

A study on the impact of Artificial Intelligence on Strategic Stability

Abstract: The military application of artificial intelligence, particularly in nuclear weapon systems, may generate new strategic risks and bring new challenges to the global strategic stability frameworks. Strategic stability has always been the focus of international arms control studies. It is generally believed that the concept of strategic stability encompasses both narrow and broad definitions. The narrow definition of strategic stability primarily, which is the classic concept of strategic stability, concerns nuclear force relationships. The concept is originating from U.S.-Soviet nuclear dynamics during the Cold War. As nuclear arsenals evolved, the immense destructive effects and unique strategic value of nuclear weapons became increasingly apparent. Through the combined efforts of strategists and national leadership, a strategic stability mechanism based on nuclear deterrence has gradually formed. The classic deterrence theory holds that when two nuclear states maintain secure second strike capability (ensuring retaliatory capacity under a pre-emptive strike), neither possesses rational incentive to initiate nuclear aggression. Under such conditions, the two countries are in a state of strategic stability. In the post-Cold War era, scholars have expanded the analytical framework to incorporate politics, economy, and technology dimensions, forming the broader concept of strategic stability. While multiple factors, such as technical, political and cognitive influence strategic stability, this report focused specifically on technical impact of artificial intelligence on narrowly defined strategic stability, through its effects on the reliability of the second strike capabilities.

AI has both positive and negative impacts on strategic stability. The survivability and penetrative capacity of strategic nuclear forces constitute core determinants of second strike capability. AI applications in nuclear weapons, nuclear force detection, decision support architectures, and non-nuclear systems affecting strategic stability will inevitably influence these critical capabilities. The application of artificial intelligence in nuclear weapon systems can enhance the survivability of nuclear weapons before launch, such as collecting and analyzing the activity rules and detection blind spots of enemy ISR assets, and improving the concealment, deception, jamming and camouflage capabilities of our nuclear forces; plan and design the maneuver route of mobile intercontinental missiles to enhance the unpredictability of their own missile maneuvers; develop underwater acoustic countermeasure devices (decoys) through sound synthesis technology to enhance the survivability of our submarines; aiming, accuracy and guidance reliability can also be improved through advanced navigation systems. In reconnaissance and surveillance domains, AI-enhanced reconnaissance systems may improve nuclear force detection and tracking, potentially undermining the pre-launch survivability, such as interpreting characteristic data and improving the efficiency of discovering, identifying and monitoring enemy ground targets; analyze and process underwater acoustic and non-underwater acoustic signals, use unmanned underwater vehicles (UUV) for anti-submarine detection, and enhance strategic anti-submarine warfare (ASW) capabilities; use long-endurance stealth unmanned aerial vehicles (UAVs) to conduct penetrating reconnaissance strikes on enemy strategic weapons. For command and control systems, AI-driven decision support could alleviate operator cognitive overload through enhanced early warning and situational awareness, while improved communication security protocols might bolster system resilience against electronic warfare. Among non-nuclear system, missile defense system most directly impact strategic stability. The application of artificial intelligence in missile defense systems can weaken the penetration capabilities of nuclear weapons, such as improving the processing capabilities of satellite and radar data to speed up the detection, tracking, and identification of missiles, and enhance the ability to intercept enemy missiles; improve the automation of the command and control of the missile defense system, and quickly realize the closed loop of the kill chain; improve trajectory prediction accuracy and decoy discrimination ability. Furthermore, AI-

enabled conventional precision strike systems may threaten nuclear force survivability through improved targeting capabilities.

In addition to military technology, arms control is an important means to strengthen strategic stability, and the application of artificial intelligence in arms control verification can play a positive role. For example, the Artificial intelligence-enhanced perimeter sensors and unmanned patrol systems can enhance the detection capabilities of monitoring systems, and the application of artificial intelligence in satellite imagery and multi-modal information analysis can improve data processing and analysis capabilities, thereby enhancing the confidence of all parties in the implementation of the treaty.

In conclusion, AI integration into nuclear and related systems introduces new complexities in assessing nuclear force survivability, potentially destabilizing existing strategic stability. The international community should pay attention to the long-term impact of artificial intelligence, and at the same time pay attention to the impact of artificial intelligence on the current international strategic stability pattern. To mitigate the risk, states should enhance exchanges and dialogues on the application of artificial intelligence weapons, to form a consensus on risks, restrict the use of AI in key military fields through mechanisms, ensure human decision-making in key military fields, and reduce the impact of AI on strategic stability. At the same time, it is necessary to strengthen research on traceability technology in response to the behavior of non-governmental actors, and reduce irrational factors from undermining strategic stability.

Keywords: strategic stability, artificial intelligence, reconnaissance and monitoring

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