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Abstract

.   The very crux of modernisation in the PLA is the process of "intelligentisation" — making high technological advances in military application of AI technology. This article makes an attempt to cover 'Why, When, How and Where' of AI and Robotics in China; it examines the maturing of China's learning curve in fields of AI and Robotics, its methodical forays in diversifying research to make it of dual-use nature, does a sneak peek into PLA's AI and robotics-driven unmanned systems, command and control applications, cyber operations, logistics and space warfare.

Keywords: PLA intelligentisation, AI, Robotics, AIDP, New Age Warfare

Introduction

The People's Liberation Army (PLA) of China has in many ways been aggressively integrating AI and robotics into its military modernisation strategy as part of China's overall effort towards "intelligentised warfare". Artificial intelligence and robotics supplement their capacity for decision-making, surveillance, autonomous weapon systems and electronic warfare capabilities across different domains. This article makes an attempt to cover Why, When, How and Where of AI and Robotics in China (focussed on PLA);it examines maturing of China's learning curve in fields of AI and Robotics, its methodical forays in diversifying the research to make it of dual-use nature, does a sneak peek into PLA's AI and robotics-driven unmanned systems, command and control applications, cyber operations, logistics, space warfare and challenges associated with its adoption of AI-powered military technologies and future trends in China's AI-driven military advancements.

(Why?) Strategic Framework and doctrinal changes

The very crux of modernisation in the PLA is the process of "intelligentisation" — making high technological advances in military application of AI technology. It very much affects transformation from the traditional character of mechanised warfare to information-centric and intelligent warfare towards better decision-making, higher operational efficiency, and greater combat effectiveness. The PLA strategic documents are stressing the necessity of

adapting to the evolution of warfare's character by also compromising on such special, disruptive ones and, in the future, cutting-edge incorporated technologies (RAND Corporation, 2024).

(When?) History of Artificial Intelligence and Robotics in China

China has been involved in developing AI since the 1980s when it began to investigate fields such as expert systems and machine learning. Entering a fast lane in the 2010s followed by introduction of the New Generation Artificial Intelligence Development Plan (AIDP) in 2017, was intended to make China the number one country in AI by 2030 (State Council of China, 2017; Lee,2018). This emphasised, among other considerations, the use of AI in defence and national security. In 2015, the PLA's Strategic Support Force (PLASSF) (which, in 2024, was reorganised as PLAISF) was created to be responsible for cyber, space, electronic and psychological warfare—very much relying on AI-driven automation and intelligence analysis (Kania, 2019).

Robotics in China dates back to the 1960s and early research was on industrial automation. Progress in China towards autonomous robotics, humanoid robots, and unmanned military systems picked up in the 2000s. Early research on robotics had the active participation of the China Academy of Engineering Physics (CAEP), whereas autonomous systems for defence applications were pioneered by institutes such as the National University of Defence Technology (NUDT) and Harbin Institute of Technology (HIT). Today, swarm robotic technology, unmanned combat vehicles, and AI-based robotics for military logistics and combat situations rank China amongst the leaders in the sector.

(How?) Key Educational and Research Institutes Involved in AI and Robotics Research

Several leading universities and research institutes in China play a vital role in AI and robotics advancements and through a well-oiled mechanism of Civil- Military Fusion strategy, collaborate with the military in adoption of these for Military Use. Some of the key educational institutes involved are as given below. Tsinghua University focuses on AI ethics, machine learning, robotics and national security applications.

- **Peking University** researches deep learning, big data analytics, AI-powered decision-making systems and intelligent robotics.
- **The Harbin Institute of Technology (HIT)** specialises in robotics, autonomous systems, AI-powered cybersecurity, and AI-driven exoskeletons.

- **Beihang University** specialises in AI applications in UAVs, aviation robotics, and AI enhancements in aerospace engineering.

- **National University of Defence Technology (NUDT)** has leading research programs on autonomous weapons, quantum computing, cyber warfare, and robotic warfare.

- **China Academy of Engineering Physics (CAEP)** does research on military robotics, AI drone swarm, and automated battlefield systems.

- **Shanghai Jiao Tong University** specialises in military logistics robotics, AI medical robotics, and automated battlefield support.

These institutions work with military and civilian enterprises, such as Huawei, Baidu, Tencent, and iFlytek, which contribute to AI research while also getting military contracts (Allen, 2021).

Dual-Use AI Research: Civil and Military Applications

The general profile of AI research in China follows the strategic dual-use wherein civilian technologies find military applications. This "Military-Civil Fusion" (MCF), strategy empowers China to seek out technological advancements related to commercial AI for defence purposes (Cheung & Lin, 2020). Examples include:

- *Facial Recognition and Surveillance:* AI-driven surveillance technologies integrated in smart cities are scalable for military intelligence as well as counter-intelligence applications.

- *Autonomous Vehicles:* Research on self-driving car finds its translation into UAVs, UGVs, and autonomous maritime systems powered by AI for reconnaissance and combat.

- *AI-Enhanced Cybersecurity:* Civilian AI applications on data protection uses cyber warfare and intelligence gathering purposes.

(Where?) Leveraging AI and Robotics in PLA

The PLA has integrated AI across various domains, enhancing its strategic and operational capabilities. Key applications are as given below.

Unmanned Systems. PLA uses AI to power its unmanned platforms in all the three Land, Sea and Air domains.

- *Aerial Platforms.* The military UAV creation and commissioning have been extremely vital in counterbalancing and enabling the PLA in reconnaissance, surveillance, and

strike capabilities. The UAVs would act independently or in cooperation with manned platforms, enjoying the flexibility while being precluded from endangering personnel (CSIS, 2024).

o **Loyal Wingman Drones.** Chinese AI-enabled drones, commonly known as "Loyal Wingman", are expected to act as companions to manned fighter aircraft engaged in reconnaissance, electronic warfare, and strikes. The FH-97 design is based on the US XQ-58A Valkyrie, allowing for autonomous decision-making and coordination during attacks (SCMP, 2024).

o **Swarming Drone Innovations.** China successfully tested autonomous swarms that uses AI to self-navigate, adapt, and create formations in real-time based on battlefield conditions, while simultaneously sending orders to each other and adjusting to changes in the perception of threat and reformatting app-based threats (Global Times, 2024). China has also tested AI-piloted swarm drones for reconnaissance, electronic warfare, and strike activities.

o **Drones with Stealth AI.** The GJ-11 Sharp Sword is an AI-capable stealth armed drone, which can perform autonomous reconnaissance and precision strikes. AI-embedded systems for target identification have been integrated into these platforms to ensure high operational efficiency (CSIS, 2024).

• *Ground Robotics.* The launch of robotic systems like the Q-UGV Wolf is a clear statement of the PLA's inclination to adopt robots in ground operations— their mobility

enables these systems to adapt in combat, yet be equipped for reconnaissance, through logistics support, or even direct combat (The Times, 2024).

o **Autonomous Battle Tanks.** Autonomous battle tanks are currently modified from Type 59 tanks to AI command autonomous combat vehicles that will be employed in urban warfare, border security, and high-risk combat zones (IISS, 2023).

o **Multi-Purpose Robotic Vehicles.** The VN-4 UGVs have a multiservice use in combat, logistics, and mine clearing. It can perform operations in a semi-autonomous or fully autonomous mode (US Congressional Research Service, 2023).

o **Robotic Infantry and Exoskeletons**. China is supposedly testing AI robotic infantry units along with exoskeleton suits to increase the endurance and fighting power of human soldiers (Australian Strategic Policy Institute, 2023) (SCMP, 2024). South Industries Group Corporation of China presented unmanned combat system integrated with "robo-wolves" quadropedal robots during the Airshow China 2024. These dominion-defying robots stirred the minds of the public by futuristic designs and advanced combat concepts in shifting towards versatile and agile robotic platforms future battlefield.

o **Armed Robotic Units.** It has been allegedly learned that PLA combat robots carried thermobaric weapons designed for use in urban warfare scenarios. One of the AI-generated videos shared among Chinese social media shows the movements of a robotic dog armed with a machine gun, moving inside a

darkened building, while humming a nursery rhyme—the level of advancement of autonomous urban combat capabilities.

- ***Maritime Unmanned Systems.*** The People's Liberation Army Navy (PLAN) is working towards developing naval warfare capabilities through AI integration with naval platforms to make operations within the maritime domain more effective (SCMP, 2024).
  - **AI Unmanned Combat Ships**. The Zhongshan-class Unmanned Surface Vehicle (USV) has autonomous missions for patrol, surveillance, and electronic warfare paired with swarm coordination capability, allowing multiple unmanned surface vehicles to act in concert (Royal United Services Institute, 2023).

  - **Unmanned Underwater Vehicle (UUV).** The HSU-001 UUV is an artificial intelligence enabled submarine drone for underwater reconnaissance and anti-submarine warfare. Applications to AI lie in its stealth application for autonomous navigation and target engagement (US Naval War College, 2023).

AI in Command and Control. In addition to developing autonomous platforms, the PLA is investing in AI applications for command and control **systems**. In an effort to provide access to vast amounts of information in the process of decision-making, optimally allocate resources, and prepare for the quick but accurate strategic and tactical decisions made at the battlefield level—AI is going to assist decision-makers with predictive analysis, wargaming, and simulations of battlefield environments. (CSIS, 2024). The AI Battle Command System (AIBCS) provides enhanced situational awareness, predictively presenting elements of the battlefield (Kania, 2019). AI is essentially used in real-time decision-making and data handling

as it reduces the roles played by human operators. The PLA is propagating that AI should empower decisions made at the batalha level rather than consuming them.

Cyber Operations, Electronic Warfare and Information Warfare with AI. PLA has included the usage of generative AI towards its advantage with respect to cyber capability, namely developing cyber-enabled influence operations and social media manipulation that uses social media platforms to accomplish strategic objectives. The introduction of AI into cyber operations is a clear reaffirmation of how the PLA regards information domination as a key prerequisite in modern warfare (RAND Corporation, 2024).

- *AI-Driven Electronic Warfare (EW) Drones.* These intelligence-driven flying machines execute electronic jamming, conduct SIGINT tasks, and implement cyber attacks on adversary systems. Such capabilities of AI-augmented EW are evident in drills by the PLA military (SCMP, 2024; NATO Strategic Communications Centre of Excellence 2023). By means of AI algorithms, China improves its skills in electronic deception and countermeasures.

- *Autonomous Cyber Warfare Bots.* Autonomous functions of AI driven cyber bots from China includes detecting weaknesses in systems, conducting penetration tests, and launching their cyber warfare (Carnegie Endowment for International Peace, 2023). Their cyber units at PLA employ AI into automatic hacking, designing malware, and spying into networks. Methods that use AI to secure networks improve strengths in defence and intrusion detection (Cheung & Lin, 2020).

AI also applies to disinformation campaigns and psychological operations through the generation of deepfakes and manipulation of public narrative.

Artificial Intelligence in Military Logistics, Training, Simulations and Space Operations.

The PLA uses AI in its military training programs with AI-led simulations to shape realistic battlefield environments. AI has been used as simulated entities in critically important aerial combat-training exercises that test pilot's limits and improve their combat proficiency in flying. This is expected to add more flavour to the trainee's experience as well as help the PLA come up with, and test its new tactics in a controlled environment (Global Times, 2024). In a recent Simulation, the first of its kind, an AI-based Naval Forces Commander exercised with full autonomy of action. It is common for PLA to use an AI to model the US forces capabilities as an aircraft carrier battle group and then simulate wargames on the same.

- ***Automated Supply Drones.*** These AI-powered logistics drones will deliver supplies to frontline soldiers in inaccessible and inhospitable areas such as the Himalayas (LAC) and the South China Sea (European Council on Foreign Relations, 2023). AI is in charging an optimal supply chain management and predictive maintenance of military hardware.

- ***Autonomous Convoys.*** An autonomous army vehicle convoy will use artificial intelligence-based programming for navigation, coordination of convoys, and threat detection. The tests are in progress or planned by PLA (SCMP, 2024).

- ***AI in Space and Satellite Operations.*** China is building AI across its satellite constellations for real-time surveillance, early warning, and targeting. Machine learning is augmenting Space Situational Awareness (SSA) to track and counter adversary satellites (Kania, 2019; RAND Corporation, 2024). In addition to detecting changes, the AI works very well on satellite imagery. It optimizes and accelerates the analysis of satellite imagery for enemy movement, naval activities, and missile launch detection.

- ***World Military Exercises Involving AI-Powered Robotics.*** Recently, the PLA has used many intelligent technologies in their drills like exoskeletons and robot dogs together with drones blasting high-power lasers. One instance was demonstrated by a member of the PLA Xinjiang Military Command, who was engaged with the training of logistics support involving an artificial robot dog on an elevated area, demonstrating how robotics was applied practically in a real environment in extreme terrains.

- **Xinjiang Military Command of PLA** conducted exercises using robotic dogs, AI-enabled exoskeletons, and drone swarms (SCMP, 2024).

- The use of AI-controlled drone swarms was put in practice to accomplish coordinated battlefield manoeuvres.

- **Autonomous UGVs** and combat robots were involved in simulated scenarios of urban warfare (Global Times, 2024).

- **AI in Pilot Recruitment.** The PLA Air Force attaches great importance to AI-based biometric screening of pilot candidates. Such technology analyses biological signals looking for risk factors for all types of health conditions. The compatibility of candidates with advanced aircraft systems is evaluated by the same system, underpinning the entire selection process for prospective pilots.

AI in Hypersonic and Missile Systems. AI assists in the development of hypersonic glide vehicles (HGVs) by optimising trajectory planning and evasion techniques. AI-driven target recognition systems improve the precision of China's missile strike capabilities.

Integration of AI into Commercial Language Models. Experimenting on its AI-enabled system, a research lab under the Strategic Support Force of PLA linked it to commercial large language models like Ernie by Baidu and Spark by iFlyTek. The focus is mainly on developing an understanding of human language and human behaviour by AI, thus improving decision-making and human-machine interactions in military contexts.

AI facilitating military communications. China has launched a moveable 5G base station that can connect up to 10,000 robotic units at once. This allows large-scale deployment of intelligent war machines, such as drones and robotic dogs, by responding to the massive data exchange needs among these units.

Future Trends in China's AI-Driven Military Advancements

The potentials that AI will generate in the future will be further manifested in China's military sphere. China's penchant for "intelligentised warfare" spurs developments in that direction. Key emerging trends include developments as follows:

- *Higher levels of autonomy in weapons systems*. Fields will be filled with autonomous combat drones, unmanned ground vehicles (UGVs), and robotic soldiers.

- *Hypersonic Weapons Enabled by AI*. The application of AI in trajectory optimization and precise targeting for hypersonic glide vehicles (HGVs).

- *Quantum AI and Computing.* The combination of quantum computing and AI for high-level cryptography and military decision making.

- *AI-Integrated Psychological and Cognitive Warfare.* Strategic communications, denied even to the most savvy observers, on social media and even more nefarious kinds of deep fakes.

- *AI-Augmented Human Soldiers.* Development of brain-computer interface (BCI) technology to enhance capabilities of soldiers through AI in battlefield awareness.

Challenges and Considerations

Technological Reliability

- *AI Decision-Making Limitations.* AI is not very good at dealing with unpredictable enemy tactics and complex urban warfare scenarios (CSIS, 2023). PLA researchers do acknowledge AI's imperfection concerning real-time battlefield decision-making (SCMP, 2024). In essence, AI's strength does not quite extend to coping with unpredictable enemy tactics and an urban warfare scenario.

- *Dependence on Data and Communications Infrastructure.* AI robots need an elaborate data connectivity structure, which renders them vulnerable to countermeasures provided by either electronic warfare or cyber disruptions (RAND Corporation, 2023).

- *Assuring reliability and robustness in AI systems across all operational realms is of great importance.* Some anti-drone technologies are said to have been recently tested—their performance issues cast doubt on their reliability, since the testing recommended further refinements. (The Sun, 2024)

Ethical and Legal Implications. The use of autonomous weapons raises new ethical and legal conundrums concerning the very decision-making processes behind their operations. Such machines raise issues surrounding matters of decision-making autonomy, as well as their operation under the international law. The algorithm for AI and autonomous weapons might be biased, which could result in a risk of civilian casualties and misidentifications (SCMP, 2024). As the international community continues to debate AI implications for warfare, and calling for immediate clarity in policies and regulations (RAND Corporation, 2024), exponential proliferation of this technology in modern armies such as the PLA is unabated.

Strategic Stability. The rapid advancement of AI in military applications might obstruct global strategic stability. An increased need or urgency for establishing dialogue and confidence-building measures among major powers exists to reduce risks emanating from military competition driven by AI (RAND Corporation, 2024).

Ethical and Strategic Concerns.

- Autonomous weapons raise concerns over decision-making autonomy and adherence to international laws.

- AI bias in targeting algorithms poses risks of civilian casualties and misidentifications (Carnegie Endowment for International Peace, 2023).

Conclusion

The superfast military modernisation of the PLA with the help of AI and Robotics indicates China's commitment to next-generation warfare and also signifies a fundamental qualitative change in its military capabilities—that would dovetail with China's overall objectives of military modernisation and technological advancement. The application of AI and robotics to autonomous drones, UGVs, naval robots, cyber warfare, logistics, and space operations indicate China's ambitions in the direction of technological superiority. The MCF strategy also supercharges AI with input from both the civilian and defence sectors. It goes without saying that, given the rapid pace of China's AI-inspired military modernisation, it will behoove defence actors across the globe to keep a watchful eye on these advancements in order to unpack the future strategic and security implications.

As these technologies evolve, the PLA's push for intelligentisation will most likely shape emerging military strategies and doctrines. Realistically, addressing these challenges must be prioritised as the integration of AI and robotisation should instead promote security and stability at the regional and global levels. Nevertheless, concerns about strategic stability, ethical challenges, and the reliability of AI remain very important in this context.

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