ARTIFICIAL INTELLIGENCE AND ARMS CONTROL

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Abstract

The emergence of artificial intelligence has brought new challenges and opportunities to the global arms control regime. Integration of AI into military systems can complicate states' security matrix, due to its speed and accuracy, with additional problems of distinguishability, integration, and accountability. AI can be a useful tool to enhance transparency in verification measures for an effective arms control treaty. Arms control for the regulation or limiting use in military systems is as important as the use of AI for improving the arms control regime. The integration of AI in arms control is not without its pitfalls; it offers several new opportunities. Its use could help address some of the anxieties that prevent states from willingly engaging in an arms control agreements. These developments are important because of the shortcomings in global arms control treaties, and regional rivals like India and Pakistan. AI intergration could incentive the South Asian nuclear neighbours to maintain strategic stability.

Keywords: *Artificial Intelligence (AI), Arms Control, Regulations, Verification, Compliance*

Introduction

The growing military competition amongst the major powers, mainly the United States, Russia and China has adversely affected the existing global arms control regime and reduced the possibility of negotiating new arms control agreements. This negative trajectory has not only strained relations amongst the major powers, adversely affecting international peace and security, but has also influenced behavior of regional powers like India and Pakistan, since both countries remain reluctant to discuss new arms control agreements for the past over one

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decade.[1]

Besides the political impediments, arms control treaties have struggled to deal with compliance and verification challenges exacerbated by vague language used in the treaty texts often to maintain deliberate ambiguity. This allows states to exploit loopholes and develop their interpretation of the agreements per their national interests that eventually lead to a lack of adherence and compliance. Traditional verification mechanisms based on physical inspections of the military sites and systems have also been a major contentious issue preventing states from engaging in arms control agreements with verifiable compliance and transparency mechanisms.

To address these challenges and reduce the technical and political cost of negotiating new arms control agreements, the use of Artificial Intelligence (AI) could offer a viable solution as it can help reduce national sensitivities, especially when arms control measures are being negotiated to reduce weapon systems or provide transparency as part of confidence building measures.[2]

The use of AI in arms control agreements could revolutionize verification and compliance mechanisms, offering real-time insights and improve the effectiveness of the existing and future agreements. Its use in advanced sensor technologies, satellite imagery, and data analytics can help overcome some challenges by providing real-time monitoring of military activities, detecting potential violations, and facilitating timely responses. This could not only strengthen transparency and accountability but also help in effective enforcement of the arms control agreements.[3]

This paper aims to explore the current state of arms control, obstacles to integrating AI into the existing and future arms control initiatives, and the potential benefits that AI could bring by enhancing verification and compliance measures that are necessary for trust and confidence building, and strengthen arms control regime. The paper also discusses impediments in arms control arrangements in South Asia, where Pakistan and India remain reluctant to engage with each other due to a lack of trust, and how the introduction of new and emerging technologies could facilitate or create more obstacles in the existing or new arms control initiatives between the two nuclear armed adversaries.

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1 Mathias Hammer, "The Collapse of Global Arms Control," *Time*, November 13, 2023, https://time.com/6334258/putin-nuclear-arms-control/.

2 "ISAB Report on AI and Associated Technologies - U.S. Department of State," Department of State, October 2023, https://www.state.gov/wp-content/uploads/2023/11/ISAB.

3 Jane Vaynman, "Better Monitoring and Better Spying: The Implications of Emerging Technology for Arms Control (Fall 2021)," *Texas National Security Review*, (2021).

Why Arms Control Remains Challenging?

Arms control can be explained as a set of measures intended to control the design, development, production, testing, or use of weapons. In sum, arms control can be used to describe "all forms of military cooperation between potential adversaries" that can help address security concerns and improve mutual security of the parties.[4] Arms control initiatives are difficult to negotiate and implement, mainly for political, military, and technical reasons. With the emergence of new and emerging technologies and their growing use in military systems, it is necessary to regulate these weapon systems through new arms control initiatives. Besides military use, AI can also be useful in enhancing verification and transparency measures that are needed for an effective arms control regime. Arms control, therefore, is as important for regulating AI-integrated weapons as AI could be to improve verification and compliance mechanisms for effective arms control agreements.[5]

The growing trend of the use of AI in military systems and weapons could trigger a new arms race that would be difficult to regulate due to the dual-use nature of this relatively new technology for military as well as peaceful applications. Since private entities are developing some of these technologies, it is not easy to develop arms control mechanisms that could regulate private entities.

Recent studies suggest that significant developments in AI are being made by large private entities with growing concerns that this technology could be used for developing biological and chemical weapons by non-state actors for terrorist activities at a mass level. In 2002, the "AI took six hours to suggest 40,000 different potentially lethal molecules, some of which were similar to VX, the most potent nerve agent ever developed."[6] This has raised alarm amongst the international community with calls for new multilateral controls that could regulate AI access, especially to the most advanced AI models also known as "Frontier AI," which can pose significant danger to the human life.[7]

Integration of AI in the military systems and weapons is gaining traction as it helps reduce the human cost and are relatively easier to build. However, fully autonomous systems that could take decisions on their own

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4 James Acton, "Reimagining Nuclear Arms Control: A Comprehensive Approach," *Carnegie Endowment for International Peace (CEIP)*, December 16, 2021, https://carnegieendowment.org/2021.

5 Louis Vaczek and Stephen R. Graubard, "Modern Technology: Problem or Opportunity. Special Issue of Daedalus," *Technology and Culture* 22, no. 3 (1981): 605, https://doi.org/10.2307/3104397.

6 "No 10 Worried AI Could be Used to Create Advanced Weapons that Escape Human Control," *The Guardian*, Sep 25, 2023, https://www.theguardian.com/technology/2023/sep/25.

7 Ibid.

would always have limitations for three main reasons. First, the peacetime environment is different from the war zone and only human mind can adapt quickly to the changed situation; second, the character and nature of an adversary would vary in different battlefields that machines may not be able to differentiate quickly; and third, lack of human judgement amongst machines that makes it difficult for AI-based weapons to deal with various contingencies.[8] These limitations may be overcome by "Artificial General Intelligence" that may be able to perform any kind of task better than humans, but this technology has yet not been attained.[9]

Notwithstanding these limitations, the intersection of advanced technologies such as AI and nuclear weapons, where compressed decision-making time during crises could lead to inadvertent escalation, makes it imperative to integrate restraint measures and limit the use of AI, especially in the nuclear decision-making processes. Any autonomous weapons that are capable of carrying nuclear warheads must have human operator-in-the-loop and AI-enabled fail-safe systems to "improve nuclear weapons security, ensure continuous positive control, and better detect warning errors."[10]

The dual use nature of AI-based systems and the involvement of non-state actors also make it difficult to negotiate new arms control agreements. This difficulty is characterized by; distinguishability and integration.[11] Distinguishability is when it is relatively easy to differentiate between the two systems being used in a similar domain. For instance, it would be easy to differentiate a commercial airliner from a military aircraft, but this may be difficult while differentiating military and civilian drones. Resultantly, arms control measures intended to regulate the use of drones for military and civilian purposes would be more intrusive and difficult to negotiate than the arrangements agreed to verify military and commercial aircraft.

The second characteristic that makes arms control agreements difficult to negotiate for regulating dual-use technologies is their integration into military or civilian systems. If the technology is deeply embedded into a system, there would always be a risk that the verification

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8 Paul Scharre, "Autonomous Weapons and Stability," PhD Dissertation, King's College London, March 2020, 4, https://kclpure.kcl.ac.uk/ws/portalfiles/portal.pdf.

9 "No 10 Worried AI could be used to Create Advanced Weapons that Escape Human Control."

10 Rebecca K.C. Hersman, Heather Williams and Suzzane Claeys, "Integrated Arms Control in an Era of Strategic Competition," *Center for Strategic & International Studies (CSIS)*, January 2022, 4.

11 Jane Vaynman and Tristan A. Volpe, "Dual Use Deception: How Technology Shapes Cooperation in International Relations," *International Organization*, Vol. 77, Issue No.3, Summer 2023, 599-632, https://www.cambridge.org/core/journals.

mechanisms required to ensure compliance would be more intrusive and may not be acceptable for the state parties due to the sensitivities associated with the military systems. This is also applicable for commercial systems due to the proprietary concerns.[12]

Due to these complexities and the growing competition amongst the major powers, there is a reluctance to engage in arms control initiatives that could limit their military developments and bring added obligations of verification and transparency. This negative trajectory has also impacted adversely regional powers like India and Pakistan as they have not discussed any new arms control initiatives for the past decade.

Most states remain reluctant to join arms control arrangements due to the associated obligations of transparency and verification that could be in the form of physical and intrusive inspections, and may not be seen in line with the state's security interests.[13] Some of these measures that have become major hurdles in implementation of agreed treaties include; on-site inspections, regular sharing of information between parties regarding their military capabilities, deployments, and activities, utilization of advanced technologies such as seismic and satellite monitoring to detect specific activities, timely communication between parties about planned military activities, changes in capabilities, involvement of international organizations, such as the International Atomic Energy Agency (IAEA) in the verification process to provide impartial assessments.[14]

The Use of AI for Strengthening Arms Control Agreements

Some of the major international agreements such as the 2001 Biological Weapons Convention Verification Protocol, the Anti-Ballistic Missile (ABM) Treaty, the Intermediate Nuclear Forces (INF) Treaty, and the Open Skies Treaty - have all faced difficulty in verification and compliance thus leading to the deterioration of the arms control regime.[15] Growing concerns about some of the states that are allegedly building latent nuclear capabilities have raised further doubts about the existing verification and compliance mechanisms that states have to negotiate with the IAEA as part of their safeguard arrangements. Some of these concerns can be addressed by integrating new tools, including the

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12 "How are Military Drones Different from Commercial Drones?" November 8, 2022, https://www.zenadrone.com/.

13 Deborah A.Ozga, "The Reluctant Giant of Arms Control," *Sage Journals*, Volume 34, Issue No.1, 2003. 87-102, https://journals.sagepub.com/doi/ abs/

14 Ibid.

15 Lynn Rusten, "U.S. Withdrawal from the Antiballistic Missile Treaty," *Center for the Study of Weapons of Mass Destruction, National Defense University,* Washington D.C. January 2010, https://doi.org/10.21236/ada572320.

AI, in developing verification mechanisms that could potentially reduce the possibility of diverting civil nuclear technology for military purposes and help strengthen the existing safeguards regime.[16]

The North Korean case of non-compliance and building a latent nuclear capability while part of the Nuclear Non-proliferation Treaty (NPT) is one example where AI-based verification measures could have provided more transparency and early warning. North Korea had joined the NPT as a non-nuclear weapon state and agreed to place all its facilities under the IAEA safeguards. In 1993, it threatened to leave the NPT arguing that the additional inspection requested by the IAEA to inspect its plutonium waste was against its national interests and sovereignty.[17] North Korea eventually left the NPT in 2003 citing national security considerations.[18]

The Joint Comprehensive Plan of Action (JCPOA) negotiated between Iran and P-5+1 (US, UK, China, France, Russia, and Germany) was another example where verification measures became contentious between the two sides, eventually leading to its demise. As part of the deal, Iran was to dismantle its nuclear and missile program and allow more inspections by the IAEA in lieu of the promised sanctions relief.[19] Differences emerged due to alleged non-compliance by Iran and reluctance by Iran to allow intrusive inspections due to the sensitivities attached with its nuclear program that it claimed was only for peaceful purposes. If both sides were to agree to renegotiate the agreement in the future, the use of new verification tools integrated with AI could address some of the sensitivities and help provide more transparency into the nuclear developments of Iran.[20]

Verification and compliance concerns are not limited to a few states but it remains a contentious issue since it is difficult to maintain a balance in providing transparency and secrecy that is often required when dealing with sensitive installations and materials that are used in the nuclear fuel cycles. The IAEA safeguards regime could benefit significantly by the use of AI-integrated inspection mechanism which would limit the

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16 Ibid.

17 "Scheinman: Iran, North Korea, and the NPT's Loopholes," *Council on Foreign Relations (CFR),* February 1, 2005, https://www.cfr.org/interview/

18 "North Korea's Nuclear Weapons and Missile Programs," *Congressional Research Service Report (CRS)*, December 19, 2023, https://crsreports.congress.gov/product/pdf/IF.

19 Kali Robinson, "What Is the Iran Nuclear Deal?" *Council on Foreign Relations*, October 27, 2023, https://www.cfr.org/backgrounder/what-iran-nuclear-deal.

20 Trevor Findlay, "IAEA Noncompliance Reporting and the Iran Case," February 2016, *Arms Control Association*, https://www.armscontrol.org/ act/2016-01/features.

need for physical onsite inspections and provide more accurate analysis and warning about proliferation related activities.

AI as a tool could also play an important role in implementing the Comprehensive Test Ban Treaty (CTBT), if it enters into force anytime in the future. The Vienna based CTBT Preparatory Commission has established several international monitoring stations around the world to monitor activities that could be related to nuclear explosions. These monitoring stations share data that can be best analysed using AI tools. This would provide objective assessments about states' non-proscribed activities without touching the national sensitivities.[21]

Another prospective arms control and disarmament treaty where AI can play a significant role is the Fissile Material Cut-Off Treaty (FMCT), which is in stalemate due to political reasons and also because of unresolved technical issues related to the verification process needed to ensure compliance by the state parties. The US had opposed a verifiable FMCT and refused to engage in the negotiations at the Conference on Disarmament for a long time. It was only in 2009 under the Obama Administration that the US agreed to a verifiable FMCT but no further progress could be made due to the diverging interests of the negotiating parties. If FMCT is concluded in the future, the use of AI could offer a solution to overcome national sensitivities attached with the identification of fissile material and controlling its movement.[22]

Potential Obstacles to Integrating AI in Arms Control

Unlike some other technologies, AI is not a standalone technology and is used by integrating it into various systems and measures to enhance the efficiency and speed. Its use in military systems could be both stabilizing as well as destabilizing. Once used for data gathering and decision making, it can provide more reaction time and could be considered as stabilizing. However, if it is used to give complete autonomy to the weapon systems without human intervention, it can trigger a crisis and lead to quick escalation as autonomous weapons are not designed to cater for variables that otherwise could play important role in the judgment made by a human mind and is necessary to avoid accidents.[23]

Integrating AI in arms control presents number of challenges that need to be addressed. While AI has the potential to revolutionize the field of arms control by enhancing verification, and compliance mechanisms, it

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21 "Comprehensive Nuclear Test Ban Treaty (CTBT)," *The Nuclear Threat Initiative* (NTI), December 20, 2023, https://www.nti.org/education-center.

22 "Fissile Material Cut-off Treaty (FMCT) at a Glance," *Arms Control Association*, June 2018, https://www.armscontrol.org/factsheets/fmct.

23 Vitorio E. Bossio Ballesteros, "Artificial Intelligence in the Military Field: A Relevant and Useful Tool," *CEEP*, October 26, 2023, http://revistas.ceeep.mil.pe/index.php/.

also raises significant concerns and challenges. Navigating the complexities of AI and taking lessons from previous arms control experiences can help in overcoming some of these challenges. Integration of AI tool in arms control agreements would help monitor treaty violations as the signatory states would be notified thus helping states to better control and regulate the use, deployment, or a buildup of military weapons.[24]

One of the biggest obstacles to the application of AI would be transparency. In contrast to conventional weapons, AI operates as a "black box," drawing conclusions from data in an increasingly unsupervised manner.[25] Nevertheless, achieving transparency may be difficult in the case of AI-integrated arms control arrangements if the code is hidden, information is false, or technology is denied.

Accountability is another concern in AI-integrated arms control arrangements. Traditional arms control efforts require human input for responsible actions. In the case of AI where human input is negligible the issue of accountability can become a major problem once AI-based verification systems identify patterns incorrectly or take actions that have unintended consequences. On the military side, the issue of accountability can have more serious consequences once the human factor in the decision making process is removed in targeting with "concerns over state responsibility, and attribution for the actions taken by autonomous weapon systems."[26]

An AI-based arms control agreement may face a compliance challenge as well. The punishments or penalties executed by arms control treaties historically have remained inadequate with powerful states escaping serious consequences for non-compliance. If treaty compliance provisions are unbalanced, stronger states may continue to commit violations with little repercussion and relatively smaller countries would continue to face severe penalties for the same violations.[27] Compliance is made more difficult by the nature of AI and its functioning. States can protect the development of AI-based weapons by masking the code such as

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24 Mauricio Baker, "Nuclear Arms Control Verification and Lessons for AI Treaties," April 8, 2023.

25 Amina Adadi and Mohammed Berrada, "Peeking Inside the Black-Box: A Survey on Explainable Artificial Intelligence (XAI)," *IEEE Xplore,* Vol 6, 52138-52160.

26 "Working Paper by Pakistan for the Conference on Disarmament, addressing the Security and Stability Implications of Military Applications of Artificial Intelligence (AI), and Autonomy in Weapon Systems," *Pakistan's Note Verbale at the Conference on Disarmament (CD) Geneva CD/2334*, 21 July 2023, 3.

27 Amina Adadi and Mohammed Berrada, "Peeking Inside the Black-Box: A Survey on Explainable Artificial Intelligence (XAI)."

showing fake images or facilitation centers to the adversary thus making it difficult to ensure compliance.[28]

The advancement in military technologies especially in the domain of self-governing weapons, require negotiation of new treaties, guidelines, and agreements that could guarantee reliability and principled application of artificial intelligence within the framework of arms control mechanisms. International organizations and policymakers need to be more creative in taking initiatives for negotiating new arms control arrangements while keeping into consideration new technology breakthroughs.[29]

Potential Benefits of Integrating AI in Arms Control

Integration of AI into arms control offers a range of potential benefits that could significantly increase global security through enhancing the mechanism of verification and compliance. The transformative power of AI in system surveillance, verification, and compliance can transform arms control efforts, provide real-time insights, and improve agreements.[30] Another advantage of AI-based arms control is that it can provide increased accuracy and efficiency in pattern recognition that can assist with the issue of compliance. AI is able to process large amounts of information quickly and make informed decisions, this ensures that arms control agreements are executed with higher degree of certainty providing an opportunity to improve compliance mechanisms making it harder for states to conceal.

AI can also contribute substantially to arms control by improving verification, analyze satellite photographs, find abnormal behavior at nuclear plants, and give early notice of potential violations and nuclear accidents.[31] The 2011 Fukushima Daiichi incident had many lessons for the security and safety of nuclear power plants being operated around the globe. Integration of AI in predicting loss and damage of nuclear power plants in such disasters would be useful in limiting the human loss. Another accident that took place at Chernobyl in 1986 caused significant human losses as operators were unable to understand the severe consequences of a minor human error that plummeted into one of the biggest nuclear disasters in the history. Integration of new tools such as the AI could help provide early warning and prevent or at least limit the extent of destruction caused by these disasters.[32]

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28 Mauricio Baker, "Nuclear Arms Control Verification and Lessons for AI Treaties," April 8, 2023, https://doi.org/10.48550/.

29 Ibid.

30 Niklas Schörnig, "AI for Arms Control," *Peace Research Institute Frankfurt* (PRIF), https://www.prif.org/fileadmin/

31 Ibid.

32 "A Brief History of Nuclear Accidents Worldwide," *Union of Concerned Scientists*, October 1, 2013, https://www.ucsusa.org/resources/

Emerging Technologies and Arms Control in South Asia

India and Pakistan have a long history of distrust due to outstanding territorial disputes and number of wars that both countries fought with each. In the pre-nuclearization period, Pakistan offered several proposals to keep the region free of nuclear weapons as it could not afford to engage in a nuclear competition with an adversary that had more resources and had already tested a nuclear device in 1974.[33] Amongst the prominent arms control proposals offered by Pakistan before 1998 included joint signing of the NPT, accepting full scope safeguards on the nuclear facilities, joint inspection of each other's nuclear facilities, declaring South Asia as a Nuclear Weapons Free Zone and Bilateral Test Ban Treaty, and several others.[34]

The 1988 agreement between the two sides prohibiting attack on each other's nuclear facilities was the most significant arms control arrangement in the pre-1998 period which is still effective despite many crises over the past years.[35] As per the agreement both sides share the lists of their declared nuclear installations on 1st Jan of every year with each other.[36] The purpose of this agreement is to avoid unintended attack on sensitive nuclear installations in a crisis or a military conflict. As of now there is no verification mechanism as both sides do not allow physical inspections of these sites and neither provide specific details of the facilities. As part of the agreement, India and Pakistan only share grid references covering broad area of a nuclear facility or facilities. To help further improve the effectiveness and compliance of this agreement, India and Pakistan can possibly use AI in the future to have better clarity of each other's nuclear facilities and avoid unintended strikes on any of these facilities.

Post 1998, both India and Pakistan agreed to engage with each other as part of Lahore MoU that signed by the two sides in 1999. This agreement amongst other issues provided a roadmap for future engagement on arms control related issues.[37] The 1999 Kargil conflict and

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33 Anna Schumann, "History of Conflict in India and Pakistan," *Center for Arms Control and Non-Proliferation*, November 21, 2023, https://armscontrolcenter.org/history.

34 A. H. Nayyar, "Pakistani Perspective on Nuclear Disarmament and Non-proliferation," *Friedrich Ebert Stiftung (FES),* Briefing Paper 9, August 2008. https://library.fes.de/pdf-files.pdf.

35 "Agreement between India and Pakistan on the Prohibition of Attack Against Nuclear Installations and Facilities," https://www.nti.org/wp-content/uploads/2021/09/.

36 "India, Pakistan Exchange Lists Of Nuclear Facilities, Prisoners," *Al Jazeera,* January 1, 2023, https://www.aljazeera.com/news/2023/1/1.

37 Bashir Ali Abbas, "Looking Back at the 1999 India-Pakistan Lahore Declaration," *The Diplomat*, May 21, 2022.

subsequently the 2001-02 military stand-off limited this progress but both sides resumed their dialogue in 2004 in the form of Composite Dialogue.

As part of Composite Dialogues, India and Pakistan agreed to a ballistic missile notification agreement in 2005, which provides early warning to each other of any ballistic missile test being conducted.[38] This agreement is also a confidence building measure and is intended to avoid miscommunication, especially during crisis. The use of AI as part of the agreement or by either of the state individually could help analyze the pattern of missile tests and predict the future postures being developed by both the adversaries.

India-Pakistan arms control process is on a hold due to number of factors. India has become increasingly dismissive towards Pakistan and does not want to engage bilaterally in any arms control initiatives that could impede its efforts to emerge as a credible regional and a potential global power. India has been increasingly propagating that its principal adversary is China and not Pakistan, and if new arms control initiatives have to be discussed, it must include China. This has reduced the possibility of restoring the bilateral arms control dialogue between India and Pakistan.

Arms control arrangements are essential as these "provide useful venues for addressing sources of conflict, reducing misperceptions, and restraining impulsive or risky actions."[39] However, for arms control to succeed, "they must be adapted to the current security environment, account for rapidly evolving technological and informational factors, and consider alternative structures, modalities, and participation models."[40]

In view of the long history of distrust and varying character of each crisis between India and Pakistan, the main purpose of arms control should be to prevent a major war, and not necessarily focus on the numbers and types of weapons. This can only be possible by identifying deterrence gaps and taking into consideration the role that the new and emerging technologies can play in crisis escalation.

For example, the 2019 crisis between India and Pakistan was an attempt by the former to take advantage of its numerical conventional superiority and launch an aerial surgical strike for limited political objectives, under a nuclear shadow. Pakistan responded with a tit-for-tat kind of a surgical strike and in the bargain shot down two of the Indian aircraft that caused significant amount of discontent for the Indian

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38 Neil Joeck, "The Indo-Pakistani Nuclear Confrontation: Lessons From The Past, Contingencies For The Future," *Pakistan's Nuclear Future: Reigning In The Risk,* ed., Henry Sokolski, *Strategic Studies Institute, US Army War College,* 2009, 19-62.

39 Rebecca K.C. Hersman, Heather Williams, Suzanne Claeys, "Integrated Arms Control in an Era of Strategic Competition."

40 Ibid.

decision makers, resulting into nuclear threats from India's Prime Minister.[41] This sudden escalation was not in synch with the theoretical understanding of Herman Kahn's 44 rung escalation ladder, and had political undertones, but also reflects the deep-rooted hatred against each other where a limited action by one actor is seen as an existential challenge by the other thus pushing the national leadership to take extreme measures, which could include the possible use of nuclear weapons without taking into consideration the effect it would have on the regional as well as global stability.

In such an environment of distrust, if any of the two actors use new and emerging technologies, such as the AI-based unmanned aerial vehicles (UAVs) in the future, it can quickly transform the crisis from a limited to an all-out war with the potential to escalate to a nuclear one. It is therefore imperative that the new arms control arrangements between the two adversaries must not be limited to specific capabilities but should address the root cause of discontent on both the sides, besides catering for the impact that the new technologies could create on crisis escalation. This can be possible if arms control is seen as a wholesome concept for maintaining strategic stability and caters for potential vulnerabilities and capabilities as part of an evolving concept of Integrated Arms Control.[42]

The evolving technological landscape where new and emerging technologies like the AI are likely to play critical role, it is important to understand three broad implications for the future of arms control. One, new and emerging technologies can complicate strategic stability as these could be an instrument for crisis escalation and arms race; two, most of these technologies have dual purpose of civilian and military use, which makes it difficult to engage in an arms control process; and three, there are negligible or limited norms and legal instruments developed to regulate new technologies so far.[43]

For India and Pakistan, it is essential to understand that if there are no limitations or agreed norms, the development and employment of new technologies, like the AI, would increase the nuclear risks and lead to miscalculations with disastrous consequences.

The concept of deterrence is predicated on the rationality or irrationality of the humans in a specific environment, who are able to cater for most variables during a crisis situation. Keeping humans out-of-the-loop and subletting the decision making to the AI-based systems could

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41 Adil Sultan, "Pulwama Crisis: Causes, Implications and Lessons for the Future," *Strategic Foresight for Asia (Strafasia),* April 10, 2019, https://strafasia.com/pulwama/.

42 Rebecca K.C. Hersman, Heather Williams, Suzanne Claeys, "Integrated Arms Control in an Era of Strategic Competition," *Centre for Strategic International Studies (CSIS)*, January 2022,3.

43 Ibid.

lead to automation of escalation with catastrophic consequences. Similarly, using AI for generating data and processing of information may provide more time for the decision makers but it can also lead to a temptation of a preemptive counterforce strike against the adversary thus fast-tracking the crisis to a point of no return. It is therefore essential to understand that while AI may have benefits but "increasing the speed of warfare and compressing decision-making timeframe, particularly in regions with high tensions and history of accidental launch incidents, represents a recipe for an unmitigated disaster."[44]

Taking into consideration the past trends, it is therefore important for both India and Pakistan to avoid integration of AI into their nuclear command and control systems and negotiate confidence building and arms control measures that could provide more transparency about each other's intent, especially during a crisis to prevent unintended escalation.

Conclusion

The emergence of new technologies such as quantum computing, cyber, hypersonic weapons, artificial intelligence, and their integration into military systems, offers both opportunities and challenges. There is therefore a need for developing new arms control measures that could limit or regulate the use of these technologies for military purposes and help maintain peace and stability at the regional as well as the global levels. New technologies, especially the AI is also useful for improving the existing arms control arrangements, if incorporated to enhance verification and transparency measures.

The growing competition amongst major powers and the increasing use of new and emerging technologies for military purposes could lead to instability at the global level. This negative trajectory is also visible amongst the regional rivals, especially in South Asia, where India is moving on a fast-track to build its AI potential as part of the new Initiative on Critical and Emerging Technology (iCET)[45] that was inaugurated jointly by the US and India in June 2023. These capabilities once integrated into military systems could adversely affect strategic stability in South Asia.

At the global level, the declining interest in the arms control arrangements has led to the unravelling of the arms control regime. The collapse of key accords, like the INF Treaty, Open Skies Treaty, ABM treaty and the difficulty being faced in implementation of the CTBT, especially after Russia's decision to withdraw its ratification, underscores the need

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44 "Working Paper by Pakistan for the Conference on Disarmament, addressing the Security and Stability Implications of Military Applications of Artificial Intelligence (AI), and Autonomy in Weapon Systems," *Pakistan's Note Verbale at the Conference on Disarmament (CD) Geneva CD/2334*, 21 July 2023, 3.

45 "Joint Statement from the United States and India," *The White House*, June 22, 2023, https://www.whitehouse.gov/briefing-room/statements-releases.

for addressing these challenges by incorporating new technologies that could help rebuild confidence in the arms control initiatives.

AI has the potential to revolutionize arms control by enhancing verification, compliance mechanisms, and addressing the challenges associated with traditional methods. The use of AI can improve accuracy and efficiency in pattern recognition, provide real-time insights, and enhance the monitoring of potential treaty violations. Its use for border surveillance through facial recognition and drone surveillance can help increase security at the international borders and prevent illegal transfer of weapons and movements of terrorist across the borders.

Although AI has the potential to improve verification, monitoring, and compliance, its complexity raises questions about accountability, and transparency. Despite these hurdles, integrating AI into arms control initiatives can contribute to global security by fostering innovation, increasing efficiency in compliance mechanisms, and building confidence among nations. States, international organizations, and policymakers need to work through collaborative approaches to develop creative solutions, establish new agreements, and ensure the responsible application of AI in arms control. Embracing the potential benefits of AI in arms control can pave the way for a more secure and stable future, mitigating the risks of arms race and fostering international cooperation.