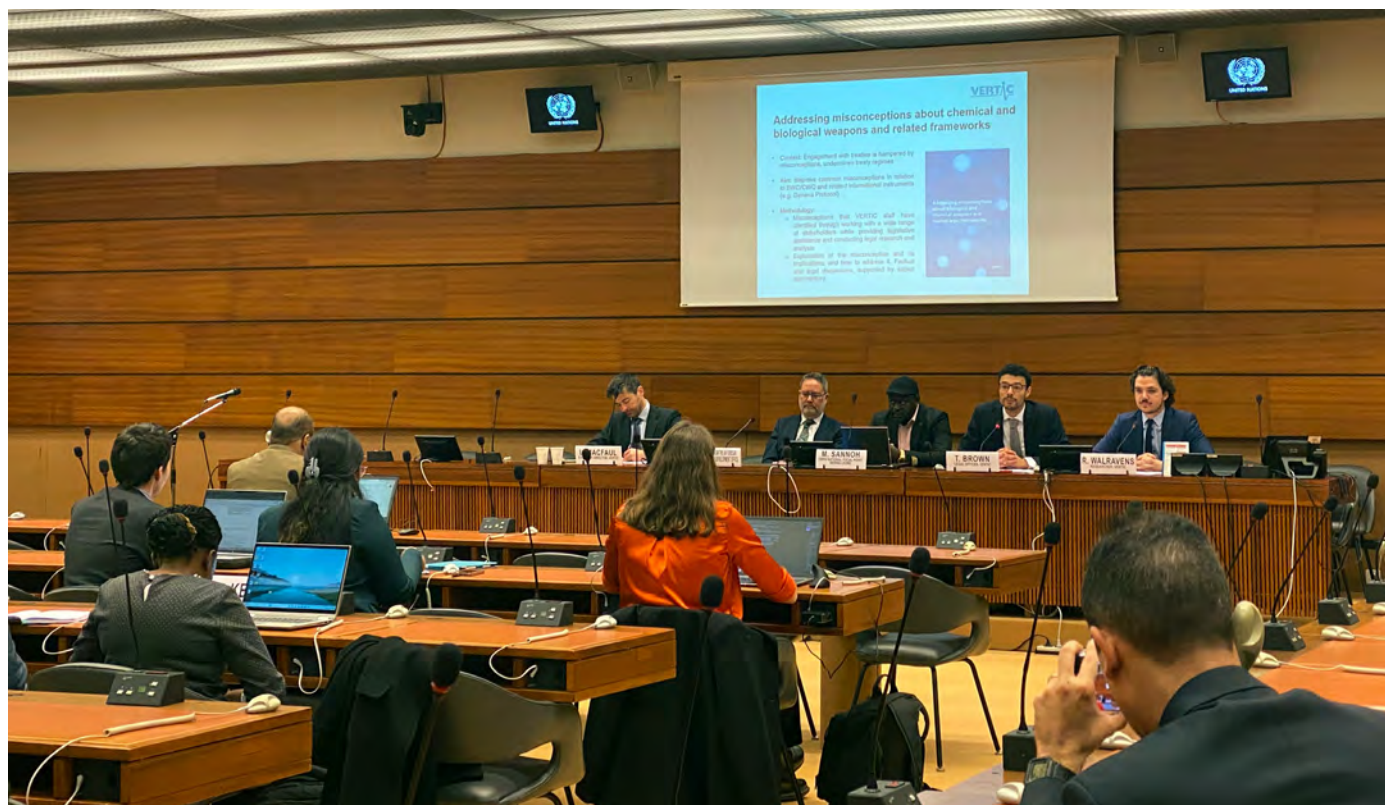


Photo 1: VERTIC side event to the BWC Working Group, Geneva, 8 December 2023.

Thomas Brown, together with Executive Director Larry MacFaul and Researcher Roel Walravens, attended the Third Meeting of the Working Group on the Strengthening of the Biological and Toxins Weapons Convention during the second week of December, and organised a side event showcasing VERTIC support under this project. Mr Mustapha Sannoh, CBRN focal point for Sierra Leone, also participated in the event to share information on his collaboration with VERTIC under this initiative (see photo 1).

Advancing BWC National Implementation in Kenya

From 17–21 July 2023, VERTIC's NIM Programme and partner Civilian Research and Development Foundation (CRDF) Global held two workshops in Naivasha, Kenya on implementation of the BWC. A legislative drafting workshop was held from 17–19 July, with an awareness raising event following on 20–21 July. The workshops formed part of the assistance provided under a project funded by the US Department of State Office of the Nonproliferation and Disarmament Fund (NDF) on Advancing BWC National Implementation in Kenya. The two workshops were organised in collaboration with the Kenyan National Commission for Science, Technology and Innovation (NACOSTI). The UN Office for Disarmament Affairs (UNODA) and its BWC Implementation Support Unit (ISU) were also key partners in these events, jointly hosting the awareness raising workshop and participating in the legislative drafting workshop. Follow up work continued with Kenya under the project after the two workshops.

EU CBRN Centres of Excellence (CoE) Project 81

The team has continued to implement EU CBRN CoE Project 81 on 'Enhanced Biosecurity in South East Asia'. We worked on reviewing partner countries' biosecurity legislation and developing related guidance under Work Package 2 of the project. The team also took part in activities with consortium partners and partner countries in-person and remotely, including a mission to Brunei Darussalam in from 31 July–4 August 2023.

Other NIM news

Thomas Brown presented on National Implementation at a panel during the conference 'Chemical and Biological Weapons: the Interconnectivity of Norms' in Gießen, Germany on 23–24 October 2023. Fanny Tonos, alongside VERTIC Executive Director Larry MacFaul, attended the twenty-eighth session of the Conference of the States Parties to the CWC in

November 2023. During this Conference, they liaised with relevant partners on implementation of the CWC. VERTIC submitted an individual statement on national implementation during the 2023 Meeting of States Parties to the Biological and Toxins Weapons Convention, from 11–13 December 2023.

During this period there have been a number of changes in personnel in the NIM programme. Sonia Drobysz left her position as Co-Programme Director at the end of September after 10 years with VERTIC. Suzanna Khoshabi also left the team in September 2023, which she had joined in 2020. The NIM programme expresses its appreciation for their valuable contributions during their time at VERTIC. Recruitment processes to identify replacement staff are close to being finalised.

Verification and Monitoring

Alberto Muti, Grant Christopher, Hugh Chalmers, Noel Stott and Hailey Wingo

In July, Senior Researcher Hugh Chalmers joined the VM programme. VM co-hosted a workshop on verification priorities for the North Korean nuclear programme with the Royal United Services Institute (RUSI) and the Open Nuclear Network in Vienna. Noel Stott provided comments at the launch of a paper on 'Resolution 1540 and the African Continental Free Trade Area: Policy Options to Strengthen Non-Proliferation Controls and Secure Trade'.

In August, VERTIC co-hosted a [side event](#) at the Preparatory Conference of the Nuclear Nonproliferation Treaty in Vienna (see photo 2), with the Governments of the UK and Norway, on irreversibility of nuclear disarmament. Noel Stott attended the first in-person meeting of the Treaty on the Prohibition of Nuclear Weapons (TPNW) Scientific Advisory Group in Vienna. VERTIC also commenced a joint project with the Open Nuclear Network on supporting the Comprehensive Nuclear-Test-Ban Treaty (CTBT), funded by the UK Government. VERTIC's role in the project explores how consultation and clarification mechanisms could be used to resolve questions and concerns regarding the absence of nuclear weapon test explosions.

In September, we launched our 'North Korea nuclear fuel cycle model interactive tool' at an event in Whitehall, with our project partners, RUSI and the James Martin Center for Nonproliferation Studies (CNS). The team also [presented our fuel cycle tool](#) to the Japan Atomic Energy Agency at their Headquarters in Ibaraki, Japan. Two projects were presented at the Science, Peace and Security 2023 Conference in



Photo 2: Side event at the NPT Preparatory Committee, Vienna International Centre, 3 August 2023.

Darmstadt, Germany: Co-programme Director Alberto Muti presented work on the link between nuclear irreversibility and latency, while our partners at CNS presented joint work on quantum information science and technology. Hugh Chalmers and Alberto attended the IAEA General Conference in Vienna to coordinate and target VERTIC's work supporting states in their implementation of IAEA safeguards. Noel Stott participated in a meeting of the African Nuclear Disarmament Verification Hub.

October saw reports that the 5MWe reactor at Yongbyon, North Korea, completed its most recent operational cycle. Hailey Wingo was interviewed for Korean-language Voice of America on consequences of this event. This month also saw Russia's Duma pass legislation to de-ratify the CTBT: Hugh Chalmers produced a [commentary](#) on this and recommendations for the policy community (also see the lead article in this edition). VERTIC participated in a visit to the former nuclear weapons test site at Semipalatinsk, Kazakhstan with the Open Nuclear Network. We were hosted by our Nuclear Disarmament Verification hub partners at the International

Science and Technology Center (ISTC) and National Nuclear Centre of Kazakhstan. Dr Grant Christopher [presented on the state of additive manufacturing](#) at the Tech Trends workshop in Frankfurt (see photo 3), hosted by the Peace Research Institute Frankfurt (PRIF).

In November, Noel Stott arranged, on behalf of the African Nuclear Disarmament Verification Hub, a webinar with three South African university professors to highlight the importance of nuclear disarmament education and in particular nuclear disarmament verification in their political sciences and international relations courses, as well as to arrange a series of outreach activities and to get their input on a planned African-appropriate Professional Development Course. Hailey Wingo attended a workshop in London hosted by the Science Policy Research Unit (SPRU) and the British American Security Information Council (BASIC) on the convergence of AI and chemical and biological weapons (a follow-on to an initial workshop in March). Hailey also presented VERTIC's North Korean nuclear fuel cycle model interactive tool to the German Young Nuclear Network.



Photo 3: Grant Christopher presenting on a panel on additive manufacturing at the Tech Trends workshop, Frankfurt, 30–31 October 2023.

In December, Alberto Muti and Hailey Wingo will attend the Biological Weapons Convention (BWC) Working Group to facilitate a discussion on biological weapons acquisition scenarios. Grant Christopher and Hailey Wingo will travel to Rio de Janeiro to participate in a forum on irreversibility of nuclear disarmament in partnership with the Nonproliferation for Global Security Foundation (NPSGlobal). The forum is intended to engage with policy and technical audiences in the region on irreversibility of nuclear disarmament.

Compliance Mechanisms and Measures

Angela Woodward and Roel Walravens

North Korean maritime sanctions

The Compliance Mechanisms and Measures (CMM) Programme's work on implementing UN Security Council sanctions on North Korea continued into the third and fourth quarters of 2023. The team is conducting training activities with states and other relevant maritime stakeholders involved in implementing the sanctions. Operating as part of a consortium together with the James Martin Center for Nonproliferation Studies (CNS) the CMM team continued to work with the consortium to develop training courses on sanctions imple-

mentation pertaining to due diligence in sanctions implementation, ship registry operations, and sanctions enforcement.

CMM's project mandate focuses primarily on research of UN Security Council maritime sanctions-related issues, particularly on matters related to their legal implementation, but also includes identifying new trends in sanctions evasion tactics, examining case studies of enforcement and compiling best practices of effective national implementation.

Maritime confidence- and security-building measures in the Asia-Pacific

The CMM programme's joint project with the Asia-Pacific Leadership Network (APLN) on preventing dangerous maritime incidents and unintended escalation in the Asia-Pacific, supported by the US Department of State, continued during the third quarter of 2023. VERTIC and APLN led a two-day substantive dialogue on managing and mitigating military incidents at sea in the Asia-Pacific in Bangkok, Thailand during 24–25 July 2023. The project [report](#) is available on the VERTIC and APLN websites. A summary of the project findings is included in this issue of *Trust & Verify*.

The project engaged Asia-Pacific policy practitioners and experts in a substantive dialogue on mitigating military

incidents at sea and reinvigorating the call for urgent maritime confidence building and crisis-avoidance measures in the Asia-Pacific. Angela is a New Zealand member of APLN and serves on the APLN's International Advisory Board.

Outreach and external relations

Angela Woodward, based in New Zealand, participated in an online workshop on 'Reducing the Risk of Nuclear Weapon Use in Northeast Asia' on 24 October. The workshop discussed the findings of a [project](#) by the APLN, the Research Center for Nuclear Weapons Abolition, Nagasaki University (RECNA), the Nautilus Institute for Security and Sustainability, and the Panel on Peace and Security of North East Asia (PSNA). The project is intended to assist policymakers to identify ways to avoid a nuclear conflict and de-escalate tensions on the Korean Peninsula and in North East Asia by developing credible nuclear use scenarios and proposing policy solutions.

On 7 November Angela joined an APLN network members' meeting and joined a briefing for APLN network members by Dr Robert Floyd, Executive Secretary of the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) on 29 November.

CMM Researcher Roel Walravens attended the training programme on 'Disarmament and non-proliferation of WMD 2023' convened by the T.M.C. Asser Institute and the Organisation for the Prohibition of Chemical Weapons (OPCW) in the Hague, Netherlands during 18–22 September 2023. Roel was a speaker at the OPCW and EU side event 'Youth and Chemical Disarmament Dialogue' at the Chemical Weapons Convention's Conference of States Parties (CSP-28) on 30 November, in the Hague, Netherlands.

During 6–8 December 2023, Roel also attended the third meeting of the Working Group on the Strengthening of the Biological Weapons Convention at the Palais des Nations in Geneva, Switzerland.



building trust through verification

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Mission statement

VERTIC is an independent, not-for-profit, nongovernmental organisation. Our mission is to support the development, implementation and effectiveness of international agreements and related regional and national initiatives, with particular attention to issues of monitoring, review, legislation and verification. We conduct research, analysis and provide expert advice and information to governments and other stakeholders. We also provide support for capacity building, training, legislative assistance and cooperation.

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Ms. Hailey Wingo, Research Assistant (USA);

Mr. Roel Walravens, Researcher (United Kingdom);

Ms. Fanny Tonos Paniagua, Programme Director Designate (Dominican Republic); and

Mr. Hugh Chalmers, Senior Researcher (United Kingdom).

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