New wine in old bottles? Cyber security coverage within the CPPNM/A and its implementing guidance

George Vardulakis

The physical protection of nuclear material and nuclear facilities is central to states' efforts to prevent theft and sabotage of such materials, and to protect against the threat of nuclear terrorism and the spread of nuclear weapons. The First Conference of the Parties to the Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM/A) is scheduled to take place in March 2022 at the IAEA Headquarters, having been delayed by the COVID-19 pandemic. This will follow the similarly delayed Non-Proliferation Treaty Review Conference (RevCon) in what promises to be a revealing and important period for nuclear non-proliferation and nuclear security. Now more than ever, visible political unity and progress is essential to strengthen global nuclear security, and for collaboration on climate change as nuclear power seeks to be part of the energy mix in existing and newcomer states. After 20 years of unprecedented technological development and changes in nuclear security practice, the interpretation of the terms 'physical protection' and 'sabotage' amongst others no longer appear to be sufficiently clear and common between states. It could be that binding obligations under the CPPNM/A may differ depending on legal interpretation of the treaty.

In this issue . . .

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The purpose of the conference, as stated in the amended convention, is to "review the implementation of the convention and its adequacy . . . in the light of the prevailing situation". It will thus provide a forum for States Parties to discuss changes in the prevailing situation since the drafting of the treaty by examining emerging technologies, vulnerabilities and threats, and the varying implementation by states. This article explores some of the issues that are likely to be discussed at the Convention's first Review Conference, including: the changing nature and scope of the physical protection landscape; the emergence of the cyber threat; and the challenges that are likely to arise as physical security and cyber security become more integrated. Finally, this article considers whether an evolutive interpretation (where the meaning/scope of terms change over time) should apply to the convention, drawing on the Vienna Convention on the Law of Treaties (VCLT) (Art 31-32), and presents the IAEA's evolving guidance, before drawing some conclusions.

The changing physical protection landscape

In the nuclear sector, physical protection can be defined as an integrated system of deterrence, detection, delay and response measures effective against unauthorised removal and sabotage of nuclear material and nuclear facilities. Originally conceived as a system to protect physical assets against physical threats, today the threat landscape also includes the cyber security of digitally controlled and networked assets at nuclear facilities.

International recommendations and guidelines for the physical protection of nuclear material were first drafted in the Cold War period. The first set of IAEA recommendations were made at the request of the IAEA Director General in 1972. These were later revised in 1975 and published the following year as INFCIRC/225 recommendations on 'The Physical Protection of Nuclear Material'. Since then, INFCIRC/225 has been revised five times, most recently in 2011 and prior to that in 1999, with each revision to the recommendations stemming from the need to address technological and scientific developments and the changing threat posed by malicious non-state actors to nuclear material and nuclear facilities. In addition to INFCIRC/225 voluntary recommendations, the international Convention on the Physical Protection of Nuclear Material (CPPNM), which came into force in 1987, legally binds its States Parties to implement physical protection measures.

The CPPNM consolidated on-going efforts to harmonise and strengthen the physical protection of nuclear material into a legally binding treaty. The Convention opened for signature in 1979 but debate surrounding its limited scope (initially it only applied to nuclear material during international transport) continued over the next two decades. In response to a request by the Director General, and shortly before the 9/11 attacks, the IAEA Open-Ended Expert Meeting presented its final report, which included recommendations for revising the CPPNM. This report set in motion the drafting of a well-defined amendment to the original convention which would expand its scope to include nuclear material in domestic use, storage and transport, as well as the protection of nuclear material and nuclear facilities from sabotage. The report also set out, inter alia, that such an amendment should cover definitions and enshrine a series of "fundamental principles" of physical protection of nuclear material and nuclear facilities. Opened for signature in July 2005, the amendment to CPPNM finally came into force in May 2016.

Although the amendment extended the scope of the CPPNM, it remained unclear on the meaning and scope of some of the terms. For example, does 'physical protection' cover computer security, and does 'sabotage' include cyber-attacks that may not (realistically) threaten radiological release? It would appear from IAEA guidance available at the time that computer security was not included in its definition of physical protection (See Box 1).

The IAEA guidance on physical protection has only included aspects of computer security since 2011 (as discussed below), six years after the CPPNM/A. Successive revisions to the IAEA guidance on INFCIRC/225 generally reflect an evolutive interpretation of physical protection. The question therefore arises: has the interpretation of the convention itself also changed to cover issues that had not been anticipated or explicitly covered at the time of adoption? If the guidelines on what constitutes 'physical protection' changes over time in the *ordinary meaning* of the term (see Article 31.1 VCLT), or explicitly in the IAEA guidelines, does this mean that obligations with regards the convention itself also change? Box 1 details some IAEA definitions and the scope of physical protection as understood at the time of the amendment, and the subsequent inclusion of computer security. However, it is clear that in many of these texts, physical protection does not include computer security.

Box 1: Evolving IAEA guidance on physical protection and computer security

1999

IAEA INFCIRC/225 Rev.4 (and its guidance published the following year TECDOC-967) make no reference to computer security or cyber threats. In the definitions, they cover measures understood to encompass physical security such as guarding, physical barriers, alarms stations, surveillance, access control, sensors and detection. Information security and *confidentiality* is detailed, but digital system *integrity* and *availability* are not included.

2008

The IAEA-TECDOC-1575 Rev. 1 Volume 6 - Physical Protection (the INPRO Manual), provides a definition of physical protection: *"The term physical protection (PP) refers to the protection of a physical asset (as contrasted from information protection or cyber protection)."* Clearly, States signing the CPPMN/A and following this guidance would not have understood computer security to be included.

2011

INFCIRC/225 Rev. 5. Out of the 194 specific recommendations, only two (4.10 and 5.19) cover computer security and *cyber-attack*, and at a general level. They simply stipulate that computer-based systems used for physical protection, safety, and nuclear material accountancy and control, should be protected against compromise.

NSS17 *Computer Security at Nuclear Facilities* - the first technical guidance document from the IAEA in the domain of cyber security. In Sections 2.3 and 5.2, it clearly distinguishes between the domains of physical security, and computer security, whilst acknowledging interactions. This guidance has since been replaced by NSS 17T (see below).

2014

IPPAS guidelines were updated include a 'new module' on computer security. It states that it is an increasingly important topic *"incorporated into INFCIRC/225 for the first time in Revision 5 (IAEA NSS No. 13)."* This statement would imply that computer security was out of scope until 2011.

2018

NSS 27-G (Implementing guide to INFCIRC225/Rev5) appears with many references to computer security. It states, in footnote 1, that the term 'physical protection' is used 'historically', and that the term 'nuclear security of nuclear material and nuclear facilities' is now preferred. That change in terminology was perhaps necessary to include computer security, but is also confusing as states and stakeholders continue use the term 'physical protection' widely and distinct to computer security – a situation acknowledged in the most recent guidance.

2021

NSS 40-T *Handbook on the Design of Physical Protection Systems for Nuclear Material and Nuclear Facilities* does not detail security measures complimentary to physical protection, including computer security. It only covers measures for protection against *physical* threats including barriers, lighting, sensors, cameras, access control, alarm stations, detection, and guards.

NSS 42-G *Computer Security for Nuclear Security* details computer security concepts, implementation, and outlines the roles and responsibilities of different nuclear security actors. Here the guidance explicitly "*treats computer security as a separate topic, distinct from physical protection, to clarify and emphasize the differences".*

NSS 17-T *Computer Security Techniques for Nuclear Facilities* distinguishes computer security and physical protection terminology. In an analogous approach to INFCIRC 225/rev 5 it details logical computer security zones and levels – separate (albeit sometimes related) to the physical protection zones: *protected area*, *limited access area, inner area* and *vital area.*

The Review Conference will provide an opportunity to consider these questions and share experience on adequacy of implementation. As nuclear security responsibility rests entirely with the state, certain states may view the amended convention as adequate, and inclusive of cyber security, but others may not. This may depend on individual states' systems of law (common law vs. civil law interpretations), national threat assessments, and whether it possesses nuclear material and facilities.

The conference will also provide a useful opportunity to examine what physical protection and security encompasses in other applications e.g. national borders, major events, and non-nuclear critical infrastructure protection, such as aviation security. Comparisons with the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT) could also be drawn across implementation and adequacy of scope. This would be useful as ICSANT does not benefit from an article 16 type review process.

Although there is unlikely to be political appetite for a further amendment, a statement at the conference on the inclusion of cyber security within the scope of the CPPNM/A could be agreed.

Physical protection and the emergence of the cyber threat

Historically, physical protection covers measures required to protect against threats and acts of physical attack to physical assets. Protection is provided by successive layers of operationally integrated security measures across security functions of deterrence, detection, delay, alarm and response. Such measures include physical barriers (e.g. walls and fences), sensors, alarms and central alarm stations, access control (e.g. biometrics, card passes and locks), surveillance (e.g. cameras, sensors, lighting), detection (e.g. X-ray and metal detectors) and human guards providing capability across all functions. In the amendment, 'physical protection' was extended to cover facilities, but the apparent interpretation of the term was unaltered. Today, the classical scope of physical protection measures (as detailed above) no longer offers comprehensive protection for modern facilities. These now face a far wider range of cyber (digital and non-physical) as well as physical threats to both security, material accountancy and safety systems.

The vulnerability of nuclear facilities to emerging, non-physical cyber-threats, or blended cyber-physical attacks, has increased significantly in the last two decades. Security economics and technological development have contributed to a broader threat and vulnerability. For instance, in a desire to increase the operational efficiency of nuclear facilities, and lower costs, analogue systems (including those used for physical protection) have been replaced with software and electronics, often connected on an internet protocol (IP) network and maintained by a pool of external contractors, and a supply chain that is increasingly moving systems and services to the cloud. This has exposed those systems to new forms of cyber-attack. These threats were simply not extant at the time of the first IAEA physical protection guidelines in the 1970s or when the original CPPNM was drafted.However, major cyber-attacks, such as those seen in the US Colonial Pipeline ransomware attack in May 2021, have highlighted a clear and present danger to all critical infrastructure.

Convergence of physical and cyber security

Physical security, cyber security and safety are becoming increasingly integrated, which has important implications. Physical protection, which provides physical security, must be implemented together with cyber and personnel security, and alongside safety, for an organisation and its assets to be safe, secure and function effectively. Professional groups often distinct in skills and backgrounds, who may have previously worked in 'silos', now need to integrate their services and functions to identify and close security gaps, and to improve overall operational efficiency.

Cyber threats can take a number of forms, including 'denial of service' attacks, theft of digital information, process

VERTIC Publication

Senior Researcher **Elena Gai** had an article published in the National Nuclear Centre of Kazakhstan's journal, 'Man. Energy. Atom'. The article, 'Ongoing initiatives on verification of nuclear disarmament', can be found on page 36 of the journal. The article was written as part of a VERTIC project on capacity building for nuclear disarmament verification.

corruption, 'electronic sabotage' and the facilitation of access to physical or digital assets to unauthorised third parties. These forms of attack may be orchestrated by external human actors, by human 'insider-threats' or executed fairly randomly by automated software 'bots'. This casts the risk envelope far wider than 'simpler' physical attacks.

To provide digital or electronic protection, cyber security measures must provide capability to ensure the *confidentiality*, *integrity* and *availability* of electronic and software-controlled assets and systems. Physical access to computers controlling physical security systems, for example by a disgruntled insider, or external denial of service attacks to physical alarm or access control systems, illustrate the interdependence between physical and logical protection.

This convergence problem is not unique to the nuclear sector. It affects other sectors, such as medical health and safety devices, and driverless cars. Nuclear security practitioners can learn from issues arising from other software controlled, networked, safety-critical and long-lived consumer products. In the future, legacy electronic systems and software in instrumentation used in nuclear facilities, often procured from a complex and dynamic commercial supply chain, will need to be protected and maintained. Consideration will need to be given to who will be responsible for patching and updating products that might have to endure for decades. One important consideration is the significant cost associated with these maintenance tasks and with any testing and re-certifying of security and safety systems.

Aviation security provides another example where strict regulatory performance testing is mandated for physical security products. For example, Explosives Detection Systems (such as aircraft hold baggage X-ray machines) must be tested and/or re-certified by independent third parties if a new detection algorithm software is introduced by a manufacturer, or if a new electronic component is used in the product. In many of these cases, partial re-tests are conducted rather than a full test, but there is still a considerable cost and delay to making changes. In theory—although not currently mandated in regulations—aviation security detection instrumentation should also ensure good cyber security to prevent cyber tampering and compromise. This may require the use of another parallel certification framework for computer security such as the 'Common Criteria' certificate used for certain IT products.

These legal, technical and cost efficiency requirements all point to the emerging security, safety and sustainability trilemma. For example, security updates/patches for safety products may be avoided by operators if this leads to increased costs and delays associated with recertification. Sustainable performance testing of physical security products and systems is an area of increasing importance, but also rising cost. Guidance for performance testing, computer security and insider threats are not covered in detail in INFCIRC/225 Rev 5, and are absent in the CPPNM/A.

Evolutive treaty interpretation

To many actors, the term 'physical protection' describes physical security as the protection of (mainly physical) assets from physical attack by criminal or terrorist actors. Cyber security is understood as a separate requirement to physical security, not least as cyber concepts and measures are often more technically complex and challenging to understand and implement. However, it is crucial to understand the emerging interactions between the two domains.

A key issue is understanding whether, or to what extent, the term physical protection, as understood within the convention, encompasses computer/cyber security requirements. The global nuclear regime would be far stronger if cyber security were included within the scope of CPPNM/A, but its inclusion would require agreement by all States Parties. States may have joined the amendment when computer security was not understood or defined to be within scope and consider it to be outside the treaty context and purpose.

This issue of interpretation of treaty terms may be resolved by examining the Vienna Convention on the Law of Treaties (VCLT). It specifically requires under Article 31 General Rule of Interpretation, that:

1. A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose.

What was the *ordinary meaning* of the term in *light of its object and purpose*, in the 1970s and at the 2005 amendment? When one looks at the IAEA guidance available at the time it is clear physical protection was separate to computer security. For example, IAEA-TECDOC-1575 Rev. 1 Volume 6 – *Physical Protection*, states that "*the term physical protection*

(PP) refers to the protection of a physical asset (as contrasted from information protection or cyber protection)". What then if the interpretation in IAEA guidance, or that of some States Parties, has changed since the time of the drafting of the convention or a state's consent (signature) to be bound by it? VCLT Article 31.3 states:

There shall be taken into account, together with the context:

(a) any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions;

(b) any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation;

The recommendations in INFCIRC/225 Rev 5 or later IAEA guidance constitute *subsequent practice* in physical protection and computer security, but not an *agreement* regarding *application of the treaty* and its *interpretation*. The VCLT could however provide a mechanism at the review conference for establishing such an agreement for an up-to-date, flexible and common interpretation.

Conclusions

The prevailing situation has changed significantly since the 1979 CPPNM and 2005 amendment to the CPPNM were drafted. At that period, the interpretation of physical protection meant physical security measures such as 'guns, guards and gates', and did not include computer security.

Six years after the amendment was opened for signature, computer security was added for the first time to the CPPNM/A guidance published as INFCIRC/225 Rev5. At the same time, we have seen that in most applications, and within other IAEA guidance documents, cyber security is considered separate to physical protection.

To address this apparent contradiction, IAEA guidance has evolved to state that if the context is the physical protection of nuclear materials and facilities, the wider scope term 'nuclear security' (which includes computer security) should be adopted. Whether this change also applies to the interpretation of the term within the context of the amended convention remains a matter to be made clear at the review conference.

The conference provides an opportunity to examine the questions of the treaty's interpretation and adequacy, and agree a way forward. The hope is that there can be effective consensus building on the scope of the amended convention, and the need for legal/regulatory frameworks to take this into account. The VCLT Article 31 may offer a method for an agreement and a binding solution to this question.

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Verification Watch

The 2022 NPT Review Conference: safeguards, verification and emerging technologies

Part I: Introduction

Larry MacFaul

Next month, January 2022, sees the long-awaited hosting of the 10th Review Conference to the 1968 Treaty on the Non-Proliferation of Nuclear Weapons (NPT). The conference—originally planned for 2020, but delayed due to the Covid pandemic—will need to address certain long-standing points of contention that are profoundly important to international peace and security. These include nuclear disarmament and regional issues, such as the proposed Middle Eastern WMD-free zone, as well as core Treaty issues on nuclear safeguards, peaceful uses of nuclear energy and the conclusions of previous Review Conferences from 2000 and 2010. Beyond these core issues, several specific matters of concern and relevance will be discussed, such as North Korea's nuclear weapons programme and proposed new agreements on issues such as fissile materials. Verification, full implementation and compliance, of varying forms, are key to any solutions to these issues. There is also a strong desire among many stakeholders to address several acute issues on nuclear risk reduction and doctrine. There may as also be discussion of many other issues

such as the transparency in the P5 Process. The impact of the new Treaty on the Prohibition of Nuclear Weapons will be felt, though as yet it is not clear how it will be treated in the negotiations. In terms of overall conference outcomes, there will likely be calls for achievable, deliverable goals that can be assessed in the coming review.

In this issue of *Trust & Verify*, we have commentary on some of these issues and related areas, including on nuclear safeguards, disarmament verification, emerging technologies, North Korea's nuclear programme, the AUKUS agreement and nuclear security.

Negotiations under the 10th NPT Review Conference will clearly underline that there are persistent and deeply troubling matters contributing to the ongoing existential risk posed by nuclear weapons. However, there are also strong signs that the international community can work together in a sustained manner to improve global peace and security. For example, a large number of countries have safeguards agreements in force and are implementing them, while, for its part, the International Atomic Energy Agency (IAEA) continues its verification activities, including during the pandemic. These agreements represent the will of governments to contribute to the goal of non-proliferation and the efforts of their officials to carry out the day to day running of nuclear material controls and reporting. VERTIC has been privileged to be able to help in this endeavour by engaging with countries and other assistance providers in their efforts in non-proliferation and to implement safeguards provisions. Most recently, we were pleased to be able to announce that the IAEA has partnered with VERTIC to strengthen safeguards knowledge and capabilities, thereby enhancing our respective efforts in this area.

Meanwhile, there has been growing recognition internationally of the importance of nuclear disarmament verification (NDV) and the role of both nuclear weapon and non-nuclear weapon states in verification activities. There are several former and ongoing state and NGO initiatives on this topic, as well as statements from previous Review Conferences highlighting its relevance and importance. The United Nations General Assembly adopted a specific resolution on nuclear disarmament verification in 2016. Resolution 71/67 stated that 'all States parties to the [Non-Proliferation] Treaty commit to apply the principles of irreversibility, verifiability and transparency in relation to the implementation of their treaty obligations'. It also said 'while verification is not an aim in itself, further development of the multilateral nuclear disarmament verification capabilities will be required' and that given the challenges associated with verifying nuclear disarmament, continuous capacity-building and technical development are critical. It called on states to work together to develop disarmament verification measures, and to address technical challenges of nuclear disarmament verification and monitoring, including tools, solutions and methods and capacity-building. It noted that such efforts will build confidence and facilitate the advancement of nuclear disarmament efforts. The resolution created a Group of Governmental Experts (GGE) on this matter. One notable proposal within this process was for a Group of Scientific and Technical Experts to be created. A follow-on GGE will hold meetings in 2022 thereby continuing to provide a specific focus for NDV within the United Nations community.

VERTIC has been working for several years with stakeholders from countries across Africa, Asia and Latin America and elsewhere to explore the interest and means for cooperative capacity building and participation in the field of NDV. The results of this process have been particularly encouraging; there is a significant degree of expertise, experience and will to contribute, and to find ways to ensure that this element of the disarmament enterprise is effective, inclusive, safe, non-proliferative and sustainable.

Part II: IAEA Safeguards

Alberto Muti

International Atomic Energy Agency (IAEA) Safeguards – the set of technical means by which the IAEA verify that no nuclear material has been diverted to the production of nuclear weapons – rarely take centre stage at the nuclear Non-Proliferation Treaty (NPT) Review Conference. Debates on the implementation of safeguards, and especially on its most technical aspects, are usually held in Vienna rather than New York, through the IAEA's Board of Governors or at its yearly General Conference. Nonetheless, safeguards are a key part of the nuclear non-proliferation regime, and it is important to understand how the broader dynamics affecting the NPT community influence them.

Many of the high-profile issues that are set to dominate the RevCon have strong safeguards implications. Such is the case for the debate over Iran's nuclear programme and the future of the Joint Comprehensive Plan of Action, especially in light of the measures taken by Iran over the last year, which significantly limited the IAEA's access to Iran's infrastructure compared to the period 2015-2020. An aspect of note is that the IAEA has publicly denounced incidents where its inspectors – especially women – suffered interference and harassment by security personnel at Iranian facilities. Some NPT Member States, including the UK, have announced they aim to use the Review Conference to reaffirm the right of IAEA inspectors to discharge their duties free of interference. Another international issue of note with prominent safeguards implications is the recent announcement that Australia will obtain nuclear-powered submarines under the AUKUS security pact (see overleaf for a discussion of the issue).

There are also other prominent policy debates surrounding the safeguards regime that are likely to surface at the Review Conference. The most prominent of these are the status of the IAEA Additional Protocol (AP), and the so-called 'State-Level Concept'.

The Additional Protocol was introduced in 1997 as a response to revelations on how Iraq had been able to conceal its nuclear weapons programme from the IAEA, and it provides the Agency additional means to verify that no undeclared activities take place in a country. Since then, some NPT Member States, chief among them the United States and several European countries, have argued that the AP should become part of the safeguards 'gold standard', and should be seen as mandatory under the NPT. Other states, including Egypt, Brazil, Argentina and several developing countries, maintain that only the Comprehensive Safeguards Agreement (CSA, the 'standard' Safeguards document since the introduction of the NPT) should be mandatory, and that the Additional Protocol should remain an additional, voluntary measure. A key part of this argument has been that the AP represents an increased burden on Non-Nuclear Weapon States, which is seen as unjustified in the face of the lack of progress on nuclear disarmament, as mandated by Article VI of the NPT.

The so-called State-Level Concept was developed by the IAEA after the introduction of the AP. The Agency started working on an 'integrated safeguards' approach to leverage verification techniques from the CSA and AP in the most effective and efficient way possible. This was accompanied by a shift in approach from the level of nuclear facilities, to the level of a state's fuel cycle as a whole. The IAEA introduced State-Level Approaches, defined as 'a customized approach to implementing safeguards for an individual State'. However, the concept of state-level safeguards was also criticised. Some states argued that it extended the Agency's operations beyond its mandate, while others claimed it had the potential to politicise the safeguards process, especially as it was introduced at the same time as the Agency started making a greater use of various sources of information in its safeguards analysis, including open-source information and in some high-profile cases, information supplied by member states (this was the case for Syria and Iran, for example). Details on the State-Level Concept and the debate surrounding it go beyond the scope of this article, but more can be found in VERTIC's Verification & Implementation yearbooks from 2015 and 2019. While some aspects of state-level implementation have been clarified and agreed to, the debate on the State-Level Concept is still ongoing and likely to surface at the Review Conference.

Much has been written about the climate of polarisation and disagreement that surrounds the 2022 RevCon, and many experts have cast doubt on the health of the NPT regime and the possible outcomes of the conference. However, 2022 also marks the 50th anniversary of the first CSAs, and the 25th anniversary of the AP. The NPT Member States should use this occasion to recognise IAEA Safeguards as a success story, and a landmark for nuclear non-proliferation and international security.

Part III: Nuclear disarmament verification

Noel Stott

The UN General Assembly and its Committee on International Peace and Security (First Committee) have for many years recognised the importance of verifying nuclear disarmament. Resolutions at the First Committee on nuclear disarmament verification are often adopted without a vote, although occasionally some states explain their no vote or abstention.

Both the first special session of the UN General Assembly (UNGA) on Disarmament (SSOD1) in 1978, and the

1968 Treaty on the Non-Proliferation of Nuclear Weapons (NPT), recognise that all states have a role to play in nuclear disarmament—including non-nuclear weapon states. Various NPT decisions and commitments made by States Parties have reinforced this, including at the 1995 Review and Extension Conference, and at the 2000 and 2010 Review Conferences. The UN Secretary-General has also issued expert reports on verification in all its aspects, including on the role of the United Nations in 1990 and 1995.

More recently, UN Member States have committed to work together to identify and develop practical and effective disarmament verification measures.

Capacity-building for nuclear disarmament verification

In the NPT context, States Parties have at least since the 2000 Review Conference recognised that importance of developing verification capabilities that will be required to provide assurance of compliance with nuclear disarmament agreements for the achievement and maintenance of a nuclear-weapon-free world (see NPT/CONF.2000/28, Parts I and II). In 2010 NPT States Parties agreed on the importance of supporting co-operation among governments, the United Nations, other international and regional organizations and civil society aimed at increasing confidence, improving transparency and developing efficient verification capabilities related to nuclear disarmament (Action 19).

Although not adopted, the draft report of the 2015 Review Conference, welcomed "efforts towards the development of nuclear disarmament verification capabilities that will contribute to providing assurance of compliance with nuclear disarmament agreements for the achievement and maintenance of a nuclear-weapon-free world, including the new and continuing initiatives pursued by Norway, the United Kingdom of Great Britain and Northern Ireland and the United States of America".

The General Assembly in December 2016 took the process further by adopting resolution 71/67 calling on the Secretary-General to establish a Group of Governmental Experts (GGE) to consider the role of verification in advancing nuclear disarmament. In December 2019, the UN General Assembly adopted Resolution A/RES/74/50 and created a new GGE to continue to consider the role of verification in advancing nuclear disarmament in light of the May 2019 consensus report (A/74/90) of the GGE established under UN General Assembly Resolution 71/67.

Both of these resolutions recognised that "capacity-building on nuclear disarmament verification is a valuable component in the nuclear disarmament process and also one of the fundamental factors determining whether the goal of verification could be effectively upheld". They further noted that, "building capacity on nuclear disarmament verification in a sustainable manner is not only of great significance, but also faced with practical challenges". The May 2019 consensus report referred to above suggested that the UN Secretary-General seek the views of Member States on being involved in capacity-building in nuclear disarmament verification and that a voluntary funding mechanism for capacity-building be established.

Verification and the Tenth NPT Review Conference

The Tenth NPT Review Conference is due to be held on 4 - 28 January 2022. The meeting is potentially fraught with difficulties especially in relation to unfulfilled commitments previously made, such as the hosting of a substantial conference to establish a verifiable Middle East zone free of weapons of mass destruction and their delivery systems.

As stated by Daryl Kimball, Executive Director of the Arms Control Association, at a Nuclear Discussion Forum at the Mission of Kazakhstan to the United Nations on 26 October 2021, NPT "States Parties will need to come together on many key issues. . ., including action strengthening nuclear safeguards. . ., among others" Kimball believes that "an action plan on disarmament that helps to address the growing disarmament deficit" would be a crucial indicator of success.

The need to enhance capacity-building efforts on nuclear disarmament verification may be one of the few topics that States Parties can agree on. An agreement that sustained efforts to develop possible verification measures, is a 'concrete step' towards a world without nuclear weapons, and hence a step that should be sought. As pointed out by the Nuclear Threat Initiative, "developing and demonstrating the necessary technologies, concepts, and procedures needed for verification of elimination of nuclear weapons", could be an objective set in 2022 to be achieved prior to the 2025 Review Conference.

Part IV: Emerging technologies

Grant Christopher

How should emerging technologies be dealt with in the forthcoming NPT Review Conference (RevCon)? Novel applications of new technologies are already impacting nuclear stability, and they may also provide new opportunities for nonproliferation and disarmament verification.

In a 2020 report, Heather Williams, an academic at King's College London, evaluated the utility of including emerging technologies in RevCon discussions and argued that ignoring emerging technologies would make the NPT irrelevant. She also argued that both Nuclear Weapons States (NWS) and Non-Nuclear Weapons States (NNWS) have a role to play in shaping discussions and should engage with non-governmental organisations (NGOs) on these issues.

In arms control, emerging technology is frequently used as a catchall term for technologies that may be used in the future with consequences that are not yet understood. Some of these technologies are fully 'emerged' with fully developed military operational roles, such as cyber operations. The scope of the 'emerging tech' discussion is often no more than an acknowledgement that the implications of this technology for nuclear stability are not understood by traditional arms control and military thinkers.

Emerging technology applications influence nuclear policy in multiple ways. Some may provide successful adopters with a strategic nuclear advantage, such as novel delivery systems (including hypersonic boost-glide vehicles), and offensive cyber capabilities. Other emerging technologies may support verification, such as neutrino monitoring. Some will have applications in both areas, such as quantum sensing.

The ability of technologies to fundamentally alter either strategic stability or the nonproliferation regime can sometimes be assessed by monitoring their steady progress in development over time. A metric such as technology readiness level (TRL) can be used to track technological development, but it is often difficult to assess when progression to the next TRL will occur. Progress is not guaranteed: nuclear fusion has been essentially stuck at the same TRL for 50 years.

When an emerging technology is an improvement over an existing technology, the benefit of the emerging technology is usually compared to what it is replacing today, rather than considering how current technologies may improve and evolve over time. Many assessments conflate applications that will be relevant in the next five years with others that may take twenty years to mature. Others lack sufficient information to assess adequately when traditional technical and doctrinal arms control literature is not applicable.

For instance, the cyber operational domain is very difficult to assess. Despite arms control researchers having case studies that can guide capability and assess risks, unlike for nuclear weapons, there are no weapons tests to observe, no arsenal sizes to monitor and scant open sources for analogies to force movements or deployment that can provide indications of capabilities and intent. We don't know how many 'zero-day' exploits the major powers possess, or how developed their denial and attribution capabilities are. Beyond well-known cases studies, the only other way of assessing capabilities and intent is through other indications, such as economic investment and doctrinal statements. Overall, however, it is difficult for cyber domain arms control debates to properly analyse the risks of left-of-launch attacks, sabotage and the possibility of new systems being cyber-compromised as they are developed.

One emerging technology—hypersonic boost-glide vehicles—can be assessed using a more traditional framework. In this case, policy makers and arms control analysts' perceptions of these systems are often misaligned. Arms control experts understand these functionally as potentially conventional/nuclear armed systems that are designed to evade missile defences in the terminal phase, but are not faster than ballistic missiles (see the article in Technology Scan). Some policy makers see these as provocative conventional first-strike systems that are designed to evade existing arms control limits. To others the term hypersonic is simply an endless source of confusion, hampered by poor media reporting. There is a risk of these systems generating relentless momentum towards a new arms race. But it should be remembered that they can be observed and analysed using existing arms control techniques: they are built in factories, deployed to their delivery platforms and flight tested. To varying degrees the status of these systems can be monitored with open-source tools available to NGOs and compared with other delivery platforms and payloads.

Arms control, disarmament, verification and proliferation are connected issues to be considered at the RevCon. NWS argue that arms control should address strategic stability,

while the NNWS are dissatisfied by progress on disarmament. All parties agree that arms control and disarmament agreements must be accompanied by adequate verification.

Complicating these emerging technology discussions are the overlaps in issue areas between existing fora. On cyber stability issues there are two United Nations fora: the Open-Ended Working Group (OEWG) and the Group of Governmental Experts. Similarly, for the space domain there are UN bodies such as the Committee on Peaceful Uses of Outer Space (COPUOS) and a new UN OEWG on space. The cyber fora are responsible for developing norms for responsible behaviour which ranges from routine day-to-day internet governance to cyber-attacks on nuclear systems. Similarly, COPUOS is responsible for governance of an operating environment that has become a home for civilian communications as well as nuclear early warning systems. Both the cyber and space fora will consider sub-nuclear threshold incidents that may subsequently escalate.

Emerging technologies are clearly relevant to discussions about strategic stability, arms control, verification and proliferation. The proposals by Heather Williams to discuss emerging technologies in the P5 context, including with invited NGO experts, and to communicate the outcomes of these discussions to the NPT RevCon, are positive first steps. Providing NNWS with an active role in assessing the challenges and opportunities posed by emerging technologies would also be a welcome step.

The NPT RevCon can also make use of some of the deliberations that have already taken place in existing fora for the space and cyber domains. NGOs and civil society can also inform the debate. Rather than bolting-on discussions that encompass dozens of technologies, many of which have an unknown influence on nuclear stability and proliferation, discussions should engage with the strategic cyber and space domains.

Verifying a 'step-by-step' nuclear agreement with North Korea

Grant Christopher

After the failure of the Trump administration to negotiate a comprehensive nuclear disarmament agreement with North Korea many analysts are proposing that the Biden administration abandon the aim of negotiating a grand bargain for denuclearization, and instead adopt what has been dubbed 'step-by-step', 'phased' or a 'roadmap to disarmament' approach. If the United States and North Korea were to reach a step-by-step nuclear agreement, what would be the implications for verification?

In the 2019 Hanoi summit, North Korea reportedly offered to dismantle the Yongbyon site, but this offer was rejected by the Trump administration. Yongbyon contains nearly all of the known North Korean fissile material infrastructure, including conversion, enrichment, completed reactors and reprocessing. The only other confirmed operational sites used for fissile material production are the declared yellowcake mine and mill at Pyongsan and the uranium mine at Suncheon. Kangson, identified by the Centre for Nonproliferation Studies in 2018, is highly suspected to be associated with the centrifuge programme, either for production/assembly/testing or an enrichment plant.

North Korea has other nuclear weaponization-related sites, but the clear implication of the US position in rejecting Yongbyon was that it believed that North Korea would retain the ability to produce fissile material even if it gave up Yongbyon. This means that the United States believes North Korea possesses at least one other centrifuge enrichment plant, as well as the associated conversion facilities for yellowcake to uranium hexafluoride (pre-enrichment) and uranium hexafluoride to uranium metal (post enrichment). It is also difficult to rule out the existence of a clandestine plutonium route with a hidden fuel fabrication, nuclear reactor and a reprocessing facility. Given that North Korea possesses enrichment technology, which is easier to conceal, it is more likely the US concerns are primarily about a clandestine uranium pathway.

Nonetheless, if North Korea were to give up its plutonium pathway (as a result of dismantling the Yongbyon site) it would limit some weapon designs. Also, without access to a reactor, or alternative means of tritium production, North Korea would have to rely on its stockpile of tritium for boosted or thermonuclear weapons.

If a disarmament agreement were to be negotiated, the IAEA would likely be responsible for nuclear-related monitoring activities. However, additional measures would likely be needed to verify the disarmament activities. North Korea also possesses a chemical weapons programme and has a suspected

biological weapons programme, and these could be part of a wider WMD disarmament agreement which could be led by the Organisation for the Prohibition of Chemical Weapons or a new ad hoc inspectorate body could be set up for CBW.

In a step-by-step plan, a complete initial declaration is unlikely. For any nuclear component of such an agreement there are at least five ways it could take shape. In the first scenario, North Korea places a freeze on fissile material and/or ballistic missile production capabilities, and this would be verified with remote monitoring including national technical means. In a second scenario, international access is regranted to Yongbyon and Pyongsan, and verification and monitoring commences with some modifications to IAEA safeguards to some or all of the facilities there. In a third scenario North Korea agrees to decommission and demolish parts of Yongbyon, possibly with neutral observers, but no technical inspections, as in a similar manner to the destruction of the Punggye-ri facility. In a fourth scenario, a cooperative agreement is reached, and North Korea decommissions and renders inoperable multiple parts of Yongbyon with technical inspections and verification that the site has been decommissioned. In the fifth scenario at least one previously unknown site used in the fissile material production system is acknowledged by North Korea and opened up for inspection.

These scenarios could also be implemented sequentially to progress towards a verified rollback with the goal of eventual disarmament. For the United States the best result would be to progress to scenarios four and five as soon as possible, with anything beyond that resembling single-step disarmament. Something as minimal as the first scenario could be an option as the first stage in a disarmament roadmap, that might also include a mutual exchange whereby the North Koreans get something they want upfront.

Verifying dismantlement of the North Korean nuclear programme, even a perfectly crafted step by step or all-in-one agreement, has challenges. NGOs have done incredible work in identifying sites connected to the North Korean nuclear programme in the last decade, and it is likely that the US intelligence community is monitoring multiple suspected sites. However, even with the resources of the US intelligence community, there is no reliable method of identifying clandestine enrichment facilities. To rule out all suspected sites storing or creating fissile material would require technical verification, such as environmental swipe sampling, in dozens of sites across the country.

The next round of negotiations is expected to occur bilaterally between North Korea and the United States. However, there are many stakeholders in the North Korean disarmament process and many of these will not have access to US classified data. They will be limited to information on the scope of the North Korea fissile material production complex that is provided by open sources. A comprehensive and transparent evaluation of the assumptions on enrichment, yellowcake production and the fissile material inventory based on those open sources would help other stakeholders follow and engage with the process.

AUKUS: Observations on non-proliferation and safeguards

Sonia Drobysz

On 15 September 2021, Australia, the United Kingdom and the United States announced a trilateral security partnership called AUKUS. The first initiative under the partnership will be an 18-month effort to identify the optimal pathway to support Australia's acquisition of a conventionally armed, nuclear-powered submarine capability. On 19 November 2021 President Biden approved the agreement between the three governments for the exchange of naval nuclear propulsion information. The AUKUS deal effectively ended a French-Australian cooperation programme to develop 12 conventional submarines, much to the chagrin of the French Government. Aside from the strategic rationale and consequences, the AUKUS deal also raises several non-proliferation and safeguards issues.

The AUKUS statement does refer to Australia's commitment to the safeguards regime, including adherence to the "highest standards for safeguards, transparency, verification, and accountancy measures to ensure the non-proliferation, safety, and security of nuclear material and technology". It also mentions Australia's commitment to fulfilling "all of its obligations as a non-nuclear weapons state, including with the International Atomic Energy Agency" (IAEA). Under Article III.1 of the nuclear Non-Proliferation Treaty (NPT), Australia concluded a comprehensive safeguards agreement with the IAEA for the exclusive purpose of verifying that all nuclear material in all *peaceful* nuclear activities within its territory, under its jurisdiction or carried out under its control anywhere, is not

diverted to nuclear weapons or other nuclear explosive device. As nuclear weapon states parties to the NPT, the UK and the US undertook not to transfer to any recipient whatsoever nuclear weapons and not to assist, encourage, or induce any non-nuclear weapon state (NNWS) to manufacture or otherwise acquire them. The US and UK can provide nuclear material for peaceful purposes, but only if the nuclear material is subject to IAEA safeguards. Both countries have concluded voluntary offer safeguards agreements with the IAEA, under which they shall provide information on nuclear material being exported.

The AUKUS deal raises the question of safeguards arrangements for the *non-explosive military uses of nuclear energy* such as naval propulsion. Article 14 of Australia's comprehensive safeguards agreement, concluded on the basis of document INFCIRC/153 (corrected) provides for the non-application of safeguards to nuclear material to be used in non-peaceful activities. As summarised in a 1964 report on the negotiating history of INFCIRC/153, to avoid this provision becoming "a loophole allowing use for nuclear explosive purposes", it was drafted in a way to narrow the non-application of safeguards . Under article 14 of INFCIRC/153, Australia would have to inform the IAEA of the activity, making it clear especially that during the period of non-application of safeguards "the nuclear material will not be used for the production of nuclear weapons or other nuclear explosive devices". In addition, Australia and the IAEA would need to make an arrangement identifying, "to the extent possible, the period or circumstances during which safeguards will not be applied". The safeguards would apply again "as soon as the nuclear material is reintroduced into a peaceful nuclear activity". The IAEA also needs to "be kept informed of the total quantity and composition of the unsafeguarded nuclear material", as well as "any export of such nuclear material". Finally, the article notes that agreement by the IAEA on each arrangement will be given as promptly as possible and relate only to "temporal, procedural provisions and reporting arrangements, etc, but shall not involve any approval or classified knowledge of the military activity or relate to the use of the nuclear material therein".

Despite those requirements, article 14 (or the corresponding paragraph in INFCIRC/153 (corrected), which also serves to draft other states' comprehensive safeguards agreements) remains controversial, especially as it has never been used before. Some experts note that its application could increase the risks of diversion of nuclear material to prohibited activities and are concerned that Australia exercising it will set a damaging precedent. Others, however, think it could establish a positive precedent in developing some "constructive thinking on verification and monitoring arrangements" in the field of naval propulsion programmes.

A number of proposals already seek to clarify and detail the non-application of safeguards to nuclear material in naval propulsion, including a non-governmental report pre-dating the AUKUS deal, as well as proposals focusing specifically on verification procedures under the partnership. These proposals address issues such as the relevance of article 14 for military-to-military transfers, the point at which the withdrawal from safeguards nuclear material intended for use in a submarine reactor may take place, information requirements, the details of the arrangement with the IAEA including inspections, the nuclear material used for the reactors, and the criteria that should be met for any NNWS to have naval reactors. In a communication to the IAEA on 29 October 2021, China, which has expressed concerns over the AUKUS deal, proposed to create a Special Committee open to all IAEA member states "to deliberate on the political, legal and technical issues related to the safeguards on naval nuclear propulsion reactors and their associated nuclear material of a non-nuclear-weapon State, and submit a report with recommendations to the Board of Governors and the General Conference of the IAEA".

Informed of the AUKUS deal through a note verbale shared by Australia, the UK and the US on 15 September 2021, the IAEA for now only said it would engage on the matter in line with its statutory mandate, and in accordance with all three countries' respective safeguards agreements with the Agency.

Redress publishes UK human rights submission template

In October 2021, Redress, a UK-based NGO, published a template for those who wish to make submissions to the UK Foreign, Commonwealth and Development Office suggesting designations under the Global Human Rights Sanctions Regulations 2020.

Implementation Watch

The EU Recast Dual-Use Regulation enters into force

Suzanna Khoshabi

The EU Recast Dual-Use Regulation (Regulation 2021/821) entered into force on 9 September 2021, following over four years of deliberation amongst EU institutions and Member States. The Recast Regulation aims to modernise the EU export control regime for dual-use items and equip it to better address the security threats posed by fast-moving scientific and technological developments. It replaces the previous Dual-Use Regulation 428/2009 as the primary piece of EU legislation governing dual-use exports and introduces the first major changes to the export control regime since 2009.

The Recast Regulation expands its scope and definitions in a number of areas. Its definition for dual-use items includes items which could be used for the "design, development, production or use of nuclear, chemical or biological weapons or their means of delivery". This goes beyond the 2009 Regulation's definition, which was limited to nuclear weapons, and reflects the EU's goals for the Recast Regulation to encompass Member States' implementation obligations under international non-proliferation and disarmament treaties and to enhance prevention of proliferation of weapons of mass destruction (WMD). It also introduces extended restrictions on "technical assistance" for uncontrolled items that may nevertheless be used for one of the prohibited purposes under Article 4, for example, for use in connection with WMD or for military end-use in a country subject to an arms embargo.

Article 5 of the Regulation introduces a new catch-all clause specifically for cyber-surveillance items. Exports of cyber-surveillance items not listed in Annex I will nevertheless require authorisation if an exporter has been informed by the competent national authority that the item may be intended for use in connection with internal repression or serious violations of human rights or international humanitarian law. The Regulation also enables Member States to adopt or maintain national legislation imposing authorisation requirements on such exports, and requires states which do so to immediately provide other Member States and the Commission with the relevant information. However, it does not offer definitions for "serious violations" of human rights or for "internal repression", which may lead to inconsistent interpretations across Member States.

The Regulation also seeks to address emerging technologies which may have dual-use implications by introducing an expanded mechanism for Member States to establish additional national export controls. Additional controls may be introduced on grounds of public security, terrorism prevention or human rights. Article 10 then creates a process that allows such a decision by one Member State to form the basis of an EU-wide authorisation requirement for the item in question.

A further goal of the Regulation is to address the significant variations in penalties and criminal provisions applied by Member States in response to violations of dual-use export controls. It creates a "Dual-Use Coordination Group" responsible for establishing an "enforcement coordination mechanism" to facilitate exchange and cooperation between states' authorities and enforcement agencies on issues such as penalties, investigation and prosecution of unauthorised exports and other relevant best practices. While it is notable for being the first time that national enforcement agencies have been formally tasked with overseeing dual-use exports from within an EU body, the mechanism does not go as far as introducing concrete measures to harmonise enforcement measures across Member States.

The new Regulation complements Member States' obligations under several international instruments, including the Biological and Toxin Weapons Convention (BWC), Chemical Weapons Convention (CWC), Non-Proliferation Treaty and UN Security Council Resolution 1540 (UNSCR 1540). BWC Article III prohibits States Parties from transferring biological weapons or assisting, encouraging or inducing others to acquire them, while at the same time Article X protects states' right to participate in the exchange of materials, equipment and information for peaceful purposes. Similarly, CWC Article VI requires States Parties to implement national measures to ensure that a number of activities involving toxic chemicals and their precursors (including transfers) only occur for peaceful purposes, and UNSCR 1540 obliges states to establish

export controls over items that could be used to create nuclear, biological and chemical weapons. The Regulation also reflects the commitments of Member States found in multilateral export control regimes, including the Wassenaar Arrangement, Australia Group and the Nuclear Suppliers Group.

Ultimately, the Recast Regulation attempts to enhance and harmonise protection against the threats posed by the shifting scientific and political landscape, however, it still allows a significant degree of discretion by Member States on matters of national implementation.

Compliance Watch

Key compliance commitments from COP26

Cristina Rotaru

The 26th United Nations Climate Change Conference, commonly referred to as COP26, took place in Glasgow, Scotland, from 31 October to 13 November 2021. Despite a yearlong delay due to Covid-19, and amid access and travel challenges posed by the pandemic, the event was attended by a record number of delegates from nearly 200 countries. It culminated in the adoption of the Glasgow Climate Pact, a wide-ranging political decision document that aims to cement a strong and coordinated international response to the climate crisis. The agreements reached in Glasgow fall under the three UN climate treaties: the 1992 United Nations Framework Convention on Climate Change (the COP), the 1997 Kyoto Protocol (the CMP), and the 2015 Paris Agreement (the CMA). The Glasgow Climate Pact impacts across all three. Hailed as an unprecedented achievement by some and criticised by others (for the strength of language not being matched by actual emissions cuts), the agreement, championed by the UK's COP26 presidency, presents significant compliance commitments and challenges. Below are some of the key takeaways.

Keeping 1.5C alive

At the centre of the formal negotiations was the UK presidency's ambition to "keep 1.5C alive", which refers to the target of the Paris Agreement to limit the impact of climate change to below 2C and aim for 1.5C. The Glasgow Climate Pact incorporates a political commitment by signatory states to "phase down" their use of coal power. This outcome was weakened after a last-minute intervention requested that the language be altered from "phase out" in the final text. The agreement also featured a political commitment to phase out inefficient fossil subsidies; however, critics have argued that the text does not provide sufficient clarification as to what constitutes 'inefficient' fossil fuel, leaving room for interpretation for certain countries to continue the use of certain fossil fuel considered as 'efficient'. Some commentators also pointed to the absence of specific references to oil and gas in the text and stressed that a phase-out of all fossil fuels would have been a preferable outcome. Importantly, the Glasgow Climate Pact recognised the importance of science and urgency in the achievement of its goals, in particular the latest report by the Intergovernmental Panel on Climate Change (IPCC), which in August 2021 delivered a stark warning calling the current climate crisis a "code red for humanity" – whereas the previous COP struggled to even "welcome" the IPPC's findings. Moreover, COP26 succeeded in accelerating action towards the goals of the Paris Agreement.

Nationally determined contributions (NDCs)

The Paris Agreement in 2015 set out that every five years, countries must revisit the action they take on climate to reduce emissions and update their nationally determined contributions (NDCs). COP26 saw an agreement by countries to revisit their 2030 NDC targets in 2022 and requested all parties to submit (before COP27) new NDCs and long-term strategies (LTS) that set out plans to reach net zero by mid-century. However, shortly after the conclusion of COP26, the climate analysis coalition Climate Action Tracker (CAT) released a report documenting that, based on current policies presently in place around the world, temperatures are projected to result in about 2.7C warming, with NDCs alone able to limit warming to 2.4C by 2030. CAT's most optimist assessment puts the median warming estimate at 1.8C, still well above the 1.5C pledged at COP26.

Adaptation

The Paris Agreement also saw the adoption of a Global Goal on Adaptation to combat the impact of climate change as one of its three core goals (alongside Mitigation and Finance). Recognising this, the COP26 parties agreed to launch a two-year Glasgow-Sharm el Sheikh Work Programme on the Global Goal on Adaptation. It involves a set of concrete steps towards achieving this goal, including establishing national systems to monitor and assess adaptation actions, and tools to empower vulnerable and developing countries.

Adaptation finance

The goal of securing $100bn of climate finance annually by 2020 for developing countries—first agreed in 2009 and subsequently carried through to 2025 in Paris in 2015—has not been achieved to date. Recognising it as a critical issue for parties most vulnerable to climate change, especially Small Island Developing States and Least Developed Countries, and building on the Climate Finance Delivery Plan, published in October 2021 by the UK COP26 Presidency, the Glasgow Climate Pact called on "developed country Parties to at least double their collective provision of climate finance for adaptation to developing country Parties from 2019 levels by 2025". However, during the negotiations, wealthy countries were largely opposed to a working definition of "climate finance", a goal long held by developing countries to clarify what counts towards these totals.

Mitigation

This outcome revolves around the steps and commitments that states parties will take to reduce emissions to keep the goal of 1.5C in reach. It includes, *inter alia*, the establishment of a work programme on mitigation ambition and implementation, and an annual high-level Ministerial meeting on pre-2030 ambition. Both steps aim to accelerate action on mitigation during the 2020s. There will also be annual Synthesis Reports to provide the latest information on progress on NDCs and LTSs.

Loss and damage

COP26 failed to reach consensus on concrete financial commitments for the 'loss and damage' provision (sometimes framed as 'climate reparations') first agreed in Paris in 2015. Instead of securing dedicated new funding for this purpose, the Glasgow Climate Pact established (a) a funding mechanism under the Santiago Network to fund technical assistance on dealing with loss and damage, and (b) a two-year Glasgow Dialogue process to discuss the "arrangements for the funding of activities to avert, minimise and address loss and damage".

Paris 'rulebook'

COP26 completed the Paris 'rulebook' necessary to operationalise the Paris Agreement by finalising outstanding political issues. It included regular new emissions reporting requirements for all countries from 2024 and established carbon market regulations under Article 6, the latter based on a three-pillar system covering voluntary cooperation, a new carbon crediting mechanism, and non-market approaches. This system paves the way for a transition from the old Kyoto Protocol regime to the instruments of the Paris Agreement.

COP26 also provided guidance to parties for a common timeframe for their future NDCs and agreed a package to implement the Enhanced Transparency Framework under the Paris Agreement. Under the new common timeframe rules, all parties are 'encouraged' to submit five-year pledges every five years, starting with pledges in 2025 covering the period from 2031-2035.

Conclusion

Overall, COP26 and the Glasgow Climate Pact reiterated key principles from the Paris Agreement and previous COPs, including the role of multilateralism and the importance of nature and biodiversity to climate action, as well as human rights, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities and people in vulnerable situations, gender equality, empowerment of women and intergenerational equity.

It established several practical and institutional mechanisms to help the UN climate process, such as on Response Measures (responding to the impacts of climate policies) and the Consultative Group of Experts (to help fulfil reporting requirements). These will help the UN climate process and its constituted bodies take forward their work. The challenge, as ever, remains in state implementation of compliance commitments.

First Committee side event on Hague Code of Conduct (HCoC) and other CBMs

Cristina Rotaru

On 13 October 2021, the Foundation for Strategic Research organised a side event to the First Committee on Disarmament and International Security of the 76th UN General Assembly on 'Exploring the role of The Hague Code of Conduct (HCoC) and other confidence-building measures (CBMs) in the field of missiles'.

During opening remarks, Marjolijn van Deelen, European Union Special Envoy for Non-proliferation and Disarmament, expressed support for the HCoC as the best available legal instrument to prevent the proliferation of ballistic missiles, in particular because of its multilateral CBMs. Tanvi Kulkarni, Policy Fellow at the Asia Pacific Leadership Network, whose own work has been to look at nuclear-related CBMs, gave a brief historical account of CBMs as multilateral instruments and described their evolution in the post-Cold War era. She stressed agreements and treaties that promote missile-related CBMs can be assessed using a set of parameters, including membership, legal force, transparency, communication about policies and data exchanges, notification requirements, constraints, consultative modalities that facilitate dialogue between states, and verification procedures to allow for monitoring of compliance. She concluded by stating that although the main export control regimes have overlapping agendas on CBMs, states are increasingly reluctant to sign up to legally binding treaties, arguing that what is needed is political readiness.

Almudena Azcárate Ortega, Associate Researcher at the UN Institute for Disarmament Research (UNIDIR) discussed the HCoC in the context of its applicability to space activities, as a CBM regulating the peaceful use of space. She described how it complements other existing outer space treaties, including the Outer Space Treaty, the Liability Convention, the Rescue and Return Agreement, and the Registration Convention. Although the HCoC is a non-binding instrument, the number of states that have signed up to it is testament to its trust building measures, and to the fact that it provides more clarity about activities in both the missile field and in the space field than other comparable instruments. In closing remarks, H.E. Gustavo Ainchil, the Argentinian Ambassador to Austria and Chair of The Hague Code of Conduct, underscored that the vocation of the HCoC is to achieve universalisation. Pointing out that states engage in negotiations based on national security assessments, he underlined the importance of a common understanding of the instrument, as well as of having a good balance between member states. Moving forward, he argued that there is a need to create an enabling environment for negotiations. Substantive agreements, he concluded, are the result of the convergence of two elements: the recognition of the fact that the issue is in a state's own interest and building trust and confidence.

UN Panel of Experts Report on North Korea highlights humanitarian crisis

Cristina Rotaru

On 8 September 2021, the UN Security Council 1718 Sanctions Committee Panel of Experts published its midterm report documenting North Korea's most recent sanctions evasion activities.

Among other trends, the Panel reported on how the Covid-19 pandemic affected the movement of people and goods, both licit and illicit, to and from North Korea. During the reporting period, the Panel found that maritime exports of coal from North Korea continued despite the border closures, albeit at a significantly reduced level. A similar trend could be observed for the import of oil products by North Korea, while the import of luxury products was said to have "all but halted". However, North Korea continued to access international financial institutions and was said to have been involved in several cyberthefts and other cybercriminal activities. The Panel also identified collaboration between North Korean academics and institutions abroad as an area of concern, noting that the intangible transfer of technology via academic means was an issue of particular interest.

The Panel warned of the humanitarian crisis arising from the impact of the pandemic and the severe floods in 2020 on the North Korean economy and noted that the "current prospects of the wider population of the Democratic People's Republic of Korea are poor". These findings are supported by a report published in October 2021 by the UN Special Rapporteur on human rights in North Korea, which highlighted the dire ongoing humanitarian situation.

To mitigate these consequences, the Panel recommended that biannual briefings by relevant UN agencies on

the unintended impact of sanctions continue, that measures be taken to re-establish a stable "banking channel" to support the transfer of funds by financial institutions for humanitarian operations in North Korea, and that the Security Council continue to pursue ways to reduce the humanitarian impact of North Korean sanctions, including on humanitarian aid operations.

In October and November 2021, the UN Security Council 1718 Sanctions Committee granted two South Korean entities humanitarian exemptions to UN sanctions on North Korea: firstly, an exemption for the Seoul-based Yoido Full Gospel Missions Foundation to send over 1200 specified items to the Pyongyang Cardiac Hospital as part of a project to treat severe diseases of vulnerable groups in North Korea, and secondly, another exemption to Gyeonggi-do to send 188 specified items related to the prevention of the spread of African Swine Fever.

Science & Technology Scan

The Rhisotope Project: Using nuclear science to reduce rhinoceros poaching

Prof James Larkin, Director, Radiation and Health Physics Unit, University of Witwatersrand, Johannesburg, South Africa

South Africa is home to 80% of the global population of the white and black rhinoceros. In a webinar on 22 September 2021, the acting CEO of South African National Parks (SANParks) Dr Luthando Dziba confirmed that the country's rhinoceros population has declined by nearly two thirds over the past ten years. Clearly then, these animals are under very significant threat of extinction in the not-too-distant future.

The Rhisotope Project grew out of a discussion about rhinoceros poaching and couldn't we just "zap the poachers with radiation?".

Clearly not a legal option but one borne from frustration. It did however plant the seeds of an idea. Why not use the international infrastructure and training that has been put in place over the past twenty years to deter nuclear terrorism? There is an extensive network of radiation portal monitors that have been installed to prevent the illicit movement of special nuclear material. What if we were to insert small quantities of radioactive material into the horns of these animals that could be detected by these installed monitors? Would that be an effective tool to help deter poaching? Thus started the Rhisotope Project. It opened with discussions with a few international colleagues who work in various areas of nuclear industry and education, especially the areas of radiation protection, nuclear security and medical physics. People were intrigued by the idea of using their skills developed over many years in an entirely different direction, but one that has a tangible, real-world result. The willingness to make their time, energy and skills available to the project, at zero cost, has been remarkable. So, what started out as an idea on a piece of paper in South Africa, has rapidly grown into an international collaboration between organisations in the United States, Australia, South Africa and Russia.

Obviously for such a radical departure from 'traditional' antipoaching and anti-trafficking methods there is going to be significant hesitancy to use the method of radioisotope insertion. To this end a research project has been set up to demonstrate to those who need convincing that what is being proposed is safe for the animals and people who might have reason to handle these animals.

The research was broken down into a few phases. The first of these was to examine whether material would move from the horn of the animal into its body? There has been some disagreement about this possibility, so it was necessary to find out one way or the other, as this would have an influence on the choice of the physical form of the selected radioisotope. This work started in May of this year, when L-Proline that had been labelled with 13C and 15N was inserted into two white rhinoceros sub-adult bulls. A series of blood and faecal samples were taken prior to, and after insertion, which after analysis, showed that there was no movement of material from the horn into the bodies of these animals.

The next phase of the project has been broken down into several elements. These include the construction of a life-sized model of a rhinoceros head called a phantom, detailed computer simulations of potential radiological doses to the

head of a rhinoceros, modelling of detector response to various radioactivity concentrations in a horn in different transport scenarios, and finally, some detailed metallurgical work to create a unique combination of radioisotopes that can be introduced into the horns of these animals. This work will then allow us to identify the appropriate quantity of radioactivity that can be inserted into the horn of an animal which will set off a radiation monitor but cause no harm. This information is necessary for the development of a radiological safety case that will be submitted to the national regulator and the university's animal research ethics committee for their review, comment, and final approval.

The final phase is the Pilot Project. This phase will see 15 – 25 animals have radioisotopes inserted into their horns. They will then be followed for at least six months to see if there is any detriment to the health of these animals.

At the satisfactory completion of the pilot project this technique will then be made available to all interested and effected parties who may wish to use it both in South Africa and globally.

FOBS and the Outer Space Treaty

Anuradha Damale

On 16 October 2021, the *Financial Times* reported that China had tested a nuclear-capable hypersonic glide vehicle delivered from a fractional orbital bombardment system, or FOBS, in August, citing anonymous intelligence officials. It has since emerged that two tests took place, in July and August respectively. FOBS maintains orbit for less than one complete orbital cycle with the purpose of evading missile defence systems. Neither of these tests were in violation of the 1967 Outer Space Treaty (OST), which forbids placing nuclear weapons in space. However, the systems tested are reported to be nuclear weapon-capable, raising questions about their compatibility with this treaty. The test of this system, which did not include any nuclear device, coincides with an upturn in discussions surrounding ethical and responsible behaviour in space, such as through the UN resolution on responsible behaviours in outer space and subsequent development of an Open Ended Working Group. It also takes place alongside China's support for a treaty on the Prevention of the Placement of Weapons in Outer Space, and international efforts to create a code of conduct for outer space. Chinese officials acknowledged the test, describing it as a "routine test of technology for reusing a space vehicle".

What is FOBS?

FOBS is a nuclear delivery system developed in the 1960s by the Soviet Union. In contrast to intercontinental ballistic missiles (ICBMs), that follow a ballistic trajectory, entering space at the high points of their flight paths, FOBS enter a low altitude orbit, complete a near full orbit, and deorbit down to their intended target. Their main use was to evade ballistic missile defence systems that expected ICBM trajectories across the North Pole. The Soviet Union retired its FOBS in the 1980s.

While much of the commentary surrounding China's test focused on the hypersonic glide vehicle (HGV) aspect of the test, it is worth noting that the HGV in this test was delivered by FOBS. HGV are also designed to evade missile defence systems by gliding in their terminal phase (thereby losing the predictability of ballistic systems) and making them more difficult to intercept. Other states, including India, Japan, South Korea and the United States are also developing HGV systems. Information about other states' interest in developing FOBS capabilities is scant, although this demonstration of China's FOBS may be a continuation of an earlier programme and, as noted above, the technology has been around for over half a decade.

Why are there concerns about FOBS technology?

While there are several policy instruments concerning activities in space, it is primarily regulated by the OST. Typical of these Cold War-era treaties, it does not explicitly address activities relating to conventional weapons in outer space. Instead, the OST prohibitions focus primarily on nuclear weapons, as well as other weapons of mass destruction which are less plausibly deployed from space, by obliging States Parties not to place these weapons in orbit (Article IV).

As regards traditional ICBMs, although the missiles pass into the area covered by the OST, their transitory nature would not breach the treaty's prohibition on placing in orbit any object carrying nuclear weapons. FOBS on the other hand, are designed to carry nuclear warheads through space, so use of a FOBS for nuclear weapons delivery, which maintain an orbit covered by the treaty, albeit fleetingly, may be considered

incompatible with treaty obligations. The Soviet Union used the term 'fractional' in naming the weapon system, indicating that it did not enter full orbit, and thereby arguing that it was treaty compliant. Similarly, arguments have been made that since FOBS is 'ground-based' and any nuclear weapons they carry are only 'temporarily placed into orbit', this should not be treated as a violation of the OST. However, some space experts regard such arguments as an 'opportunistic technicality' and contend that the operational deployment of a launch vehicle carrying nuclear weapons, for any orbit duration, is incompatible with treaty obligations. Moreover, according to these counterarguments, the fact that the weapon needs to de-orbit through its design confirms its incompatibility with the OST. While this compliance debate is likely to continue, one thing is clear: FOBS is not a full orbital bombardment system, which would place a nuclear weapon indefinitely in orbit, to be delivered when needed—and that is something that is expressly forbidden under the OST.

Centre News

National Implementation Measures

Sonia Drobysz, Yasemin Balci, Thomas Brown and Suzanna Khoshabi

The National Implementation Measures (NIM) team has continued to implement a number of global projects.

The team made progress on a project funded by the Norwegian Ministry of Foreign Affairs to provide legislative assistance for national implementation of the Biological Weapons Convention (BWC) and the Chemical Weapons Convention (CWC). On 10 June 2021, the NIM programme held a webinar promoting their newly updated legislation analysis tools: the BWC and CWC legislation survey templates. The NIM team has also continued to engage with a number of countries to provide legislative awareness-raising, analysis and drafting assistance for the BWC and CWC, in cooperation with international partners including the BWC Implementation Support Unit. Furthermore the team held a webinar on 30 November 2021 on the margins of the 2021 CWC Conference of States Parties (CSP), highlighting the CWC legislative analysis tool and the experience of Tajikistan in analysing its CWC legislation in collaboration with NIM legal officers under the project.

NIM staff participated in additional events and activities. On 3 September, Sonia gave a virtual presentation on VERTIC's BWC legislative implementation assistance and activities as Guest of the Meeting at the 2020 BWC Meeting of Experts, during MX3 on Strengthening National Implementation. Part of the NIM team attended the 2020 BWC Meeting of States Parties (MSP) and the 2021 CWC CSP in person in November, for which they supported and/or delivered the VERTIC and joint NGO statements. During a virtual side-event on the margins of MSP, NIM presented a new project on BWC legislative assistance that is funded by the US Department of State and implemented with CRDF Global.

As part of EU CBRN CoE Project 81 on Enhanced Biosecurity in South East Asia, the NIM team is providing biosecurity legislative analysis and meeting virtually with state representatives in the region and project partners. The team has been drafting reports on partner countries' legislative response to the COVID-19 outbreak, as part of Work Package 7 addressing the response to COVID-19 in South-East Asia. The reports will be followed by a regional webinar in December 2021. Work is also progressing under EU CBRN CoE Project 61 in Southeast Asia to develop specific reports regarding partner countries' legislation for the comprehensive management of chemicals and their wastes.

The NIM team has continued to work on a project to promote universalisation and implementation of the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT), implemented by the UN Counter-Terrorism Centre of the UN Office of Counter-Terrorism (UNOCT) and the UN Office on Drugs and Crime. In coordination with UNOCT, the team sent a questionnaire developed under the project to states on their experience of joining ICSANT (or not doing so) and is now in the process of analysing the results.

Sonia and Yasemin also co-authored Learning Unit 17 of the EU Non-Proliferation and Disarmament eLearning

Course an initiative of the EU Non-Proliferation and Disarmament Consortium that is funded by the EU. The Learning Unit, which was launched in June 2021, covers non-proliferation and disarmament law.

Verification and Monitoring

Larry MacFaul, Alberto Muti, Noel Stott, Elena Gai, Grant Christopher and Anuradha Damale

Building capacity for nuclear disarmament verification

The VM programme, in partnership with in-country organisations, has completed regional discussions on establishing nuclear disarmament verification (NDV) hubs in Africa, Central Asia and Latin America. These research and innovation hubs are intended to complement the efforts of UN member states in their quest to achieve and maintain a world without nuclear weapons. Participants in each of the regions have agreed on a roadmap to establish the hubs as a means to enhance their involvement in the development and strengthening of practical and effective NDV measures

The conclusion of this project, at the end of November 2021, was capped by a Trilateral Conference hosted by VERTIC between the three NDV hub regions on the 17 and 18 November. Representatives from South Africa, Kazakhstan and Latin America joined together to discuss the status, action plan and long-term sustainability of the hubs. The conference, discussed inter alia how each hub could support research into NDV measures and provide a platform to also examine related conceptual issues. A session was also devoted to addressing the possibility of having the hubs form the basis of a NDV network consisting of universities, governmental initiatives and applied policy research institutes from the Global North and the Global South.

Open-source monitoring of the North Korean nuclear programme

With our project partners at the Royal United Services Institute and the Center for Nonproliferation Studies, the VM team continued its analysis of North Korean WMD production using open sources.

Other Activities

In September 2021, Assistant Researcher Anuradha Damale presented joint work with Senior Researcher Dr Grant Christopher at the Science Peace and Security Conference '21 on the impact of quantum technology on the space operating environment.

In October 2021, Acting Executive Director/Programme Director Larry MacFaul and Anuradha Damale spoke at a joint China-Europe dialogue on global arms control organised by the University of Bradford; Senior Researchers Alberto Muti and Grant Christopher published on the Nonproliferation impact of the UK's Integrated Review in an edited volume by King's College London.

In November 2021, Anuradha Damale was a speaker on the Next Gen Lunar Ethics panel on exploration and sustainability. Anuradha was also the discussant for a Stockholm Security Conference panel on IHR and Space, and appeared on the Ploughshares 'Press the Button' podcast to discuss the Russian ASAT test and on a Third Nuclear Age panel about FOBS alongside an expert from the Secure World Foundation. Alberto Muti contributed to the online course on 'Safeguards for Policymakers: What You Need to Know', hosted by the Vienna Center for Disarmament and Non-Proliferation. Alberto gave a lecture on nuclear safety, security and safeguards, their differences and how they intersect, and lectured on Safeguards Legislation and Legislative Assistance alongside a representative of the IAEA's Office of Legal Affairs.

Condolences

VERTIC is sad to report the passing of South African colleague, Pat Thema, in December 2021. Pat was a member of South Africa's Council for the Non-Proliferation of Weapons of Mass Destruction and an ardent supporter of VERTIC's quest to build Africa's capacity in nuclear disarmament verification. From 1999-2005 he was based at the Permanent Mission of South Africa to the UN and Other International Organisations in Vienna, Austria. More recently, Pat was the Chief Operating Officer at Mzansi Energy Solutions and Innovations, a technical support organisation offering professional services and expertise in nuclear energy and related industries. VERTIC offers condolences to his family.

In December 2021, Senior Researcher Elena Gai published an article in the National Nuclear Centre of Kazakhstan Journal, *Man. Energy. Atom.*, on Nuclear Disarmament.

Compliance Mechanisms and Measures

Angela Woodward and Cristina Rotaru

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 2021. The team is involved in 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 Centre for Nonproliferation Studies (CNS) and King's College London, the CMM team continued to develop online training courses on sanctions implementation pertaining to due diligence in sanctions implementation and to ship registry operations.

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.

Outreach and external relations

In light of the Covid-19 pandemic-induced travel restrictions continuing in much of the world, the CMM programme's work during 2021 has continued to take place online. Assistance, training and similar instructional activities that would otherwise be delivered during in-person conferences and meetings have been rescoped for delivery online, and participation in network events has similarly moved to online conferencing platforms.

As much of the United Kingdom has remained in lockdown or with access to events severely restricted throughout 2021, **Cristina Rotaru**, based in London, has continued to engage with the sanctions and compliance community through a number of online webinars and events of relevance to the CMM Programme's work. Cristina co-authored an article with Paulina Izewicz, a Senior Research Associate at CNS, on 'Maritime Sanctions: Tips for Due Diligence' which was published in the *Financial Institutions Sanctions Compliance (FISC) Journal* in October 2021. Cristina also co-wrote a feature-length article about organisations working on non-proliferation, including VERTIC, titled 'Welcome to the Dark Side of the Moon' for the 100th anniversary issue of the *WorldECR* journal on export controls and sanctions.

Angela Woodward, based in New Zealand, spoke about her paper on 'Reinforcing the NPT at 50: Regional Arrangements and Nuclear-Weapon-Free-Zones' that was published in the Korean Journal of Nuclear Non-Proliferation and Energy in a webinar on the NPT organised by the Asia-Pacific Leadership Network for Nuclear Non-Proliferation and Disarmament (APLN) on 9 July. She gave a talk on North Korean sanctions-busting for the New Zealand Institute for International Affairs, Hawkes Bay branch on 3 August. On 24 August she met with New Zealand's Minister for Disarmament and Arms Control to discuss VERTIC's work in relation to New Zealand's Disarmament Strategy, and on 20-21 September she participated in the Council for Security

VERTIC–IAEA partnership

On 8 December 2022, VERTIC signed an agreement for Practical Arrangements on Cooperation in the area of International Safeguards with the International Atomic Energy Agency (IAEA). Under the agreement, VERTIC and the IAEA will consult regularly on their safeguards activities and will cooperate on some initiatives, with a focus on training and capacity-building.

The agreement was signed by VERTIC Acting Executive Director Larry MacFaul and IAEA Deputy Director General and head of Department of Safeguards Massimo Aparo in a virtual ceremony. The ceremony was also attended by representatives of the IAEA's Department of Safeguards and VERTIC's three programmes.

VERTIC has long supported the IAEA's mission in nuclear non-proliferation, through research on verification in the nuclear field and in providing assistance to IAEA Member States in implementing their safeguards commitments and bringing safeguards agreements into force. We are looking forward to a closer cooperation with the Agency.

and Cooperation in Asia-Pacific's Non-Proliferation Study Group, which met virtually, as a representative for New Zealand. On 8 October, she was a discussant in the APLN webinar on 'Reducing the risk of nuclear weapon use in North East Asia' and she wrote an invited article on 'Debating Nuclear Disarmament at the U.N. First Committee' for the APLN's regular column in The Korea Times, on 24 November. She also contributed analysis on nuclear safeguards and verification issues pertaining to the Treaty on the Prohibition of Nuclear Weapons for the *Nuclear Weapons Ban Monitor 2021*, which will be published in early 2022. Angela was elected to the APLN Board on 9 September, serving alongside former foreign ministers and senior government officials, and academics from other Asia-Pacific countries.

Other Centre news

VERTIC is pleased to announce the following institutional reorganisation and staff promotions: In the NIM team, Yasemin Balci has been promoted to Co-Programme Director, alongside Sonia Drobysz. Thomas Brown has been promoted to Legal Officer. In the VM team, Alberto Muti and Grant Christopher have been appointed Acting Co-Programme Directors. Anuradha Damale has been promoted to Researcher.

Elena Gai, Senior Researcher, has left the organisation taking the position of Disarmament Attaché at the Permanent Mission of Italy in Geneva in December. Elena was a highly valued colleague and member of the VM team, with superb diplomatic skills. She made remarkable contributions to VERTIC projects in her time with us and she will be greatly missed, but we look forward to working with her in her new role and wish her all the best.

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building trust through verification

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.

Personnel

Mr Larry MacFaul, Acting Executive Director (United Kingdom);
Ms Angela Woodward, Programme Director (New Zealand/United Kingdom);
Dr Sonia Drobysz, Co-Programme Director (France);
Ms Yasemin Balci, Co-Programme Director (the Netherlands);
Dr Grant Christopher, Acting Co-Programme Director (USA/United Kingdom);
Mr Alberto Muti, Acting Co-Programme Director (Italy);
Mr Noel Stott, Senior Researcher (South Africa);
Ms. Nataliya Izedinova, Finance Director (Russia/United Kingdom);
Ms. Cristina Rotaru, Researcher (Romania);
Mr Thomas Brown, Legal Officer (United Kingdom);
Ms Suzanna Khoshabi, Associate Legal Officer (United Kingdom); and
Ms Anuradha Damale, Researcher (United Kingdom).

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