Preparatory Committee for the 2026 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons

25 April 2025

Original: English

Third session
New York, 28 April–9 May 2025

Navigating the potential impact of emerging technologies on nuclear disarmament, arms control, non-proliferation and peaceful uses of nuclear energy and technology

Working paper submitted by the members of the Stockholm Initiative for Nuclear Disarmament (Argentina, Canada, Ethiopia, Finland, Germany, Japan, Jordan, Kazakhstan, Netherlands (Kingdom of the), Norway, Republic of Korea, Spain, Sweden and Switzerland)

Introduction

1.   We reaffirm our unequivocal support of the Treaty on the Non-Proliferation of Nuclear Weapons and its three mutually reinforcing pillars: nuclear disarmament, non-proliferation and peaceful uses of nuclear energy and technology. We all share the collective goal of a world free of nuclear weapons and reaffirm that nuclear weapons must never be used again. We remain unwavering in our commitment to advancing nuclear disarmament under the Non-Proliferation Treaty in accordance with the Treaty obligations. We underline that past Treaty commitments, including the "13 steps" of the 2000 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons and the 64-Point action plan of the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, remain valid and form the basis for making further progress in fully implementing the Treaty and achieving a world without nuclear weapons. Commitments must be implemented and obligations must be met.

2.   The Stockholm Initiative has focused on making disarmament recommendations that, if implemented, would reduce international tension, improve global security and promote transparency and confidence between States. Previous proposals by the Stockholm Initiative, in particular "Stepping stones for advancing nuclear disarmament" (NPT/CONF.2020/WP.6), "A nuclear risk reduction package" (NPT/CONF.2020/WP.9) and "Stepping up efforts: towards a successful review cycle" (NPT/CONF.2026/PC.II/WP.13) remain relevant and valid.

3.   At the 2022 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, a call was made for the intensification of regular dialogue among and between the nuclear-weapon States and with the

non-nuclear-weapon States on the potential implications of emerging technologies. The development and deployment of emerging technologies, such as artificial intelligence, cybercapabilities and outer space technologies, while not necessarily new, can have significant implications for nuclear risks and global stability. They may increase the likelihood of nuclear weapons use through accidents, escalation or unauthorized actions.

4.   At the same time, emerging technologies provide opportunities to strengthen the implementation of Non-Proliferation Treaty commitments under all three pillars. They can enhance the effectiveness and efficiency of non-proliferation, disarmament, arms control and verification measures, as well as the peaceful uses of nuclear energy and technology.

5.   While managing the challenges and leveraging the opportunities of emerging technologies is not a direct implementation of article VI of the Non-Proliferation Treaty, it can play a supportive role. Work on nuclear disarmament verification has already demonstrated how emerging technologies can enhance transparency, verifiability and irreversibility in disarmament efforts.

6.   In keeping with the recommendations made by the Stockholm Initiative in its working papers (see para. 2) to engage in a dialogue on the impact of emerging technologies on nuclear risks and global stability, the aim of the present working paper is to contribute to the ongoing discussion on this topic. We will highlight some of the challenges to nuclear risks and the opportunities for global stability presented by a number of emerging technologies, including artificial intelligence, as well as those in the cyberspace and outer space domains.

Risks of emerging technologies

7.   It is essential for the Non-Proliferation Treaty community to develop a better understanding, increased awareness and expertise with regard to emerging technologies and their potential impacts. This requires better integration of the expertise of actors from the civil and private sectors in its work. By increasing awareness of the potential impacts of emerging technologies, the Non-Proliferation Treaty community can prepare the ground for specific and meaningful steps to reduce associated risks, including a joint commitment by the nuclear-weapon States to keep human control and involvement in decisions that could lead to the use of a nuclear weapon and to refrain from any interference in nuclear command, control and communications systems.

8.   The integration of artificial intelligence (AI) into nuclear weapons systems and nuclear decision-making processes can introduce multifaceted risks. AI applications could inadvertently contribute to misinterpretations, which may originate from design flaws, unintended consequences, including from data, algorithmic and other biases, potential misuse or malicious use of the technology and the interaction of AI applications with the complex dynamics of global and regional conflicts and stability. Decisions about nuclear weapons deployment or employment must always remain with humans.

9.   Cyberthreats present significant risks to the stability and security of nuclear command, control and communications systems. Risks and vulnerabilities arise, inter alia, from the potential for cyberattacks to manipulate, disrupt or disable critical components of these systems. For example, falsified warning signals or unauthorized data manipulation could mislead decision makers into perceiving an "imminent attack" where none exists. Such misinterpretations could escalate tensions, increase the risk of miscalculation and inadvertently trigger conflict escalation.

10.   Counterspace technologies, including anti-satellite weapons and other tools designed to disrupt or degrade space systems, could pose significant escalation risks. Many nuclear command, control and communications systems rely on space-based infrastructure for functions such as early warning, navigation and secure communications. Any attack on or manipulation of these systems could compromise situational awareness, hinder crisis management and increase the risk of miscalculation during crisis scenarios, potentially triggering nuclear escalation.

Opportunities of emerging technologies for enhancing nuclear disarmament, arms control and non-proliferation and peaceful uses of nuclear energy and technology

11.   Emerging technologies can offer opportunities to improve and further develop arms control and verification, as well as to benefit the peaceful uses of nuclear energy and technology, contributing to the implementation of the Non-Proliferation Treaty and to improving global stability.

12.   Cybercapabilities could offer significant opportunities for enhancing nuclear disarmament, arms control and non-proliferation efforts. Cybertools could improve verification mechanisms by enabling more efficient and accurate monitoring of treaty compliance. For instance, real-time data transmission and analysis from remote sensors or monitoring devices can enhance transparency while reducing the need for on-site inspections. They can also improve reliability of communication around monitoring and verification.

13.   AI-driven algorithms can process vast amounts of data from satellites, sensors and other sources to detect potential treaty violations or the development of unauthorized nuclear activities. This capability could enhance situational awareness and provide States with timely, actionable insights, strengthening global non-proliferation monitoring efforts. In addition, AI can assist in modelling and simulating disarmament scenarios, allowing stakeholders to explore the potential impacts of different arms reduction strategies. AI-driven data analysis could be used as a powerful tool to strengthen nuclear verification mechanisms, which could increase trust and contribute to nuclear risk reduction.

14.   Outer space applications already play a critical role in monitoring the implementation of arms control treaties, and emerging technologies in the space domain can provide robust tools for verifying compliance and advancing effective nuclear disarmament and arms control. High-resolution satellite imagery and sensors enable precise tracking of nuclear facilities and missile movements, reducing reliance on on-site inspections. Shared data from multilateral platforms and commercial satellites promote global transparency and trust, while space-based tracking of delivery systems may strengthen treaty enforcement.

15.   Cybercapabilities already play a vital role in enhancing the ability of the International Atomic Energy Agency (IAEA) to safeguard nuclear materials and facilities. AI also has the potential to transform IAEA safeguards by enhancing nuclear monitoring and verification through data analysis, anomaly detection and automation. These emerging technologies could enable inspectors to more efficiently analyse proliferation risks.

16.   We recognize the potential benefits of emerging technologies for furthering the promotion of peaceful uses of nuclear energy and technology, and in this regard we look forward to the International Symposium on Artificial Intelligence and Nuclear Energy, organized by IAEA, to be held on 3 and 4 December 2025.

Recommendations to the 2026 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons

17.   Non-Proliferation Treaty States Parties should increase awareness of risks, as well as opportunities linked to the use and implications of new technologies in the nuclear realm. Nuclear-weapon States and non-nuclear-weapon States should engage in a dialogue to understand and minimize potential vulnerabilities emerging from disruptive technologies, as well as to consider how certain technologies may lessen risks and contribute to improving the security environment.

18.   Non-Proliferation Treaty States Parties should actively discuss the opportunities presented by advances in cybertechnologies, AI and space-based technologies for enhancing the various activities of IAEA. By harnessing the potential of these advanced technologies, the Non-Proliferation Treaty community can work together to maintain international peace and security through strengthening the ability of IAEA to ensure the peaceful uses of nuclear energy and technology and prevent the proliferation of nuclear weapons.

19.   All States Parties, in particular the more technically advanced, should commit to explore ways in which emerging technologies can benefit the nuclear disarmament and non-proliferation regime, such as strengthening nuclear verification, which could increase confidence and trust.

20.   Non-Proliferation Treaty States Parties should further engage in and promote education and support capacity-building on the benefits of new technologies on nuclear issues, including those related to nuclear verification. Efforts should prioritize inclusive participation, ensuring broad access to knowledge and resources, in particular among underrepresented communities. Special emphasis should be placed on fostering the involvement of younger generations and integrating balanced representation in these discussions.

21.   The Stockholm Initiative encourages nuclear-weapon States to actively engage in dialogue through the P5 Process and with non-nuclear-weapon States to develop a common understanding of the potential impact of emerging technologies on their nuclear command, control and communications systems and decision-making processes and to identify risk reduction measures through a common framework. Nuclear-weapon States should commit to refrain from any attacks or interference in nuclear command, control and communications systems of other States, acknowledging that such acts pose a significant threat to international security.

22.   All States Parties, in particular the nuclear-weapon States, as part of their commitment to report on nuclear concepts, doctrines, policies and risk reduction, should regularly report on concrete steps that they are taking or planning to take individually or jointly to reduce risks associated with emerging technologies.

23.   Nuclear-weapon States that have not yet done so are encouraged to conduct independent reviews of the safety, security and reliability of nuclear weapons and related systems (fail-safe reviews) to comprehensively address existing and forecasted threats, including those challenges posed by emerging technologies. Conversations between nuclear-weapon States and with non-nuclear-weapon States around national measures to assure the safety and security of nuclear weapons would be a welcome risk reduction measure.

24.   Nuclear-weapon States should commit or reaffirm their commitment to maintaining human control over decisions to use nuclear weapons. In this context, we welcome the joint paper by the United States of America, France and the United Kingdom of Great Britain and Northern Ireland for the 2022 Non-Proliferation Treaty Review Conference, which reaffirmed their commitment to maintaining human

involvement in all actions critical to informing and executing sovereign decisions on nuclear weapons employment, as well as the pledge made in November 2024 by the United States and China that decisions on nuclear weapons must remain under human control.

25.   The Stockholm Initiative calls upon all States, in particular those with major space capabilities, to adhere to the Outer Space Treaty. The obligations under the Outer Space Treaty not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner must be met by all States.

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