PLA's Perception about the Impact of AI on Military Affairs*

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Abstract

Advances in artificial intelligence (AI) technologies have intensified the debate within the People's Liberation Army (PLA) about "intelligentized warfare" as a future form of warfare. It is being argued that the change from "informatized warfare" to "intelligentized warfare" could prove to be revolutionary, depending on the degree of AI technology development. In "intelligentized warfare" it is assumed that "human-machine collaborative decision making" will become the norm, whereby AI takes command and makes decisions in a mutually complementary manner with human officers. Furthermore, "intelligentized warfare" also anticipates that the application of AI technologies will lead to significant improvements in unmanned capabilities, resulting in a situation where unmanned systems will take the central role in combat on the actual battle field, with humans retreating from the front lines to rear areas, where they will be responsible for determining strategy and taking command of campaigns. In terms of operations in "intelligentized warfare," in addition to "human-machine collaborative operations" being conducted in a way that achieves synergies between the manned and unmanned platforms working together, it is also noted that the battlefield will expand into "virtual space," including the "cognitive domain" of national leaders and commanders. Within the PLA there is a sense of growing expectation that pressing forward with "intelligentized warfare" will provide an advantage in any future wars.

Introduction

Since the early 2010s there has been a perception in China that future wars will be "informatized warfare" (智能化战争), which has led to vigorous debate on their various aspects, including concept and theory, the nature of strategy, campaigns, and tactics, the elements required for victory, and the requisite direction for military reform. For example, in the *Science of Military Strategy* (2013 ed.) published by the PLA's think-tank, the Academy of Military Science, it is noted that the three essential elements for warfare are materials, energy and information, and goes on to explain that to date, wars have been "mechanized warfare" (机械化战争), in which victory has been won by utilizing materials and energy to cause human and physical destruction to the enemy. However, the same publication emphasizes that the rapid development of information and communications technology (ICT) and the advancement of military applications of ICT have resulted in information becoming of critically high importance in order to win wars of the future.

It also presented the view that wars of the future would become "informatized warfare" (信息化战争), whereby advanced capabilities of information operations are leveraged to conduct efficient joint operations and whereby non-physical means such as cyberattacks would be used to paralyze the enemy's chain of command system.[1] It was against the backdrop of such discussions that the 2015 National Defense White Paper *China's Military Strategy* noted that: "The form of war is accelerating its evolution to informatization," and set out a new military strategy that places "informatized local wars" as the basic point for military struggle.[2]

However, just four years later, in the 2019 National Defense White Paper *China's National Defense in the New Era* it is noted that: "War is evolving in form towards informatized warfare, and *intelligentized warfare is on the horizon*" (italics for emphasis by the author).[3] In other words, China had begun to conceive of a form of future warfare that was not just "informatized warfare," but also included "intelligentized warfare." "Intelligentized warfare" is said to be a "form of warfare that is supported primarily by AI technologies and methods,"[4] and the rapid development of AI technologies would appear to have triggered a vigorous debate in China on "intelligentized warfare." The purpose of this paper is to organize the debate within the PLA concerning the impact that AI could have on future wars, given the importance ascribed to AI as a pillar of "intelligentized warfare." Regarding the debate in China about the impact of AI on the military, there are various pioneering studies, including papers by Elsa B. Kania.[5] These studies carefully analyze discussions in China based on primary sources, and present extremely useful implications. This paper aims to present the author's own understanding of the discussion in the PLA on AI, by focusing on the primary sources from China as in previous studies, while also incorporating as much of the most recent discussions as possible into analyses. Tasks that remain for the future are to engage in comparisons and appraisals with the excellent previous studies and consider the policy implications. The following is largely a consideration of the discussions on AI and "intelligentized warfare" detailed in such publications as *PLA Daily*, the official newspaper of the PLA.

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[1] Military Academic Works, Academy of Military Science, *Zhanlue Xue (erlingyisan nian ban)* [The Science of Military Strategy (2013 Edition)], *Junshi Kexue Chubanshe* [Military Science Press], 2013, pp. 91–92.

[2] The State Council Information Office of the People's Republic of China, *Zhongguo de junshi zhanlue* [China's Military Strategy], *Renmin Ribao* [People's Daily], May 27, 2015.

[3] The State Council Information Office of the People's Republic of China, *Xin shidai de zhongguo guofang* [China's National Defense in the New Era], *Renmin Ribao* [People's Daily], July 25, 2019.

[4] Li Shijiang, Yang Ziming, and Chen Fenyou, *Yi xin linian Yingjie zhinenghua zhanzheng tiaozhan* [Meeting the Challenges of Intelligentized Warfare with New Concepts], *Jiefangjun Bao* [PLA Daily], July 26, 2018.

[5] For example, see the following: Elsa B. Kania, *Battlefield Singularity: Artificial Intelligence, Military Revolution, and China's Future Military Power*, Center for a New American Security, November 2017; Elsa B. Kania, "Artificial Intelligence in Future Chinese Command Decision-Making," SMA Periodic Publication, *AI, China, Russia, and the Global Order: Technological, Political, Global, and Creative Perspectives*, December 2018; Elsa B. Kania, "Chinese Military Innovation in Artificial Intelligence," Testimony before the U.S.-China Economic and Security Review Commission Hearing on Trade, Technology, and Military-Civil Fusion, June 7, 2019; Lora Saalman, "Exploring Artificial Intelligence and Unmanned Platforms in China," Lora Saalman, ed., *The Impact of Artificial Intelligence on Strategic Stability and Nuclear Risk, Vol. 2, East Asian Perspectives* (SIPRI, October 2019), pp. 43–47; Gregory C. Allen, *Understanding China's AI Strategy: Clues to Chinese Strategic Thinking on Artificial Intelligence and National Security*, Center for a New American Security, February 2019; and Yatsuzuka Masaaki, "China's 2019 National Defense White Paper and Intelligentized Warfare," *NIDS Commentary*, No. 105, September 2, 2019.

1. Discussion on the Evolution from "Informatized Warfare" to "Intelligentized Warfare"

There is a vigorous debate ongoing among Chinese strategic researchers about how "intelligentized warfare" should be appended to and positioned in the history to date relating to changes in forms of warfare. Li Shijiang et al of the PLA's National Defense University Joint Operations College are among those who define "intelligentized warfare" as a "form of warfare that is supported primarily by AI technologies and methods," and this group explain the emergence of "intelligentized warfare" as an inevitable consequence of a historical discipline in which advances in science and technology have transformed the nature of warfare. The contention of Li et al, is that advances in science and technology have promoted the evolution of weapons and equipment, bringing about fundamental changes in military formations, operational methods, and military theories, and ultimately leading to a historical transformation in forms of warfare. Their view is that every major advance in science and technology has in turn facilitated a significant change in the military affairs. For example, the invention of gunpowder heralded the "age of hot weapons (firearms)," rendering infantry and cavalry that had been the traditional core military force until that time obsolete, and the advent of the steam engine ushered in the "age of mechanization," which saw the emergence of large-scale "mechanized warfare," including naval vessels, tanks, and aircraft. Li et al observe that just as has occurred in history in the past, "the emergence and military applications of intelligent technologies will significantly alter human cognition and the ideology and modus operandi of warfare, bringing about another major military revolution, with intelligentized warfare taking its place in the theater of war."[6]

Li Minghai of the National Security College of the National Defense University, also argues for the historical inevitability of "intelligentized warfare." Li, who defines "intelligentized warfare" as "integrated warfare based on IoT (Internet of Things) systems that uses intelligentized weaponry and their corresponding strategy on land, sea, air, and space, and electromagnetic, cyber and cognitive domains," argues that the human method of production in any given period has determined the mode of warfare at that time. In other words, in the "agrarian era," when handcrafting was the predominant production method, "cold weapon warfare" using spears and swords was the mode of warfare. In the "industrial era," when mechanization was the predominant production method, "mechanized warfare" using firearms, tanks, aircraft and ships, etc., was the mode of warfare. In the "information age," when the information industry is the major means of production, "informatized warfare" becomes the mode of warfare, whereby information resources and information superiority are the primary factors required to ensure victory in war. In the "intelligent age," in which AI replaces the human brain in making calculations to become the dominant production method, a new mode of warfare, namely "intelligentized warfare" then emerges. Li notes that the advancement of various AI-related technological innovations will "bring about disruptive change to forms of warfare, with "intelligentized warfare" making its debut on the stage of military history."[7]

Just as there are opinions as those noted above that emphasize the discontinuity in the change from conventional forms of warfare to "intelligentized warfare," there are also those who seek to

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[6]   Li, Yang, and Chen, *Yi xin linian Yingjie zhinenghua zhanzheng tiaozhan* [Meeting the Challenges of Intelligentized Warfare with New Concepts].

[7]   Li Minghai, *Zhinenghua zhanzheng zhisheng jili* [Winning Mechanism of Intelligentized Warfare], *Qianxian*, Vol. 2, 2019, p. 35.

identify continuity in the change from the current form "informatized warfare" to "intelligentized warfare." Wang Li of the Academy of Electronics and Information Technology of China Electronics Technology Group Corporation emphasizes that, "The intelligentizing of the military constitutes the inheritance and development of military informatization, and as such represents a strong technological power that will gradually change the form of informatized warfare." Wang Li notes that the first power to achieve a technological breakthrough will be able to dictate the rules of warfare and maintain the dominant position in future wars, and goes on to argue that AI technologies will lead to major breakthroughs in informatization and mechanization. Accordingly, Wang notes the necessity for China to pursue not only the development of informatized technologies, but also focus on the development of "disruptive technologies" such as AI, as a means of "grasping the initiative" in new forms of warfare that will succeed informatized warfare. He observes that "Controlling mechanized and informatized weaponry through intelligent methods will make it possible to maximize the effectiveness of operations."[8]

Furthermore, in a paper by Ren Zehua and Jing Bing of the PLA Army Infantry College published in the *PLA Daily*, the authors note that "intelligentized warfare" was once one of the subcategories of "informatized warfare," together with "digital warfare" and "networked warfare." At the same time, they point out that "intelligentized warfare" is heading towards the ultimate fusion of machine intelligence and human intelligence, and unlike digital warfare, which focuses on the control of individual circuits, and also in contrast to networked warfare, which focuses on network systems, "intelligentized warfare" focuses on "collaborative intelligence" (协同智能) between humans and machines, while at the same time it is "intelligence superiority" (智能优势) that will bring about new advantages in decision-making and actions. They go on to argue that "intelligentized warfare" is "the highest form of informatized warfare, and is an advanced form of warfare that has sublated informatized warfare." They argue that "intelligentization promotes advances in mechanization and informatization, and promoting such 'three-way' fusion and development will make it a major driving force in bringing about rapid progress in the new military revolution."[9]

At the same time there are also views that seek to find a compromise between the two perspectives detailed above. Li Dapeng of the Naval University of Engineering notes on the one hand that because AI belongs in the category of information technology, "intelligentized warfare is inevitably informatized warfare, operating at an even higher level along the developmental trajectory of informatized warfare." On the other hand, he also argues that AI has the potential to bring about revolutionary changes in the military and forms of warfare comparable to "mechanized

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[8] Wang Li, *Rengong zhineng zai junshi lingyu de qintou yu yingyong sikao* [Thoughts on the Penetration and Application of Artificial Intelligence in the Military Field], *Keji Daobao* [Science & Technology Review], Vol. 35, 2017, p. 17.

[9] Ren Zehua and Jing Bing, *Zhinenghua zhanzheng damu xuxu lakai* [The Curtain on Intelligentized Warfare Gradually Raised], *Jiefangjun Bao* [PLA Daily], March 9, 2018. For further arguments on the mutual complementarity of "mechanization," "informatization" and "intelligentization," see Wu Minwen, *Zhinenghua shi xinxihua gaoji jieduan* [Intelligentization Is the Advanced Stage of Informatization], *Jiefangjun Bao* [PLA Daily], November 14, 2019; Zheng Yufu, *Wuqi zhuangbei jixiehua, xinxihua, zhinenghua, zenme rong* [How to Integrate Weapons and Equipment Mechanization, Informatization, and Intelligentization], *Jiefangjun Bao* [PLA Daily], October 10, 2019; and Yuan Yun, Guo Yonghong, and Bai Guangwei, *Jixiehua, xinxihua, zhinenghua, ruhe ronghe fazhan* [How to Integrate the Development of Weapons and Equipment Mechanization, Informatization, and Intelligentization], *Jiefangjun Bao* [PLA Daily], September 12, 2019.

warfare," "informatized warfare," and nuclear warfare, but that whether this will be successful depends on the future development of AI.[10] Given the strong interlinkage between AI technologies and information technologies, while recognizing the continuity in the transition from "informatized warfare" to "intelligentized warfare," if emphasis is placed on the potential for AI technologies to bring about "revolutionary" change, the possibility cannot be ignored of discontinuous changes occurring between the combat aspects of "informatized warfare" and those of "intelligentized warfare." This argument appears to be the largest common denominator when analyzing debate within the PLA regarding the historical positioning of "intelligentized warfare."

2. Transformative Effect of AI on Command Structures and Decision Making

Discussion is taking place that in "intelligentized warfare" brought about by the development of AI, the forms of battle command and operational decision making will be very different from those of today. For example, Xu Chunlei et al emphasize that in light of the fact that AI is deeply related to all command and decision-making processes in "intelligentized warfare," command and decision making will change from the conventional format in which humans are assisted by computers, to a "command brain" (指挥大脑) model in which humans and machines are integrated. In other words, command information systems in "informatized warfare" are "external tools of the human brain," which supplement commanders' decisions through the collection, management, processing and transmission of information. In contrast, command systems in future "intelligentized warfare" will function as an "extension of the human brain," in which the "command brain" is fused and integrated with the human brain, and "human-machine joint decision making" will become the predominant method for command and decision making.[11]

The abovementioned Li Minghai argues that the future transition of decision making from "human decisions" to "intelligentized decisions" will significantly enhance operational activities. According to Li, "intelligentized decisions" are comprised of three types of decision making: human-machine, cloud brain, and neural networks. Human-machine decision making is where humans and machines share roles rationally and cooperate to elicit the best solution to a problem. The human brain has superior creativity, flexibility and initiative, whereas machines have the advantages of speed, precision and imperviousness to fatigue. While high-level decisions requiring a certain degree of artistry will be made by humans, the computational processing of big data will be conducted by machines. Moreover, in "intelligentized warfare" of the future, widely dispersed operational units are connected by the "cloud brain," which takes the central role in all kinds of information gathering, as well as being a central presence in command and control. This "cloud brain" is capable of integrating various operational resources and providing advanced support for various operational activities. Even in the event of a cyberattack, the network can be quickly reconfigured and retain its decision-making capabilities. Furthermore, Li also observes that assuming there are further advances in neural network technologies, it could be anticipated that AI will acquire the ability to deepen self-awareness and make strategic decisions, leading to the

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[10] Li Dapeng, *Women gai ru yingdui zhinenghua zhanzheng tiaozhan* [How Should We Respond to the Challenges of Intelligentized Warfare?], *Zhongguo Qingnian Bao* [China Youth Daily], April 4, 2019.

[11] Xu Chunlei, Yang Wenzhe, and Hu Jianwen, *Zhinenghua Zhanzheng, bian hua zai nali* [Changing Features of Intelligentized Warfare], *Jiefangjun Bao* [PLA Daily], January 21, 2020.

realization of "neural network decisions" entirely without human involvement.[12]

A paper by Dong Jianmin published in *China National Defense Daily* argues that with the coming of the "intelligentized warfare" era, the conventional vertical command structure from high command down to units in the field would no longer be viable, and "human-machine collaborative decision making" would become the main method of command and decision making. This is because the human brain and sensory organs are incapable of processing and understanding large volumes of instantaneously changing information about the battle situation, meaning that decisions that rely solely on commanders are delayed and ultimately rendered of little use. Dong's view is that unless an "intelligentized" decision-making support system is in place that autonomously encourages commanders to make decisions based on the latest battlefield situation analysis, it would be impossible to ensure command and decision-making superiority.[13]

There is also debate on the extent to which AI should be involved in command and decision making in "intelligentized warfare" of the future. Yuan Yun et al of the PLA's Academy of Military Science classify command and decision making into three levels of tactics, campaigns, and strategy, and argue that above all in command and decision making at the tactical level it is likely that AI has a central role to play. With regard to tactical-level command, including the selection of attack targets and permission to launch attacks, Yuan et al note that AI has an overwhelmingly faster reaction time than that of humans and the transfer of such authority to AI is accelerating. They point out that in the future, in tactical-level actions such as air defense combat, missile defense, and network defense, "intelligentized" command and control systems should be given command authority, and that failures in command and control arising from human reaction speeds that are too slow should be avoided. At the same time, they highlight that even in tactical-level operations humans should be given direct command in cases of high political sensitivity, or where there are special objectives, or when there is a complex operational environment. Conversely, in decision making at the campaign level, in terms of such matters as planning of operations, assignment of duties, selection of targets and allocation of resources, it is noted that such authority could partially be transferred to AI. It is anticipated that utilizing AI systems will help to conserve resources and expedite command and decision making at the campaign level. With regard to decisions on the strategic level it is emphasized that humans should retain a firm grip on command relating to personnel, the timing of when to start and end combat, and the control of weapons capable of causing large-scale casualties. Yuan et al maintain the view that in command and control at the strategic level the role of AI should remain at an auxiliary level, and even if AI technologies improve rapidly in the future it will still be necessary for humans to retain final decision-making authority.[14]

Wang Ronghui of the Army Academy of Armored Forces argues that even if there are developments in military applications for AI, it is humans capable of subjective actions who will continue to take the initiative in warfare, and will continue to be the substantive and decisive

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[12] Li Minghai, *Zhinenghua zhanzheng de zhisheng jili bian zai nali* [Where the Winning Mechanism of Intelligentized Warfare Has Changed], *Jiefangjun Bao* [PLA Daily], January 15, 2019.

[13] Dong Jianmin, *Weilai zhanzheng jiang daxiang duozhiquan* [Future Wars Will Be Fought to Capture the Dominance of Intelligence], *Zhongguo Guofang Bao* [China National Defense Daily], February 13, 2019.

[14] Yuan Yun, Gao Dongming, and Zhang Yujun, *Ye tan zhinenghua zhihui "zizhu juece"* [Also Discuss "Autonomous Decision Making" by Intelligentized Command], *Jiefangjun Bao* [PLA Daily], April 18, 2019.

factor in "intelligentized warfare." Wang posits that big data and technologies such as deep learning and smart chips represent the fruit of human wisdom, and machines are incapable of surpassing human creativity, powers of thought, and the ability to respond flexibly. He notes that it is humans, who possess such abilities, who are the "arbiters, designers and commanders of warfare," and who remain in a core and dynamic position in the so-called OODA (Observe-Orient-Decide-Act) loop.[15]

3. Unmanned Systems as the Main Type of Weaponry and Equipment

As applications of AI into weaponry and equipment have advanced, so too has debate increasingly come to coalesce around the view that in "intelligentized warfare" unmanned weaponry and equipment (hereinafter referred to collectively as "unmanned systems") will play a major role on the battlefield. According to Li Fenglei of the China Aerospace Science and Industry Corporation's Third Institute, in future wars it is unmanned systems that will replace soldiers and conventional equipment as the primary operational force. A major characteristic of "intelligentized warfare" will be "machine-led warfare," in which humans will retreat from the frontlines to the rear areas, while retaining responsibility for deciding strategy and commanding the campaign, and machines will advance to the frontlines to become the primary executor of the tactical aspects of war. Furthermore, humans in the rear areas will control the various dispersed platforms, meaning that the "Internet of Everything" will be required to link these platforms. In addition, a "game of algorithms" (算法致胜), whereby victory in battle is determined by superiority over the algorithms that control AI capabilities, will become the key to victory or defeat. Li's view is that it is unmanned systems, featuring all aspects of "machine-led warfare," "Internet of Everything" and "game of algorithms" that will become the main force in the "intelligentized warfare" of the future.[16]

"Swarm attacks" are attracting interest as a form of combat utilizing unmanned systems. According to Lan Shunzheng, a research fellow at the Yuanwang think tank, as the cost of making unmanned systems lighter and more miniaturized decreases as a result of advances in 3D printer technologies, this will enable mass production of such unmanned systems. Furthermore, utilization of AI and other technologies could enable the implementation of swarm attacks, with unmanned systems increasing in number from several dozen to hundreds and in some cases thousands of units. Furthermore, a swarm constituted of so many unmanned vehicles could continue to implement its mission even if a part of the swarm were to be disabled or destroyed, thus ensuring extremely high stability. Moreover, as a swarm is composed of various unmanned vehicles capable of performing various differing missions, from reconnaissance and surveillance to electronic combat, attack and evaluation, this also gives a swarm a high degree of adaptability on the battlefield. In addition, given that high-volume, low-cost unmanned systems could be expected to be highly adept at

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[15] Wang Ronghui, *Toushi weilai zhinenghua zhanzheng de yangzi* [Perspective on the Future of Intelligentized Warfare], *Jiefangjun Bao* [PLA Daily], April 30, 2019. For arguments that emphasize the importance of the human role in "intelligentized warfare," see also Fu Wanjuan, Yang Wenzhe, and Xu Chunlei, *Zhinenghua zhanzheng, bubian zai nali* [Unchanging Features of Intelligentized Warfare], *Jiefangjun Bao* [PLA Daily], January 14, 2020 and Chu Li, *Zhinenghua zhanzheng buhui rang ren zoukai* [Intelligentized Warfare Will Not Send People Away], *Renmin Ribao* [People's Daily], September 17, 2019

[16] Li Fenglei, Lu Hao, Song Chuang, and Hao Mingrui, *Zhinenghua zhanzheng yu wuren xitong jishu de fazhan* [Intelligentized Warfare and the Development of Unmanned Systems Technology], *Wuren Xitong Jishu* [Unmanned Systems Technology], Vol. 2, 2018, p. 17.

neutralizing the high-cost offensive weapons of the opposing force, it has also been noted that this could make it possible to impose significant defensive costs on the enemy.[17]

A paper published in the PLA Daily describes the essential nature of a swarm operation in this way: "An operational model in which unmanned intelligentized operational platforms realize autonomous swarm operations through self-organization, self-adaption, and self-communication among platforms under the control of swarm operational algorithms through IoT intelligentized systems." The same paper goes on to explain the superiority of swarm operations over conventional "precision operations" that rely on expensive high-tech weapons such as precision-guided weapons. Firstly, it points out that swarm operations by unmanned systems are cheaper than air-to-ground missiles used in conventional operations, making it possible to reduce the costs required for an attack. Secondly, it notes that as multiple unmanned vehicles are used in a swarm attack, even in the event that the swarm is partially destroyed, it would still be possible to achieve the desired operational targets. Thirdly, it notes that given that swarm attacks conducted by unmanned systems are networked and widely dispersed operations, this fact ensures a high survivability from enemy attacks and ease of penetration of enemy defense networks.[18]

There are also various discussions underway about the assumed form of operations using unmanned systems. For example, on the role of unmanned systems in maritime operations, one commentary piece in *China National Defense Daily* offers the following analysis. Currently, the primary means of implementing situational awareness in maritime warfare is through the use of early warning aircraft and anti-submarine patrol aircraft piloted by humans. However, the loss to operations would be immense if such aircraft were to be shot down and would have a gravely adverse impact on situational awareness and the judgment of the commanding officer. However, if unmanned systems could replace manned aircraft and be employed as a means of "tactile" situational awareness, it could be expected that they would collaborate with manned aircraft to detect and track enemy vessels more safely and efficiently. In addition, it is noted that the utilization of unmanned systems in the electromagnetic domain could also be envisaged. For example, unmanned systems for electronic jamming could be deployed in enemy areas to support the operations of manned aircraft, with unmanned electronic decoys being flown as a means of deceiving enemy detection systems. Flying unmanned systems fitted with communications relay functions at high altitudes for extended periods would make it possible to secure communications in maritime warfare and this type of system could also be utilized for such purposes as guiding long-range missiles.[19]

A paper in the *PLA Daily* proposes three methods for the use of miniaturized unmanned systems on the battlefield. The first method of use is "decapitation (assassination) actions." Miniaturized unmanned attack craft could be fitted with explosive devices for the purposes of mortally wounding people, creating a wholly new means of implementing assassination actions.

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[17] Lan Shunzheng, *Wurenji neng zai duoda chengdu shang gaibian weilai zhanzheng xingtai* [The Extent to Which Drones Can Change the Forms of Future Warfare], *Shijie Zhishi* [World Affairs], Vol. 21, 2019, p. 54.

[18] Chai Shan, *"Fengqun"zuozhan daodi gaibian le shenme* [What "Swarm" Operations Have Changed], *Jiefangjun Bao* [PLA Daily], July 16, 2019. For another study on swarm attacks by unmanned systems, see also Chu Weiwei and Li Huan, *Wurenji jiqun zuozhan de zhuyao yangshi* [Major Patterns of UAV Cluster Operations], *Jiefangjun Bao* [PLA Daily], January 23, 2020.

[19] Shu Nong, *Wurenji ping shenme tuidong haizhan biange* [What Makes Drones Drive Changes in Naval Warfare], *Zhongguo Guofang Bao* [China National Defense Daily], August 27, 2019.

In comparison to missile attacks, and conventional means of assassination such as special operations, etc., assassinations using miniaturized unmanned attack systems have the advantage of being simple, accurate, safe, economical and effective, and could become an important part of assassination operations in future warfare. The second method of use is "intelligence gathering." Miniaturized unmanned spy systems are fitted with miniaturized intelligence devices and are tasked with various operations, such as listening in, and taking photos and videos, meaning that they are capable of penetrating enemy bases and command posts to acquire important audio, image and video intelligence. Third method of use is "enemy territory reconnaissance." An unmanned reconnaissance system would be fitted with day and night photography equipment to conduct observation and surveillance over the battlefield. In comparison to conventional methods of reconnaissance, including satellites, reconnaissance aircraft and battlefield surveillance radar, a miniaturized unmanned reconnaissance system would have the advantage of being small, multifunctional and possessing stealth characteristics, meaning that it could fulfil some of the monitoring and surveillance duties required on the battlefield, and supplement conventional reconnaissance methods. Furthermore, such systems could also demonstrate their capabilities in such scenarios as reconnaissance inside buildings in urban warfare.[20]

4. Expanded Combat Domains in "Intelligentized Warfare"

Debate is ongoing about how "intelligentized warfare," in which advances in AI technologies mean that unmanned systems will play a central role on the battlefield, might also transform the nature of operations. Zhou Xiaocheng and Gao Dongming argue that advances in AI technologies will mean that "human-machine joint operations" will become an important means of waging war in the future. Unmanned systems of the future will be able to automatically identify attack targets by utilizing "intelligent sensing" capabilities to rapidly and accurately collect and analyze information about the attack targets. Furthermore, they will also possess "intelligent decision" capabilities by analyzing various intelligence obtained from the battlefield, using big data and deep learning technologies to make optimal decisions. In addition, through the utilization of AI, unmanned systems of the future will also have enhanced "precision kill" capabilities, being able to search autonomously for targets, autonomously analyze surveillance and reconnaissance information, and autonomously identify friend or foe to attack targets precisely. Zhou and Gao state that it is these new kinds of capabilities of unmanned systems that will greatly enhance the efficiency of future "human-machine joint operations."[21]

Furthermore, Zhao Xiangang and You Bitao also observe that future operations will be characterized by "human-machine integration." Their view is that as it is anticipated that in future wars unmanned forces will become the main actors in operations, carrying out missions jointly with manned forces and sometimes executing missions independently, this will transform the relationship between humans and machines from one of a "master-servant" relationship, in which humans dominate machines, to a "partner" relationship, in which humans and machines work to complement each other. They argue that by implementing integrated operations through

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[20]   Li Zhanghai, Lyu Qibing, and Jin Rong, *Weixing wurenji you he yongwu zhi di* [What's the Use of Micro Drones?], *Jiefangjun Bao* [PLA Daily], February 18, 2020.

[21]   Zhou Xiaocheng and Gao Dongming, *Renji xietong "zhi" zai bide* [Human-Machine Synergy "Intelligence" Is the Must], *Jiefangjun Bao* [PLA Daily], December 6, 2019.

a "unified new style operations system" that fuses unmanned and manned operational platforms, the capabilities of both would be simultaneously enhanced, making it possible to improve overall joint operational capabilities.[22]

It has also been pointed out that in an "intelligentized warfare" where unmanned systems become the main actors on the battlefield, the spaces or domains where operations are conducted will greatly expand. Liu Haimin and Guo Qiucheng note that with new technological advances the operational space for future warfare will expand to integrate multiple dimensions, including land, sea, air, space, electromagnetic, cyber, and psychological. They go on to note that the domain of operations will also change from a single domain to deeply integrated physical, information, cognitive, and social domains, and priorities in the struggle for control will shift from information, maritime, and aviation to intelligence, space, and networks. Furthermore, given that unmanned systems can overcome human mental, physiological and physical limitations and fulfil difficult missions in challenging environments, including extremes of heat and cold, and high pressure, oxygen-free, toxic and radioactive situations, Liu and Guo note that they can execute operations no matter what the time or space.[23]

Xu Yan and Fu Wanjuan observe that in future wars the spaces where control is contested will expand from "real spaces" to include "virtual spaces." In traditional warfare, control is contested in physical real spaces, such as on land, sea, and in the air and in space. However, progress in science and technology means that the struggle for control will also take place in the future in intangible "virtual spaces" including information, cyber, electromagnetic and psychological spaces. Accordingly, in future wars, at the same time that the "supremacy in real spaces" will be contested, such as for the "supremacy in land, sea, air and space," so too will the struggle for "supremacy in virtual spaces" gain importance, including the "supremacy in information, electromagnetic, cyber and psychological domains." Xu and Fu note that assuming the continued progress of technology, new technologies in "virtual spaces" and the new operational capabilities they in turn create will become a new strategic key point.[24]

Among the new domains in "intelligentized warfare" many people note the importance of the "cognitive domain." For example, Li Yi notes that as the military applications of AI technologies have broadened, military opposition has already expanded from the "physical battlefield" to the "cognitive battlefield" and from the tangible battlefield to the intangible battlefield, and the "cognitive space" that is comprised of human mental and psychological activities has become a new space for operations. Future wars will be fought in the three domains of physical, information and cognitive space, but it is in the cognitive space where, by using means such as cultural communications and guiding public opinion to degrade the enemy's cognitive capabilities, while at the same time defending one's own cognitive capabilities, the aim is to gain the initiative and control in counter-operations in the cognitive space. The core concept behind this "cognitive confrontation" is to eliminate the enemy's ability to resist by eliminating or diminishing their

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[22] Zhao Xiangang and You Bitao, *Wuren zuozhan ruhe sisu zuozhanguan* [How Unmanned Combat Is Reshaping the Operational View], *Jiefangjun Bao* [PLA Daily], July 11, 2019.

[23] Liu Haimin and Guo Qiucheng, *Zhinenghua wuren zhuangbei gaibian le shenme* [What Has Changed with Intelligent Unmanned Equipment?], *Jiefangjun Bao* [PLA Daily], July 23, 2019.

[24] Xu Yan and Fu Wanjuan, *Xinxihua zhanzheng ying you zemyang de zhiquanguan* [What Is the View of Dominance for Informatized Warfare?], *Jiefangjun Bao* [PLA Daily], September 17, 2019.

commanders' decision-making capabilities and will to resist.[25]

Dong Jianmin also cites "cognitive combat" as one of the new operational methods in "intelligentized warfare." His argument is that in "intelligentized warfare" of the future, by making human cognition and thoughts operational targets and influencing the enemy's cognitive systems through methods of controlling the functions of the mind, by analyzing the key features of enemy actions and operational decisions in real time, and by controlling the enemy's command center through computer encoding, the goal is to control the enemy's thoughts and consciousness, with the ultimate aim of seizing the "cognitive supremacy." Dong also points out that through the unceasing evolution of new technologies, "blinding," "deafening," and "paralyzing" the enemy will become a new operational method in "intelligentized warfare."[26]

5. Direction of Debate on the Impact of AI

As can be seen from the above, a vigorous debate is taking place within the PLA on the impact of AI on the military, focused around "intelligentized warfare" as a central theme. As far as can be perceived from such discussions, it would appear that the understanding is that developments in AI-related technologies will have an extremely significant impact on the military, giving rise to a new form of warfare, termed "intelligentized warfare." For the PLA, which perceives in the human history surrounding warfare the law that newly emergent technologies have brought about decisive changes in the forms of warfare, AI is understood to be just such a new technology that will bring about historical changes in warfare. There appear to be no arguments that attempt to suggest that AI will have a minor impact on the military.

On the other hand, with regard to the relationship between "intelligentized warfare" and "informatized warfare," which is currently what the PLA officially envisions as the future form of warfare, as detailed above opinion is divided. In other words, there are those with the view that the rise of "intelligentized warfare" will bring about revolutionary change completely different in nature to "informatized warfare," whereas there are also those who consider that "intelligentized warfare" will emerge as the result of the advanced development of "informatized warfare," along with progress in information and communications technology, including AI. One reason that can be cited as to why these differing views have emerged is that there are varying outlooks on the extent and speed of future developments in AI. If the assumption is that AI will advance in a relatively short period to the extent that it replaces or surpasses human intelligence, then it is anticipated that the coming "intelligentized warfare" will be a form of warfare of a wholly different dimension to "informatized warfare." On the other hand, if it is assumed that advances in AI will be gradual and that AI will remain as an auxiliary to human intelligence, then continuity can be perceived in the change from "informatized warfare" to "intelligentized warfare."

What will be noteworthy in terms of the future direction for this debate is how China will officially refer to "intelligentized warfare." In the National Defense White Paper *China's Military Strategy* published in May 2015, "informatized local wars" were covered in considerable detail. In addition, in October 2017, at the 19th Chinese Communist Party (CCP) National Congress,

[25]   Li Yi, *Renzhi duikang: Weilai zhanzheng xin lingyu* [Cognitive Confrontation: New Domain of Future Warfare], *Renmin Ribao* [People's Daily], January 28, 2020.

[26]   Dong Jianmin, *Zhinenghua zhanzheng, ni zhunbei hao le ma?* [Are You Ready for Intelligentized Warfare?], *Zhongguo Guofang Bao* [China National Defense Daily], June 12, 2019.

the goals for building the army were stated as follows: "[We will] see that, by the year 2020, mechanization is basically achieved, [and] IT application has come a long way," "We will make it our mission to see that by 2035, the modernization of our national defense and our forces is basically completed," and "by the mid-21st century our people's armed forces have been fully transformed into world-class forces."[27] From now, if debate within the PLA on the relationship between "informatized warfare" and "intelligentized warfare" were to converge, it would be likely that a more concrete policy to respond to "intelligentized warfare" and position it as part of the long-term goals for building the military would be set out in some kind of official document, such as the National Defense White Paper, or a report to the CCP National Congress.

In debates on the impact that AI would have on command and decision making in "intelligentized warfare," there is a prevailing view that envisions the emergence of a mutually complementary command and decision-making system between humans and AI, given the increasing need to utilize the capacity of AI to surpass human capabilities. On the other hand, there are also differences of opinion relating to how roles should be divided between humans and AI in command and decision making. While there are some arguments that as the development of AI technologies progresses, AI should be used at higher levels of command and decision making, it appears that there is still a firmly entrenched view that humans should continue to have the final say at these high levels of command and decision making. However, debate on this point is ongoing and no consensus has yet been reached. This lack of consensus among commentators is something that can be perceived from the fact that there is still no fixed term to describe cooperation between humans and AI in command and decision making, with terminology ranging from "human-machine joint decision making" (人机共同决策) to "human-machine mixed decisions" (人机混合决定) and "human-machine joint decisions" (人机共同决定). If a shared direction could be found for the ideal form of human-AI cooperation in command and decision making as envisaged in "intelligentized warfare," the terminology would also be expected to naturally become more consistent.

In terms of the impact that AI would have on weaponry and equipment, suffice it to say that there is a shared understanding that unmanned systems will take on a leading role on the battlefield. A specific image is held of "intelligentized warfare" as advanced joint operations between unmanned systems and humans, whereby through the application of advanced AI, intelligence gathering and analytical capabilities on the battlefield are enhanced, and in some cases unmanned systems capable of making autonomous decisions about the optimal actions to take engage in combat on the front lines, while humans provide instructions and support from rear areas. Many commentators have also pointed out that the domains in which combat takes place are likely to expand as unmanned systems with capabilities surpassing the limitations of humans are brought to the front lines.

In terms of the expansion of combat domains in "intelligentized warfare," in addition to physical domains such as land, sea, air and space, non-physical domains such as cyber, electromagnetic, and cognitive are of increasing importance, and above all there is perceptibly strong interest in operations that gain victory by disrupting the enemy's operational capabilities and will to fight, by establishing control in the "cognitive domain." Debate in the PLA is leaning

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[27]   *Juesheng quanmian jianshe xiaokang shehui, Duoqu xin shidai zhongguo tese shehui zhuyi weida shengli* [Secure a Great Victory of Socialism with Chinese Characteristics for the New Era in China's Endeavor to Build a Moderately Prosperous Society in All Aspects], *Renmin Ribao* [People's Daily], October 28, 2017.

towards AI technologies being also utilized in non-physical domains, including the "cognitive domain," and given the views held in the PLA on the so-called "winning without fighting" from *The Art of War*, and the concepts of the "Three Warfares" and "Unrestricted Warfare," one point that will need further attention is whether or not the PLA will devise any kind of operations that use AI in non-physical domains.

If one were to make a general judgement concerning the impact of AI on the military, or to put it another way, the direction for the coming of "intelligentized warfare," it could be said that a common view is in the process of being formed within the PLA.[28] This is likely linked to the expression used in the latest National Defense White Paper that "intelligentized warfare is on the horizon." On the other hand, there are no discernible signs that specific preparations are being made on the assumption of "intelligentized warfare," such as the formation of new units or the deployment of weaponry and equipment. The PLA, while closely observing development trends in AI technologies, is expected to further deepen debate on "intelligentized warfare," while for the time being focusing its efforts on realizing the current military strategy of winning "informatized local wars."

Conclusion

This paper has reviewed the various arguments within the PLA to date concerning the impact of AI on the military. Many such arguments are predicated on the view that developments in AI technologies will herald the era of "intelligentized warfare," and express the expectation that in wars of the future China will be able to demonstrate superiority over other nations by promoting the development of AI, big data, and unmanned systems technologies, etc., using them for command and decision making in war, promoting the use of unmanned weapons and equipment, and expanding operational domains.

On the other hand, there are also observations about the challenges facing "intelligentized warfare." For example, although it is anticipated that human casualties will be reduced in "intelligentized warfare" as unmanned systems are deployed in combat, it is noted that there is a possibility that this point could lower the threshold for political leaders when making a decision to go to war.[29] Another possibility to be pointed out is that AI, which relies on algorithms configured under a set of predetermined conditions, may have difficulty in responding flexibly to unexpected situations, or may be influenced by uncertain information or misinformation planted by enemies to make erroneous judgments.[30]

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[28] Asano Ryo notes that in the debate within the PLA on "intelligentized warfare" there are points of difference between the proactive theorists and the more cautious practitioners. Asano Ryo, "Chugoku no Chinoka Senso" [China's Intelligentized Warfare], *Boeigaku Kenkyu* [Defense Studies], Vol. 62 (March 2020), pp. 19-40.

[29] Zhao Xiangang and Liu Xiaoxing, *Wuren zuozhan ruhe chongji zhanzheng lunli* [How Unmanned Operations Impact the Ethics of Warfare], *Jiefangjun Bao* [PLA Daily], November 14, 2019 and Chou Hao and Liang Kui, *Chuantong zhanzheng zhisheng jili jiang bei dianfu* [The Winning Mechanism of Traditional Warfare Will Be Overturned], *Jiefangjun Bao* [PLA Daily], November 8, 2018.

[30] Yan Xiaofeng, *Xunzhao rengong zhineng xin tupodian* [Finding New Breakthrough Points in Artificial Intelligence], *Jiefangjun Bao* [PLA Daily], October 15, 2019; Zeng Zilin and Zou Li, *Jinfang zhinenghua zhanzheng de suanfa wuqu* [Beware of the Algorithmic Misconceptions in Intelligentized Operations] *Jiefangjun Bao* [PLA Daily], April 25, 2019; and Wang Chunfu, *Rang junshi zhinenghua buru kexue fazhan guidao* [Let the Military Intelligentization Join the Track of Scientific Development], *Jiefangjun Bao* [PLA Daily], March 26, 2019.

While recognizing such challenges, China is nonetheless moving forward with steady preparations for the coming "intelligentized warfare." The Chinese government has set the target of leading the world in the AI sector by 2030 and national research and development efforts are being advanced.[31] Development of unmanned systems that are expected to be the core weaponry in "intelligentized warfare" is also continuing, and various such systems were displayed at the military parade to mark the 70th anniversary of the founding of the nation.[32] By staying ahead of other countries in the development of new technologies such as AI and unmanned systems and their military applications, it is thought that China aims to build "world-class forces" that possess overwhelming superiority in the era of "intelligentized warfare."

(National Institute for Defense Studies)

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[31] State Council of the People's Republic of China, *Xin yidai rengong zhineng fazhan guihua* [The Development Plan on the New Generation of Artificial Intelligence], July 8, 2017.

[32] See Tanaka Saburo, "2019-nen Kokkeisetsu de Koji! 'Shinsokuka' Hotai" [Showing off the 'Informatized Unit' on National Day 2019!], *Gunji Kenkyu* [Japan Military Review], April 2020, pp. 81-91.