

ARTIFICIAL INTELLIGENCE AND NUCLEAR WEAPONS: WAY TO THE FUTURE OR PATH TO DISASTER?

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(Views expressed in the brief are those of the author, and do not represent those of ISSI)



Artificial intelligence (AI) is a revolutionary technology that is taking over everyday facets of life, from Chat GPT to healthcare, education, agriculture, social media, advertising, customer service, financial services,¹ and transport. However, it is revolutionizing warfare and defence. Major world powers have already begun the race to induct AI into modern warfare. At the moment it is being used in a limited manner by perhaps giving algorithms control over individual weapons or drone swarms. However, it is fast-talking over aspects of modern warfare. As Pakistan's representative to the UN expressed concern: "We are standing at the cusp of a new arms race, where algorithms would be in the driving seat. As AI heads to the battlefield, it is reasonable to ask whether and to what extent humans would continue to control it and hold the 'off switch'."² Given the increasing prevalence of AI in all facets of life including warfare and defence, it is pertinent to examine what role, if any, it can play in nuclear deterrence and future nuclear postures.

¹ The finance industry estimates AI could contribute between \$10 and \$15 trillion to the global economy by 2030. "Secretary-General Urges Security Council to Ensure Transparency, Accountability, Oversight, in First Debate on Artificial Intelligence," SG/SM/21880, July 18, 2023, <https://press.un.org/en/2023/sgsm21880.doc.htm>

² Statement by Ambassador Khalil Hashmi at the Conference on Disarmament (C.D) on Agenda Item 6: "AI in the military domain and LAWS" August 3, 2023 in Geneva, <https://pakungeneva.pk/TopicDetail.aspx?ID=1203>

The Cold War nuclear history of the U.S. and Russia is replete with instances where false alarms were raised³ but did not end up in accidental nuclear conflict. However, imagine AI was in control of assessing information and launching a nuclear counterattack, there is a high probability that nuclear conflict may have ensued.

AI is already being used and its potential future usage in nuclear deterrence architectures around the world is likely to increase. Machine learning and autonomy are two elements of AI that are relevant to nuclear deterrence. There are four key areas of the nuclear deterrence architecture where AI has a potential role: early warning and ISR; command and control; delivery systems; and non-nuclear operations like cyber. Machine learning and autonomy are two elements of AI that are relevant to nuclear deterrence.

Early Warning Systems and ISR:

AI-powered early warning systems can help detect and analyze potential nuclear threats, such as missile launches or unusual activities at nuclear facilities. AI algorithms can quickly process vast amounts of data from various sensors, satellites, and intelligence sources, providing faster and more accurate information to decision-makers. Also, machine learning can be used to give any type of ISR system more perceptual intelligence. AI-powered autonomous systems, such as unmanned aerial vehicles (UAVs) or unmanned underwater vehicles (UUVs), are already widely used for surveillance, intelligence gathering, and monitoring adversary's activities.

AI can assist decision-makers in evaluating nuclear threats and formulating appropriate responses. It can analyze multiple variables, such as adversary capabilities, intentions, and historical data, to assess the credibility and severity of a threat. Machine learning algorithms can be used for cross-analysis of intelligence data to identify more quickly and reliably if preparations for a nuclear attack may be underway. AI can also simulate different scenarios and evaluate the potential consequences of different response options.

In essence, machine learning can provide enhanced situational awareness and potentially more time to make decisions. Autonomous systems, in contrast, can improve the remote-sensing capabilities of nuclear-armed states for early warning and ISR.

³ Daryl G. Kimball "Nuclear False Warnings and the Risk of Catastrophe," *Arms Control Today*, December 2019, <https://www.armscontrol.org/act/2019-12/focus/nuclear-false-warnings-risk-catastrophe>

Command and Control

There seems to be a general agreement among nuclear weapon experts and policymakers that autonomy should not be integrated into nuclear command and control systems. However, it can be used to enhance cyber security measures to protect nuclear facilities and systems from cyber-attacks. AI algorithms can continuously monitor and analyze network traffic, identifying potential threats and vulnerabilities. They can also assist in rapidly detecting and responding to cyber breaches, minimizing the potential damage inflicted by adversaries.

Delivery Systems

Many nuclear delivery systems already use some degree of autonomy. Intercontinental Ballistic Missiles (ICBM) and Submarine-launched Ballistic Missiles (SLBM), once launched, operate autonomously because they rely on automation to set their flight trajectory and navigate to their target.⁴ AI does have a role primarily in qualitative improvement in delivery systems. Countries may already be using some elements of AI in delivery systems. China may be exploring the use of machine learning to develop control systems for hypersonic vehicles.⁵ Russia has reportedly developed Poseidon, which is an Intercontinental Nuclear-Powered Nuclear-Armed Autonomous Torpedo with a reported range of 10,000 km, a speed of 56 knots, and the capability to descend to a depth of 1000 meters.⁶ It is not clear how much autonomy it will have but it can be assumed that autonomy will be operational after the launch decision, which may be a requirement of its operational environment. The U.S. may also be building a dual-capable bomber, the B-21 Raider, which would reportedly be 'optionally-manned'. The U.S. has not specified whether it would be prepared to operate the bomber remotely while carrying nuclear weapons.⁷ India's long-range subsonic cruise missile Nirbhay may also use AI for maneuverability and precision strikes. India is known to be working on a number of AI capabilities and systems that may in the future contribute to the enhancement of integrated early-warning systems; the Multi Agent Robotics Framework (MARF) system for robot collaboration on surveillance and reconnaissance; and unmanned systems using AI enhancements and autonomy, like the Matsya UUV and the Autonomous Unmanned Research Aircraft (AURA) program.⁸

⁴ Vincent Boulanin et al, *Artificial Intelligence, Strategic Stability and Nuclear Risk* (SIPRI, June 2020), p. 26.

⁵ Lora Saalman, 'China's integration of neural networks into hypersonic glide vehicles', ed. N. D. Wright, *AI, China, Russia, and the Global Order: Technological, Political, Global, and Creative Perspectives*, White Paper (US Department of Defense and Joint Chiefs of Staff: Washington, DC, Dec. 2018), pp. 153–60

⁶ Zachary Kallenborn, "Giving an AI control of nuclear weapons: What could possibly go wrong?" *Bulletin of Atomic Scientists*, February 1, 2022.

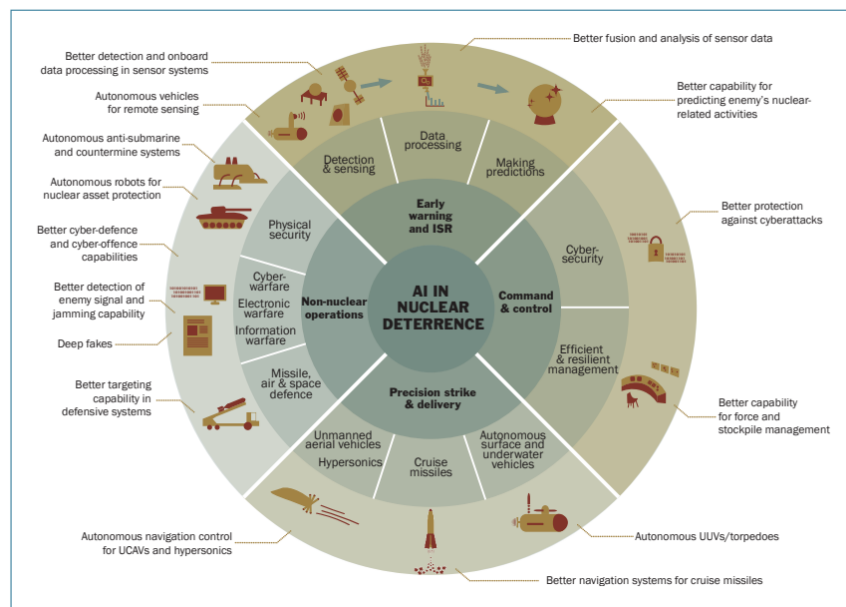
⁷ Boulanin et al, *Artificial Intelligence, Strategic Stability and Nuclear Risk*, op.cit, p. 26.

⁸ Ibid, p. 84.

Non-Nuclear Operations

AI can be used in non-nuclear domains that would have significant strategic uses and have an indirect impact on nuclear deterrence. These include conventional high-precision strikes, missile, air, and space defences, cyber warfare, electronic warfare, information warfare, and the physical security of nuclear weapons. The most significant application that is relevant to nuclear deterrence is in missile and air defence systems. BMD systems have relied on automation for decades using an AI-based technology called automatic target recognition (ATR) that can detect, track, prioritize, and select incoming air threats. Advances in AI can make the detection and tracking of incoming missiles more efficient. AI also plays a part in countermeasures. Also, autonomy has been part of cyber-defence architecture. However, advances in autonomy have made both offensive and defensive systems more efficient.⁹

AI Potential Use in Nuclear Deterrence



Source: Vincent Boulanin et al, *Artificial Intelligence, Strategic Stability and Nuclear Risk* (SIPRI, June 2020).

Dangers of AI in Nuclear Deterrence

While AI is already partially incorporated into nuclear deterrence architectures around the world, there are a number of dangers associated with it. The adoption or perceived adoption of new AI capabilities by any state could make a nuclear-armed state fear for the survivability and reliability of its nuclear deterrent. This AI-nuclear security dilemma could result in countermeasures that could

⁹ Ibid, p. 28.

undermine nuclear stability. The incorporation of AI into military systems could increase the risk of escalation into a nuclear conflict accidentally due to technical failure or unauthorized use.

AI systems rely on large amounts of data to perform tasks. Thus, there is a danger that data may be biased, incomplete, or inaccurate at times, which will result in biased outcomes or conclusions. Deliberate data poisoning of information that feeds the AI system, or early warning or unmanned systems or emitters could be used to trick an AI into believing a nuclear strike is incoming. In a hypothetical scenario, non-state actors could use AI-enhanced cyber tactics to manipulate information and spread conspiracy theories, or damage command, control, and communications systems, early warning satellites, and radars. They could cause escalation by hacking into command and control systems and sending wrong information to the adversary or about the adversary.¹⁰ Thus, there is a risk that AI tools in the hands of third-party actors could pull nuclear adversaries into conflict or trigger a nuclear war.

James Johnson argues in his book that advances in AI may allow adversaries to target nuclear assets; attack nuclear command, control, and communications systems with AI-cyber weapons; and use drones in swarms to strike military assets. He also proclaims that AI algorithms could misinterpret an adversary's signaling and complicate decision-making in a nuclear crisis.¹¹

There are also concerns that while decision-making processes in a nuclear crisis are already very rushed. The limited use of AI even in merely sensors and targeting, will further shorten the already limited time for deciding whether to launch a strike. This will increase the risk of miscalculation or irrational choices.¹²

There are also risks from the use of AI in satellite and other intelligence-detection systems, which will make it harder to conceal weapons, and nuclear-armed submarines. This will risk lowering thresholds and encourage nuclear weapon states to deploy their nuclear weapons earlier in a conflict before that enemy can eliminate them.

As AI technology is increasingly used it is likely to increase the risk of escalation. Even if AI is not making the weapons launch decisions, the AI tools will influence every stage of decision-making, ultimately affecting the human-machine dynamics. Thus, AI is adding another layer of risk to an already unacceptable level of danger.

¹⁰ James Johnson, *AI and the Bomb: Nuclear Strategy and Risk in the Digital Age* (Oxford University Press, 2023)

¹¹ Ibid

¹² Melissa Parke, "Preventing AI Nuclear Armageddon," November 8, 2023, <https://www.project-syndicate.org/commentary/dangers-of-artificial-intelligence-ai-applications-nuclear-weapons-by-melissa-parke-2023-11>

UN Concern on AI and Security Linkage

The UN Secretary General, in his 'New Agenda for Peace' proposals, has noted that "the increasing ubiquity of AI, combined with its rapid scalability, lack of transparency and pace of innovation, poses potential risks to international peace and security and presents governance challenges."¹³ He also highlighted that, "the malicious use of AI systems for terrorist, criminal or state purposes could cause horrific levels of death and destruction, widespread trauma and deep psychological damage on an unimaginable scale."¹⁴ AI-enabled cyber attacks are already targeting critical infrastructure and our own peacekeeping and humanitarian operations, causing great human suffering. Moreover, the technical and financial barriers to access are low, including for criminals and terrorists. Thus, the UN Secretary General emphasized: "Both military and non-military applications of AI could have very serious consequences for global peace and security."¹⁵ Further, "the interaction between AI and nuclear weapons, biotechnology, neurotechnology, and robotics is deeply alarming." Generative AI has enormous potential for good and evil at a large scale. It has even been called the new weapon of mass destruction. He urged "that human agency and control are essential for nuclear weapons and should never be withdrawn."¹⁶

Pakistan's Perspective

Pakistan has also raised concerns over the military capabilities of AI. Pakistan has not only been active in the fight against AI-driven weapons but has also tabled proposals including the one on an "International Legal Instrument on Lethal Autonomous Weapons Systems (LAWS)." It has tabled a working paper stating the profound security and stability challenges posed by the unregulated development and deployment of AI for military purposes and autonomous weapon systems.¹⁷

Some pertinent points raised in the working paper were the absence of any "normative guardrails which creates and may escalate nuclear risks, lead to miscalculations, and entail catastrophic consequences."¹⁸ The working paper also highlights "the danger of AI integration with nuclear force posture and employment policies that can undermine traditional concepts of deterrence escalation and risk reduction, endangering regional and global security." It also highlighted the danger that "the use of AI-generated data and information may foster a false sense of confidence, prompting

¹³ "Secretary-General Urges Security Council to Ensure Transparency, Accountability, Oversight, in First Debate on Artificial Intelligence," SG/SM/21880, July 18, 2023, <https://press.un.org/en/2023/sgsm21880.doc.htm>

¹⁴ Ibid

¹⁵ Ibid

¹⁶ Ibid

¹⁷ Hashmi, August 3, 2023 in Geneva.

¹⁸ Ibid

states to consider destabilizing pre-emptive counterforce strikes or target second strike capabilities. Disinformation generated through using AI could also manipulate critical decision-making processes, especially during crises.”¹⁹ In addition, Pakistan’s working paper highlighted the risk of lowering the threshold for the use of force and armed conflict, increasing the likelihood of miscalculation, reduction in time available for decision-making, arms race, and proliferation including non-state actors.

Regulating Military Use of AI

Given the dangers associated with the use of AI in nuclear weapons architecture, even if AI is not fully incorporated at present, it may not be too early to commence discussing options that nuclear-armed states and the international security community could explore to prevent and mitigate the risks that military applications of AI as well as nuclear weapon systems, may pose to peace and stability. There are a number of measures that states should take:

- Raising awareness among stakeholders like governmental practitioners, industry, and civil society, on challenges posed by AI in the nuclear arena.
- Support transparency and confidence-building measures that can help to reduce misperception and misunderstanding among nuclear weapon states on AI-related issues.
- Discuss and agree on concrete limits to the use of AI in nuclear forces.²⁰

There are a number of initiatives taken to regulate the use of AI in recent weeks. The G7 agreed on the Hiroshima Process International Code of Conduct for Organizations Developing Advanced AI Systems, “to promote safe, secure, and trustworthy AI worldwide.” The U.S. President, Joe Biden, issued an executive order establishing new standards for AI “safety and security” while the UK hosted the first global AI Safety Summit.²¹ However, a lot more needs to be done on the use of AI in weapons and military technology. There has been progress in this regard as the UN first Committee approved new resolution on Lethal Autonomous Weapons.²²

¹⁹ Ibid

²⁰ Vincent Boulanin et al, *Artificial Intelligence, Strategic Stability and Nuclear Risk* (SIPRI, June 2020), p. X,

²¹ Melissa Parke, “Preventing AI Nuclear Armageddon,” November 8, 2023, <https://www.project-syndicate.org/commentary/dangers-of-artificial-intelligence-ai-applications-nuclear-weapons-by-melissa-parke-2023-11>

²² “First Committee Approves New Resolution on Lethal Autonomous Weapons, as Speaker Warns ‘An Algorithm Must Not Be in Full Control of Decisions Involving Killing,’” GA/DIS/3731, November 1, 2023, <https://press.un.org/en/2023/gadis3731.doc.htm>

Conclusion

AI is all pervasive. Whether we like it or not it has entered the modern warfare and battlefield. AI is already being incorporated into nuclear deterrence architectures around the world. While it has some advantages in some domains of nuclear deterrence architecture, giving total autonomy to AI would be catastrophic. At the same time, it is apparent that the march of AI-driven technologies cannot be stopped. It is only a matter of time before it will be significantly entrenched in the nuclear weapons complexes. It would be prudent to prepare for what is to come. However, it is imperative that states should firmly keep humans in the loop and not rely on machines or computers to make the decisions to launch nuclear weapons. It is important to exercise extreme caution when leveraging AI in nuclear deterrence. Ensuring the reliability, transparency, and ethical use of AI systems is crucial to prevent unintended consequences or the escalation of conflicts. Close human oversight and responsible AI development practices are necessary to ensure the effective and safe integration of AI in nuclear deterrence strategies. Most of all, it is imperative for nations of the world to develop norms, rules, and principles on the use of AI in military technologies, as well as enact international law.