The PLA and Intelligent Warfare: A Preliminary Analysis

Kevin Pollpeter and Amanda Kerrigan

With contributions by Andrew Ilachinski

Abstract

The widespread adoption of artificial intelligence (AI) and autonomous weapon systems portends a new revolution in military affairs. The People's Liberation Army (PLA) is now conceptualizing a future battlefield environment dominated by AI and autonomy, which it calls "intelligent warfare." This paper explores the PLA concept of intelligent warfare, according to articles by writers from the People's Republic of China (PRC). It concludes that PRC discussions of intelligent warfare reflect an ongoing debate over the nature and effects of the widespread use of AI and autonomy in warfare. Despite this ongoing debate, the PLA can be expected to adopt the use of AI and autonomy even as it explores the most appropriate concept of operations. PRC discussions of intelligent warfare suggest that the US military should begin preparing to face a PLA made more effective through the widespread adoption of AI and autonomy.

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M.Kivlehan-Wise

Maryanne Kivlehan-Wise
Director, China Studies Programs
CNA China & Indo-Pacific Security Affairs Division

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Executive Summary

The widespread adoption of artificial intelligence (AI) and autonomous weapon systems portends a new revolution in military affairs. The People's Liberation Army (PLA) is now conceptualizing a future battlefield environment dominated by AI and autonomy, which it calls "intelligent warfare." This paper explores the PLA concept of intelligent warfare, according to articles by writers from the People's Republic of China (PRC). It addresses the following questions, based on a survey of 52 articles published between October 2017 and December 2020 by media outlets affiliated with the Chinese Communist Party, PRC government, and PLA.

- How do PRC writers characterize intelligent warfare?
- How do they envision intelligent warfare?
- How do they characterize future battlespaces, and how do they think humans and machines might interact?
- What implications do PRC writers discuss that may result from intelligent warfare?
- What are the implications for the US military?

Characteristics of intelligent warfare

Most PRC writers do not explicitly define *intelligent warfare,* but describe it as follows:

- A new and advanced stage of warfare based on AI and autonomy
- A combination of human and machine intelligence
- The extensive use of AI in all military applications

PRC writers emphasize the importance of data, algorithms, and computing power to intelligent warfare.

- *Data.* PRC writers stress that data are the foundation of intelligent warfare. Writers call data the "new oil" and big data the "most important resource" in intelligent warfare.
- *Algorithms.* The importance of algorithms to intelligent warfare is related to the central role of AI. Some PRC writers envision that warfare will become a contest between competing algorithms.

- ***Computing power.*** PRC writers view real-time computing of large amounts of data as essential for intelligent warfare.

PRC writers envision a hybrid command and control system involving humans and machines.

- Most PRC writers envision humans remaining in command of autonomous systems, especially at the strategic level, while exerting only limited control of machines at tactical levels.

- Many PRC writers seemed to be influenced by Marxist and Maoist teachings that humans will remain the most decisive factor in war. These writers make several arguments:
  - No matter how advanced intelligent weapons and equipment become, they will still require human innovation, design, production, and management.
  - War is still a conflict between people, and war is ultimately about the ability to influence a human enemy.
  - Machines cannot replace the ingenuity, creativity, and flexibility of humans.

- A minority of PRC writers contend that over time machines will completely replace humans because of the extreme speed and complexity of future warfare.

PRC writers conclude that intelligent warfare will expand the battlespace.

- PRC writers argue that AI and autonomy will expand warfare into outer space, the deep sea, and the polar regions, where humans cannot easily operate.

PRC writers conclude that the cognitive domain will become more important in intelligent warfare.

- PRC writers argue that militaries will seek to influence an adversary's perceptions through the denial, degradation, and manipulation of data and algorithms and the denial and degradation of computing systems.

PRC views of the implications of intelligent warfare

PRC writers conclude that AI will increase the speed and effectiveness of military operations.

- PRC writers argue that intelligent warfare will bring about an acceleration of the entire observe, orient, decide, act (OODA) loop process from intelligence collection to transmittal, processing, and decision-making.

Some PRC writers conclude that AI will facilitate greater first mover advantage.

- Some PRC writers argue that the increased effectiveness of AI and autonomy will enable rapid strike capabilities that could facilitate first strikes, including preemption.

Some PRC writers conclude that AI will increase the likelihood of war.

- According to some PRC writers, the prominent use of lower cost robotic systems will increase the likelihood of war by reducing its human and economic costs.

- Some PRC writers also conclude that low-cost robotic systems and the increased effectiveness of AI and autonomy may increase the likelihood of war by enabling weaker countries to "even the odds" against more powerful adversaries.

PRC writers conclude that AI and autonomous systems have weaknesses.

PRC writers discuss three types of vulnerabilities of AI and autonomous systems:

- ***Vulnerability to attack and destruction.*** AI and autonomous systems rely on electricity, information networks, and command centers. An attack on any of these elements can degrade their normal operation.

- ***Vulnerability of data.*** AI systems may be unable to cope with superfluous or corrupted data. Because of the shortcomings of deep-learning algorithms, AI systems based on big data have inherent defects in interpretability and credibility and are thus "extremely vulnerable to attacks."

- ***Inflexibility.*** Based on current technology levels, AI can only solve problems within a specific range and lacks the ability to respond effectively to new situations.

PRC writers conclude that AI and autonomy present new ethical issues.

PRC writers discuss three main ethical issues pertaining to the wartime use of AI and autonomy:

- ***Indiscriminate killing.*** AI and autonomous systems may be less effective at distinguishing between civilians and the military.

- ***Numbness toward killing.*** PRC writers argue that research has shown that people become bolder and more violent in a virtual world because they cannot experience the fear or pain of death.

- ***Accountability for wartime actions.*** PRC writers highlight the complexity of assigning accountability for wartime actions resulting from the use of AI and autonomy. Issues concern the many actors involved in the manufacture and use of autonomous weapons and the varying levels of autonomy these types of weapons may have.

Conclusions

PRC discussions of intelligent warfare recognize AI and autonomy as important to future warfare.

- Articles surveyed for this report suggest that the PLA is contemplating how best to integrate AI and autonomy into its operations.

PRC discussions of intelligent warfare reflect an ongoing debate over the nature and effects of the widespread use of AI and autonomy in warfare.

- The differing opinions on the nature, conduct, and implications of intelligent warfare found in the dataset collected for this report suggest that the PLA has yet to reach an official understanding of the fundamental attributes of intelligent warfare.

- The development of a doctrine for the integration of AI and autonomy into PLA warfighting would appear to be dependent on first reaching a consensus on those fundamental attributes.

PRC writers may envision AI and autonomy as providing capabilities to defeat the United States.

- Assessments that AI and autonomy will enable weaker militaries to defeat stronger militaries suggest that writers may view AI and autonomy as new technologies that could play a significant role in defeating the US military.

- Although several articles argue that the development of AI and autonomous technologies can allow the PLA to catch up with or surpass the US military technologically, no article surveyed for this report argued that AI and autonomy should be used to compensate for the type of PLA deficiencies that cast doubt on the professionalism of the PLA officer corps, such as the "five incapables."

PRC writers argue for some degree of human control of autonomous systems.

- Most PRC writers assess that humans should maintain some degree of control over machines, but the degree itself may be subject to advancements in AI and autonomy.

PRC writers characterize AI and autonomy as possibly leading to actions that increase instability.

- Some PRC writers assess that the widespread adoption of AI and autonomy will facilitate first strikes due to an acceleration of the OODA loop process. These assessments suggest that the PLA may seek to gain a first mover advantage against the United States during an armed conflict.

- The facilitation of first strikes by AI and autonomy could be also encouraged by the PLA's active defense military strategy, which has a strong offensive component that includes first strike and possibly preemption.

The PLA may emphasize cognitive warfare as it integrates AI into warfighting.

- Some PRC writers argue that cognitive warfare can enable the PRC to achieve the Sun Tzu maxim of "winning without fighting" by sapping the morale and will of adversaries.

- The PLA may increase efforts to influence competitors and potential adversaries in the cognitive domain by spreading propaganda and disinformation.

- PRC writings on the growing importance of cognitive warfare suggest that the PLA will focus on the denial and degradation of adversary data, programming, and computer systems that enable AI and autonomous systems, regardless of the domains they serve.

- An increased emphasis on cognitive warfare may provide a greater role for the PLA's Strategic Support Force, which has responsibilities for outer space, cyber, electronic warfare, and psychological warfare operations.

AI and autonomy will reduce direct human involvement in war.

- An emphasis on the development of AI and autonomous technologies may focus the PLA on the development of human capital to sustain innovation in these areas, and the creative employment of autonomous weapon systems to achieve victory rather than the willingness of humans to sacrifice for their country.

- The widespread adoption of AI and autonomy by the PLA could diminish the effect of political indoctrination and human will in warfare that the PLA has traditionally stated as inherent advantages over potential adversaries.

The PRC may be open to establishing international norms for the ethical use of AI and autonomy.

- Ethical concerns cited by PRC writers regarding the wartime use of AI and autonomy suggest that there is openness in China to dialogue on how to govern the military use of AI and autonomous systems.

- Although the restrictions proposed by PRC writers appear to be very limited, further discussions could reveal areas of common ground that could be beneficial to US national security interests.

- The PRC's official stance at the United Nations, however, indicates that it only supports limited arms control measures for autonomous weapon systems.

Contents

Chapter 1: Introduction

After decades of reform and modernization, China's military is beginning to challenge the US military in ways not seen since the Soviet military challenge of the Cold War. No longer committed to a "people's war" strategy that emphasizes massed formations, the Chinese People's Liberation Army (PLA) has made rapid progress across a broad swath of technologies and institutional capabilities intended to enable it to fight as a joint force across all warfighting domains.

The PLA is now conceptualizing a future battlefield environment dominated by artificial intelligence (AI) and autonomy. Not only does the PLA regard AI and autonomy as the future of warfare for which it must prepare; it also appears to regard them as an opportunity to offset the US military's technological superiority.[1] Indeed, the US National Security Commission on Artificial Intelligence warns that the PRC could surpass the United States as the world's AI leader "within the next decade" and that it may "not be constrained by the same rigorous testing and ethical code that guide the US military."[2]

The widespread adoption of AI and autonomous weapon systems portends a new revolution in military affairs that could fundamentally change the nature of warfare. The use of these systems in a wartime context presents new questions on the role of humans in warfare; the command and control (C2) of autonomous weapon systems; and the effects of AI and autonomy on deterrence, strategic stability, and the ethics of war.

The PLA is debating these issues as it explores what it calls "intelligent warfare" (*zhinenghua zhanzheng*; 智能化战争) and "military intelligentization" (*junshi zhinenghua;* 军事智能化). In 2017, Chinese leader Xi Jinping called for the PLA to "accelerate the development of military intelligentization."

This paper explores the PLA concept of intelligent warfare, according to the views of writers from the People's Republic of China (PRC). It represents an effort contributing to the ever-

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[1] Chen Dongheng, "Chen Dongheng: Exert Great Effort to Promote Military Intelligentization" (*Chen Dongheng: Dali tuijin junshi zhinenghua*; 陈东恒：大力推进军事智能化), *Study Times (Xuexi Shibao;* 学习时报*)*, Dec. 27, 2017, http://www.71.cn/2017/1227/979861.shtml.

[2] The National Security Commission on Artificial Intelligence, *Final Report*, https://www.nscai.gov/wp-content/uploads/2021/03/Full-Report-Digital-1.pdf, 23.

growing US scholarship on understanding the integration of AI into the Chinese military.[3] It asks the following questions:

- How do PRC writers characterize intelligent warfare?
- How do they envision intelligent warfare?
- How do they characterize future battlespaces, and how do they think humans and machines might interact?
- What implications do PRC writers discuss that may result from intelligent warfare?
- What are the implications for the US military?

> **Intelligent Warfare vs. Military Intelligentization**
>
> Intelligent warfare and military intelligentization are closely related. The term *intelligent warfare* tends to refer to how artificial intelligence may be used in war. The term *military intelligentization* is broader than intelligent warfare: it covers the application of AI for military purposes writ large. In our data, intelligent warfare was discussed more directly with aspects of warfare itself, including specific types of combat operations and the future battlefield. However, the use of the term *intelligent warfare* sometimes also has broader applications, similar to the use of *military intelligentization*, and the two terms are often used together.

This paper concludes that PRC discussions of intelligent warfare reflect an ongoing debate over the nature and effects of the widespread use of AI and autonomy in warfare. Most of the articles surveyed for this report, for example, argue for some degree of human control over AI and autonomous systems and say that some degree of international norms should govern their use. How these issues should be resolved is not fully addressed, however.

Despite this ongoing debate, the PLA can be expected to adopt the use of AI and autonomy even as it explores the most appropriate concept of operations due to the military benefits provided by AI and autonomy, top-level PRC leadership direction to exploit the advantages of AI and autonomy, and general military technology trends. PRC discussions of intelligent warfare suggest that the US military should begin preparing to face a PLA made more effective through the widespread adoption of AI and autonomy. This includes not only increasing its own use of

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[3] There are many noteworthy research endeavors on this topic. Some recent publications of interest include: Elsa B. Kania, ""AI weapons" in China's Military Innovation," Brookings, Apr. 2020, https://www.brookings.edu/research/ai-weapons-in-chinas-military-innovation/ and Michael Dahm, "Chinese Debates on the Military Utility of Artificial Intelligence," *War on the Rocks,* June 5, 2020, https://warontherocks.com/2020/06/chinese-debates-on-the-military-utility-of-artificial-intelligence/.

AI and autonomy, but also determining how best to defend these systems from attack. US national security may also be improved by dialogue with China over how best to govern the military use of AI and autonomy.

Data collection and approach

The sample of data used in this study includes articles published by PRC media outlets between October 18, 2017, and December 1, 2020. We chose October 18, 2017, as the start date because it was the day that Xi Jinping stated in his 19th Party Congress work report that the PLA would "accelerate the development of military intelligentization."[4] We were interested in what the discussion of military intelligentization and intelligent warfare looked like following his emphasis on it during this key time in Chinese policy-making (Party congresses occur only once every five years). We used both the terms military intelligentization and intelligent warfare to search for relevant articles, resulting in 52 articles for analysis. We subsequently coded these articles according to the themes and topics they discussed.

The 52 articles come from six PRC media outlets affiliated with the Chinese Communist Party (CCP), the PRC government, or the PLA. Although the ideas expressed in these publications may not represent official policy, they may reveal issues being considered by the broader PRC military community. The majority (75 percent) of the articles were published by organizations affiliated with the PLA: the *PLA Daily,* the official newspaper of the PLA; and *China Defense News,* published by the Central Military Commission's Political Work Department. Over a quarter of the articles were written by authors affiliated with the Academy of Military Sciences (AMS), the PLA's highest-level research institute for military science.

Because the articles surveyed for this report come from media outlets that are not research publications, the opinions expressed by writers may not always align with current technological realities. Consequently, associated technical issues and questions are often given short shrift. As a result, although this report is intended to characterize the range of PRC thinking on intelligent warfare, it may not reflect actual AI technologies the PLA is developing and/or deploying.

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[4] Xi Jinping, "Secure a Decisive Victory in Building a Moderately Prosperous Society in All Respects and Strive for the Great Success of Socialism with Chinese Characteristics for a New Era," *China Daily*, Oct. 18, 2017, https://www.chinadaily.com.cn/china/19thcpcnationalcongress/2017-11/04/content_34115212.htm.

Table 1.   Source publications

Sources	Percentage of articles
PLA Daily	69
Study Times	9
China Social Science News	8
China National Defense News	6
Science & Technology Daily	4
China Youth Daily	4

Chapter 2: Defining Intelligent Warfare

PRC research on intelligent warfare appears to be aimed at reaching a common understanding of its characteristics. Most of the writings surveyed for this report, however, do not directly define intelligent warfare, and there appears to be no consensus in the PLA research community over how to define the term.[5] According to one of the few sources that do provide a definition, intelligent warfare is "the extensive use of AI in various fields of military construction to penetrate and optimize a military system….It uses AI to enhance, extend, and replace human intelligence."[6]

According to PRC writers, intelligent warfare is the next step in the evolution of warfare. According to China's Ministry of National Defense in 2020, the PLA has "basically achieved mechanization and made significant progress in informatization. However, with the accelerated evolution of modern warfare, it has become a major trend in world military affairs to build intelligent military systems."[7]

As illustrated in Figure 1, for much of the 20th century, mechanized warfare replaced human strength with machines. Its focus was on platforms' mobility and range, and the destructiveness of ammunition. In the 1990s, mechanized warfare began to transition to informatized warfare. Whereas mechanized warfare emphasized platforms, informatized warfare emphasized information technologies and the role of networks in connecting platforms into a "system-of-systems." Whereas mechanization stressed the destruction of platforms, informatized warfare stressed the ability to collect information and the ability to

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[5] Li Dapeng, "How Do You Fight an Intelligent War?" (*Zhinenghua zhanzheng zenme da*; 智能化战争怎么打)," *China Youth Daily (Zhongguo Qingnian Bao; 中国青年报）*, July 11, 2019, http://zqb.cyol.com/html/2019-07/11/nw.D110000zgqnb_20190711_3-12.htm ; Xu Jinhua, Huang Heqing, and Yuan Yi, "Analysis of the Basic Characteristics of Mechanization, Informationization and Intelligentization" (*Qianxi jixiehua, xinxihua, zhinenghua jiben neihan*; 浅析机械化、信息化、智能化基本内涵), *China Defense News (Zhongguo guofang bao; 中国国防报)*, Nov. 27, 2019, http://www.81.cn/gfbmap/content/2019-11/27/content_248456.htm; Zhao Yun and Zhang Huang, "An Ethical Review of Intelligent Warfare" (*Zhinenghua zhanzheng de lunli shenshi*; 智能化战争的伦理审视)," *China Social Sciences Today (Zhongguo Kexue Shehui Bao; 中 国 社 会 科 学 报 ）*, July 19, 2018, http://news.cssn.cn/zx/bwyc/201807/t20180719_4505575.shtml.
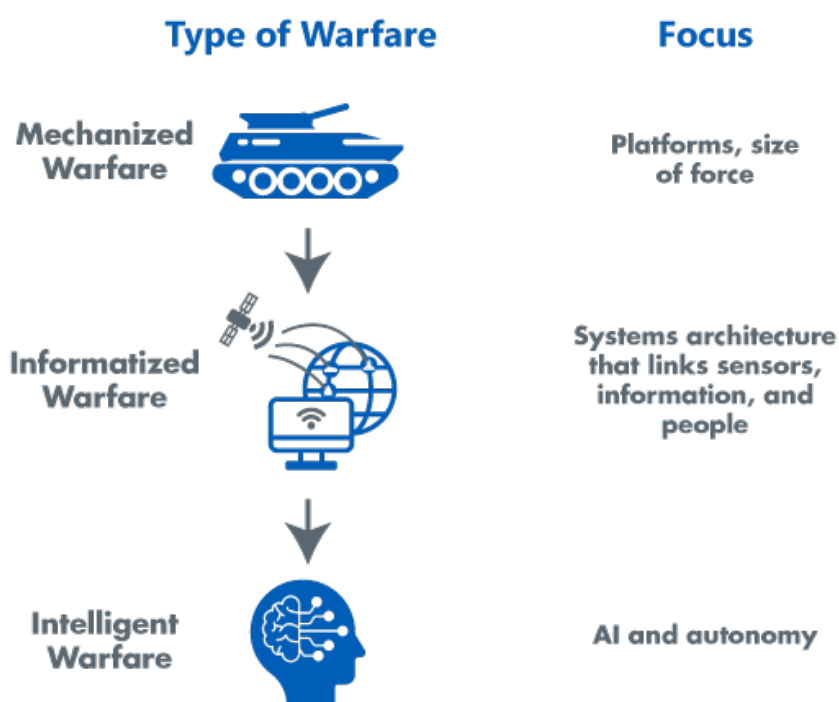
[6] Huang, Xu, and Yuan, "Analysis of the Basic Characteristics of Mechanization, Informatization, and Intelligentization."

[7] Li Wei, "Regular Press Conference of the Ministry of National Defense on November 26," *China Military Online*, Nov. 29, 2020, http://eng.mod.gov.cn/news/2020-11/29/content_4874839.htm.

deny information to adversaries as key to winning wars.[8] Intelligent warfare is described as a continuation of this process with an emphasis on AI and autonomy.

Although PLA thinking on intelligent warfare is far from preliminary, it remains unsettled. Nevertheless, PLA discussions of intelligent warfare appear to have coalesced around at least three core characteristics and a set of three key foundations of AI that must be developed before the PLA can successfully conduct intelligent warfare.

Figure 1.   The evolution from mechanized warfare to intelligent warfare

Source: CNA.

[8] Huang, Xu, and Yuan, "Analysis of the Basic Characteristics of Mechanization, Informatization, and Intelligentization." For more information, see Kevin Pollpeter, "Towards an Integrative C4ISR System: Informationization and Joint Operations in the People's Liberation Army," in *The PLA at Home and Abroad: Assessing the Operational Capabilities of China's Military*, ed. David Lai, Roy Kamphausen, and Andrew Scobell (Carlisle: Strategic Studies Institute, June 2010), 183-235; and Andrew Scobell, "Discourse in 3-D: The PLA's Evolving Doctrine, circa 2009," in *The PLA at Home and Abroad: Assessing the Operational Capabilities of China's Military*, ed. David Lai Roy Kamphausen, and Andrew Scobell (Carlisle: Strategic Studies Institute, June 2010) , 99-133.

The core characteristics of intelligent warfare

The writings in our dataset suggest that intelligent warfare is based on three core characteristics that separate it from informatized warfare.

Based on artificial intelligence and autonomous systems

According to the PRC writings we examined, intelligent warfare is a new and advanced stage of warfare in which the ubiquity and salience of AI and autonomous systems make them the key factors that separate it from informatized warfare.[9]

A combination of human and machine intelligence

Intelligent warfare differs from informatized warfare in regard to the role of humans. Whereas informatized warfare involves the use of information systems to assist humans, intelligent warfare involves replacing functions traditionally performed by humans with AI.[10]

The permeation of AI into all aspects of military operations

AI will play a significant role in all aspects of military operations, including command and control (C2), weapons platforms, training, logistics, and intelligence.[11]

The foundations of intelligent warfare

PRC authors emphasize data, algorithms, and computing power as central to intelligent warfare.[12] Indeed, most of the articles consulted for this study discussed at least one of these

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[9] Li, "How Do You Fight an Intelligent War? "; He Lei, "Intelligent Warfare Is Not Far Away" (*Zhinenghua zhanzheng bingbu yaoyuan*; 智能化战争并不遥远, *PLA Daily (Jiefang Junbao*; 解放军军报）, Aug. 8, 2019, http://www.81.cn/jfjbmap/content/2019-08/08/content_240321.htm; and Chen Xiaonan and Cong Hanwen, "Talking about the 'Intelligence' in Intelligent Warfare" (*Huashuo zhinenghua zhanzheng zhi "zhi"*; 话说智能化战争之"智")," *PLA Daily*, Dec. 27, 2019, http://www.81.cn/jfjbmap/content/2019-12/27/content_250879.htm.

[11] Yang Wenzhe, "Exploring the Way to Victory Amidst Changing and Unchanging Intelligent Warfare" (*Zai bian yu bu bian zhong tanxun zhinenghua zhanzheng zhisheng zhidao*; 在变与不变中探寻智能化战争制胜之道), *PLA Daily*, Oct. 22, 2019, http://www.81.cn/jfjbmap/content/2019-10/22/content_245810.htm; and Liu Weiqi, "The Curtain on Intelligent Warfare Has Been Opened" (*Zhinenghua zhanzheng da mu lakai*; 智能化战争大幕拉开), *People's Daily,* accessed May 17, 2018, http://www.xinhuanet.com/mil/2018-05/17/c_129874572.htm.

[12] Shen Shoulin and Zhang Guoning, "Promote Military Intelligence Construction with Algorithm Innovation" (*Yi suanfa chuangxin tuidong junshi zhinenghau jianshe*; 以算法创新推动军事智能化建设), *PLA Daily* http://www.xinhuanet.com/2017-11/23/c_129747614.htm.

three technologies, indicating the high level of importance placed on them.[13] In 2019, AMS even published an entire series of articles in the *PLA Daily* about military intelligentization that focused on data issues.[14]

The emphasis placed on data, algorithms, and computing power is directly related to their essential role in developing AI. According to one writer, "Algorithms, computing power, and data are not only the internal driving force and core support for the development of AI, but also the 'key' to solving the problem of the winning mechanism of intelligent warfare."[15] According to another writer, "Algorithms are equivalent to intelligence, computing power is equivalent to speed, and data is equivalent to resources."[16] Themes around each of these AI foundations are discussed in the following subsections.

Data

PRC writers stress that data are the foundation for intelligent warfare. PRC sources call data the "new oil" and big data the "most important resource" in intelligent warfare and central to achieving victory.[17] This is because AI functions—such as natural language processing, image

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[13] Most of the articles analyzed for this paper discussed the importance of at least one of these three building blocks. Of the 52 articles, 31 discussed issues pertaining to at least one of the following topics: algorithms, data, and computing power.

[14] The series was published weekly from September through November 2019. The first article in the series is: Li Xiaosong and Lei Shuai, "Wake Up The Sleeping Military Management Data—Military Big Data Pushes the Development of Military Intelligentization Series No. 1" (*Huanxing chenshui de junshi guanli shuju - junshi da shuju tuidong junshi zhinenghua fazhan xilie tan zhi yi*; 唤醒沉睡的军事管理数据——军事大数据推动军事智能化发展系列谈之一), *PLA Daily*, Sept. 13, 2019 http://www.81.cn/jfjbmap/content/2019-09/13/content_243299.htm.

[15] Li Dapeng, "How to take advantage of intelligent warfare" (*Ruhe duoqu zhinenghua zhanzheng youshi*; 如何夺取智能化战争优势), *China Youth Daily*, May 23, 2019, accessed May 17, 2021, http://www.xinhuanet.com/mil/2019-05/23/c_1210141455.htm. Similarly, Chai Shan says, "The more complete the data, the stronger the computing power, and the more advanced the algorithm, the greater the probability of victory." Chai Shan, "The Essence of Winning an Intelligent War" (*Zhinenghua zhanzheng de shengl jingsui*; 智能化战争的制胜精髓), *PLA Daily (Jiefang Junbao; 解放军报)*, June 4, 2019, accessed May 17, 2021, http://www.81.cn/jfjbmap/content/2019-06/04/content_235225.htm.

[16] Li, "How Do You Fight an Intelligent War?"

[17] Li, "How to take advantage of intelligent warfare"; Lei Shuai and Lu Bin, "Get rid of Data Fog—Military Big Data Promotes Military Intelligence Development Series No. 7" (Q*uchu shuju miwu ——junshi da shuju tuidong junshi zhinenghua fazhan xilie tan zhi qi*; 驱除数据迷雾 ——军事大数据推动军事智能化发展系列谈之七)," *PLA Daily*, Nov. 1, 2019; Yang Wang and Zuo Wentao, "Recognize the Winning Elements of Intelligent Warfare" (*Renqing zhinenghua zhanzheng zhisheng yaosu*; 认清智能化战争的制胜要素), *PLA Daily (Jiefang Junbao; 解放军报)*, June 6, 2020, http://www.81.cn/theory/2020-06/20/content_9838385.htm; Shi Jianbo and Zhan Jing, "Exploring Intelligent Warfare from the Perspective of Thinking" (*Cong siwei cengmian tianxun zhinenghua zhanzheng*; 从思维层面探寻智能化战争), *PLA Daily* Sept. 30, 2020, accessed May 17, 2021, http://www.81.cn/gfbmap/content/2020-09/30/content_272716.htm.

recognition, and virtual reality—depend on data.[18] Given the necessity of data, authors from AMS emphasize the importance of standardizing and centralizing military databases, using common formats and open standards, and building databases oriented to military applications.[19]

Algorithms

Some writers envision that warfare will become a contest between algorithms where advantages in algorithms will drive advantages in war.[20] Several writers refer to algorithms as the "core" of AI, with one even asserting that algorithms are the core element for transforming war from informatized to intelligentized. [21] According to these writers, the side with the

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[18] Chai, "The Essence of Winning an Intelligent War"; and Wang and Zuo, "Recognize the Winning Elements of Intelligent Warfare."

[19] Li Congying and Lu Bin, "Building a Data Pool to Open Up Data Flow-Military Big Data Promotes Military Intelligence Development Series 6" (*Jian hao shuju chi datong shuju liu——junshi da shuju tuidong junshi zhinenghua fazhan xilie tan zhi liu*; 建好数据池 打通数据流——军事大数据推动军事智能化发展系列谈之六), *PLA Daily,* Oct. 25, 2019, http://www.81.cn/jfjbmap/content/2019-10/25/content_246053.htm; Lei Shuai and Lu Bin of AMS also express similar sentiments: "Strengthen the research on military big data governance technology, build data test verification methods and means, conduct actual verification, and improve data authenticity analysis capabilities to ensure the timeliness, authenticity and credibility of data." See: Lei and Lu, "Get rid of Data Fog—Military Big Data Promotes Military Intelligence Development Series No. 7."

[20] Dong Jianmin, "Are you ready for intelligent warfare?" (*Zhinenghua zhanzheng, ni zhunbei hao le ma?*; 智能化战争，你准备好了吗？, *China National Defense (Zhongguo Guofang Bao; 中国国防报)*, June 12, 2019, http://www.xinhuanet.com/mil/2019-06/12/c_1210156535.htm ; Li Minghai, "Where is the Winning Mechanism of Intelligent Warfare?" (*Zhinenghua zhanzheng de zhisheng jili bian zai nali*; 智能化战争的制胜机理变在哪里), *PLA Daily (Jiefang Junbao; 解放军报)*, Jan. 15, 2019, http://www.xinhuanet.com/mil/2019-01/15/c_1210038327.htm; Wang Ronghui, "Insight into The Future of Intelligent Warfare" (*Toushi weilai zhinenghua zhanzheng de yangzi*; 透视未来智能化战争的样子), *China Military Online (Zhongguo Junwang; 中国军网）*, Apr. 30, 2019, http://www.81.cn/xue-xi/2019-04/30/content_9492869.htm; and Shen and Zhang, "Promote Military Intelligence Construction with Algorithm Innovation." Other authors express similar sentiments about the importance of algorithm development and testing. See: Chen Dongheng, "Deeply Grasp the Winning Mechanism of Intelligent Warfare" (*Shenke bawo zhinenghua zhanzheng de zhisheng jili*; 深刻把握智能化战争的制胜机理), *Study Times (Xuexi Shibao; 学习时报）*, Mar. 23, 2020, http://www.qstheory.cn/llwx/2020-03/23/c_1125752487.htm; Li and Lu, "Building a Data Pool to Open Up Data Flow-Military Big Data Promotes Military Intelligence Development Series 6."

[21] Li, "How to take advantage of intelligent warfare"; Li, "How Do You Fight an Intelligent War?"; Shen and Zhang, "Promote Military Intelligence Construction with Algorithm Innovation"; Chen Dongheng and Dong Junlin, "Military Intelligentization in the Dialectical Perspective" (*Biànzhèng shì yù xià de jūnshì zhìnéng huà*; 辩证视域下的军事智能化) , *PLA Daily*, May 15, 2019, http://www.qstheory.cn/defense/2019-05/15/c_1124498258.htm; Li, "Where is the Winning Mechanism of Intelligent Warfare?"

algorithmic advantage will be able to predict the battlefield situation more quickly and accurately, to be innovative, and to achieve the goal of "winning without fighting."[22]

Computing power

PRC writers view real-time computing of large amounts of data as essential for intelligent warfare. As one writer states, "No matter how complete the data, no matter how advanced the algorithms," intelligent warfare cannot be conducted without strong computing power. [23] Writers conclude that the next generation of computers—such as quantum computers, photonic (or optic) computers, and biocomputers—will provide unprecedented computing potential and help advance AI technology.[24]

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[22] Li, "Where is the Winning Mechanism of Intelligent Warfare? " and Dong, "Are you ready for intelligent warfare?"

[23] Chai, "The Essence of Winning an Intelligent War."

[24] Li, "How to take advantage of intelligent warfare"; Dong, "Are you ready for intelligent warfare?"; and Li, "Where is the Winning Mechanism of Intelligent Warfare?"

Chapter 3: Human-Machine Interaction

A critical question in the PRC writings we examined is the extent to which humans will retain control over robotic systems. PRC sources represent a diverse spectrum of views on this matter. Most of the PRC writers emphasize that machines will not completely replace humans in intelligent warfare. These researchers make several arguments in support of this point: (1) AI and autonomy will still require human innovation, design, production, and management;[25] (2) war is still a conflict between people—and war is ultimately about the ability to influence people, not machines; [26] and (3) machines cannot replace the ingenuity, creativity, and flexibility of humans.[27]

Human control of machines is a dominant theme

Human-machine teaming is a prominent feature of discussions on intelligent warfare. Most of these writers envision a hybrid decision-making system where humans remain the dominant

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[25] Shi Xiaogang, "Intelligent Warfare Forms and Countermeasures" (*Zhinenghua zhanzheng xingtai ji yindui zhengl*üe;智能化战争形态及应对策略, *China Social Sciences Today (Zhongguo Kexue Shehui Bao; 中国社会科学 报)*, July 5, 2018, http://news.cssn.cn/zx/bwyc/201807/t20180705_4496198.shtml; He, "Intelligent Warfare Is Not Far Away"; Wang and Zuo, "Recognize the Winning Elements of Intelligent Warfare."

[26] Li Dapeng, "How to Take Advantage of Intelligent Warfare" (*Ruhe duoqu zhinenghua zhanzheng youshi*; 如何夺取智 能 化 战 争 优 势), *China Youth Daily (Zhongguo qingnian bao; 中 国 青 年 报)*, May 23, 2019, http://www.xinhuanet.com/mil/2019-05/23/c_1210141455.htm; Ma Rongsheng, "The Study of Intelligent Warfare is Inseparable from Dialectical Thinking" (*Zhinenghua zhanzheng yanjiu libukai bianzheng siwei*; 智能化战 争 研 究 离 不 开 辩 证 思 维), *Qiushi (Qiushi; 求 是 ）*, July 4, 2019, http://www.qstheory.cn/defense/2019-07/04/c_1124710009.htm.

[27] Li Xu, "Intelligent Warfare Will Not Let People Walk Away" (*Zhinenghua zhanzheng buhui rang ren zoukai*; ;智能 化 战 争 不 会 让 人 走 开), *Qiushi (Qiushi; 求 是 ）*, Oct. 17, 2019, http://www.qstheory.cn/defense/2019-10/17/c_1125117765.htm; Li, "How to Take Advantage of Intelligent Warfare"; Li, "Where is the Winning Mechanism of Intelligent Warfare?"; Wang, "Insight into The Future of Intelligent Warfare"; Wang and Zuo, "Recognize the Winning Elements of Intelligent Warfare"; Chai, "The Essence of Winning an Intelligent War"; Wang Chunfu, "Let Military Intelligence Enter the Track of Scientific Development" (*Rang Junshi Zhinenghua Buru Kexue Fazhan Guidao*; 让军事智能化步入科学发展轨道), *PLA Daily (Jiefang Junbao; 解放军报）*, Mar. 26, 2019, http://www.chinamil.com.cn/jwgd/2019-03/26/content_9459996.htm.

actor.[28] As one author writes, "No matter how highly intelligent the combat robot system is, humans as the leading factor of war will never change."[29]

Some writers directly reference their Marxist and Maoist training in emphasizing that no matter how advanced AI and autonomy may become, humans will always be the "decisive factor" in warfare.[30] According to one article, "Technology determines tactics, but technology will never automatically become a tactic for defeating the enemy. It will always work through the subjective initiative of humans." According to this writer, human control of AI "is the core of intelligent operations and also an intrinsic requirement of the ethics of war."[31]

Other writers argue that machines cannot replicate the inherent subjective human qualities that often win wars. These writers argue that war is not only a science but also an art that machines cannot easily replicate. As a result, these writers state that humans and machines will complement each other. While machines are precise and have immense computing power, humans are creative.[32] In this respect, although machines may be better at the "science" of war, the adaptability and ingenuity of humans make them better at the "art" of war.[33]

These writers argue that human commanders can better devise strategies and tactics, analyze opposing forces, act in real time to exploit opportunities, predict enemy actions, employ forces to seize the initiative, and act unpredictably.[34] As a result, automated command systems will

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[28] Human-machine teaming was one of the most prominent themes in the dataset, appearing in 34 of the 52 articles (65%). Yang, "Exploring the Way to Victory in Amidst Changing and Unchanging Intelligent Warfare"; Chen, "Chen Dongheng: Exert Great Effort to Promote Military Intelligentization"; Yin Junsong and Cheng Gang, "Intelligent Warfare is Knocking, Are You Ready?" (*Zhinenghua zhanzheng zheng zai qiaomen, ni zhunbei haole ma*; 智能化战争正在叩门，你准备好了吗), *PLA Daily (Jiefang Junbao; 解放军报）*, Apr. 24, 2018, http://www.81.cn/jfjbmap/content/2018-04/24/content_204533.htm; Wang, "Insight into The Future of Intelligent Warfare"; and Zhao and Zhang, "An Ethical Review of Intelligent Warfare."

[29] Zhao and Zhang, "An Ethical Review of Intelligent Warfare."

[30] Yang, "Exploring the Way to Victory in Amidst Changing and Unchanging Intelligent Warfare"; Ma, "The Study of Intelligent Warfare is Inseparable from Dialectical Thinking"; Xu, "Intelligent Warfare Will Not Let People Walk Away"; Chai, "The Essence of Winning an Intelligent War"; Fu Wanjuan, Yang Wenzhe, and Xu Chunlei, "Intelligent Warfare, What Stays the Same" (*Zhinenghua zhanzheng, bu bian zai nali*; 智能化战争，不变在哪里), *PLA Daily*, Jan. 14, 2020, accessed May 21, 2021, http://www.81.cn/jfjbmap/content/2020-01/14/content_252163.htm; and Xu, "Intelligent Warfare Will Not Let People Walk Away."

[31] Wang and Zuo, "Recognize the Winning Elements of Intelligent Warfare."

[32] Wang Gungwu, "Upgrading the Migrant: Neither Huaqiao nor Huaren," in *The Last Half Century of Chinese Overseas*, ed. Elizabeth Sinn (Hong Kong: Hong Kong University Press, 1998), muse.jhu.edu/book/5795; Wang and Zuo, "Recognize the Winning Elements of Intelligent Warfare"; and Wang, "Let Military Intelligence Enter the Track of Scientific Development."

[33] Xu, "Intelligent Warfare Will Not Let People Walk Away."

[34] Xu, "Intelligent Warfare Will Not Let People Walk Away." Dong, "Are you ready for intelligent warfare?"

only support human commanders with information and will provide plans to deal with multiple contingencies, not replace them.[35]

These assessments appear to be based, in part, on the PLA's understanding of its own history. According to one researcher:

> The history of the growth and development of our army also proves time and again that correct military strategic guidance and mobile and flexible strategies and tactics are the winning formula for overcoming strength with weakness, winning with less, and enabling our army to continuously move from victory to victory, which cannot be imitated and created by intelligent machines.[36]

PRC writers also argue that machines cannot replace the intangible human assets of emotion and psychology that can be important factors in battle. Characteristics such as "indestructible political beliefs," heroism, and daring, in addition to superior strategy and flexible tactics, will still be a source of strength that can allow an inferior combatant to defeat a superior opponent."[37]

A third argument made by some PRC writers is that humans are better than machines in identifying the weaknesses of AI and autonomy.[38] According to one writer, every weapon has its "Achilles heel" and the "magic weapon for defeating the enemy is human beings with their infinite wisdom." As a result, "degrading, controlling, and destroying intelligent weapons and equipment is where human ingenuity comes into play."[39]

A transition to full autonomy?

Other writers speculate that at some point AI and autonomy may become so advanced that "human-oriented and AI-assisted" command will shift toward a more AI-centric model that increasingly replaces humans. [40] These writers argue that future war will become too complicated and too rapid for humans without the aid of machines. According to one article, humans will remain in the chain of command, but human commanders will face a rapidly

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[35] Lu Zhisheng, "Draw a Picture of the Future Intelligent Warfare" (*Weilai zhinenghua zhanzheng hua ge xiang*; 为未来智能化战争画个像), *PLA Daily (Jiefang Junbao;* 解放军报 〉 , Oct. 18, 2018, http://military.people.com.cn/n1/2018/1018/c1011-30348113.html.

[36] Xu, "Intelligent Warfare Will Not Let People Walk Away."

[37] Ma, "The Study of Intelligent Warfare is Inseparable from Dialectical Thinking."

[38] Xu, "Intelligent Warfare Will Not Let People Walk Away."

[39] Xu, "Intelligent Warfare Will Not Let People Walk Away."

[40] Chen and Cong, "Talking about the "Intelligence" in Intelligent Warfare."

changing battlefield that "the human brain can no longer quickly accommodate and efficiently process."[41]

As a result, because AI and autonomy will be able to autonomously access information and be situationally aware, the role of humans and machines will become reversed. While machines are now in support of human decision-making, at some point humans will be in support of machine decision-making.[42]

Continuing this theme, one writer argues that AI-enabled C2 systems will be able to carry out John Boyd's OODA loop of "observe, orient, decide, act" so rapidly and effectively that they will replace humans.[43] Another writer, making reference to the 2016 Go match where Google's AlphaGo defeated Korean Go champion Lee Sedol, concludes that the "self-evolution and strategic decision-making capabilities of deep neural networks will result in AI-enabled systems taking people 'out of the loop.' "[44] A third writer argues that autonomous systems will replace humans in all areas in which they can be replaced.[45]

A fourth article states that weapons systems enabled by "higher-level AI" will be solely responsible for coordinating operations, controlling the pace of battle, situational awareness, and making decisions.[46] As a result, "artificial intelligence will play a more central role in the battlefield environment of intelligent warfare."[47]

Command and control of AI under debate

Although PRC writers surmise that humans will retain command at the strategic level—determining when to initiate combat, developing plans, and deciding when to disengage—there appears to be less of a consensus on the level of war at which humans will have direct control of autonomous systems. One article, for example, appears to argue for strict control of autonomous weapons. In this case, humans will retain control over autonomous weapons systems throughout the OODA loop process.[48] Another writer states that "it is necessary for commanders at all levels to personally make decisions, make the determination to begin

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[41] Dong, "Are you ready for intelligent warfare?"

[42] Li, "Where is the Winning Mechanism of Intelligent Warfare?"

[43] Chai, "The Essence of Winning an Intelligent War." See also, Lu, "Draw a Picture of the Future Intelligent Warfare."

[44] Li, "Where is the Winning Mechanism of Intelligent Warfare?"

[45] He, "Intelligent Warfare Is Not Far Away."

[46] Chen and Cong, "Talking About The "Wisdom" of Intelligent Warfare."

[47] Chen and Cong, "Talking About The "Wisdom" of Intelligent Warfare."

[48] Wang, "Upgrading the Migrant: Neither Huaqiao nor Huaren."

operations, and issue combat orders." [49] According to this writer, although autonomous systems might ultimately not need human control, only humans can decide when and how to employ them. Allowing machines to have total autonomy would be "a disaster for the whole human race."[50]

Other writers, however, appear to argue that although humans may be in command of machines, they may give machines a large degree of autonomy. For example, two writers argue that humans will be responsible for deploying capabilities, targeting, assigning missions, and defining mission success. AI-enabled weapons will then autonomously conduct reconnaissance, strikes, and battle damage assessments.[51]

Another article appears to argue that humans will remain the architects of war but may not play a direct role in its prosecution. Instead, humans will manufacture weapons and equipment, plan military operations, employ weapons, and devise tactics.[52] Another article argues that the human role in future wars is as planner, organizer, and executor. According to this writer, the value of AI-enabled technologies is in their direct participation in combat and auxiliary position in C2.[53] This point is also argued by another writer, who posits that humans will be "stealth" behind the scenes, mainly serving as commanders and staff officers.[54]

Another article also foresees only top-level human involvement in war. According to this writer, human influence over AI-enabled weapons will come in the form of software and data and the determination of goals. The responsibility of AI, on the other hand, will be to carry out the orders of humans and accomplish the mission.[55]

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[49] Xu, "Intelligent Warfare Will Not Let People Walk Away."

[50] Xu, "Intelligent Warfare Will Not Let People Walk Away."

[51] Wei Dong and Kai Gao, "Intelligent War Calls for Command Intelligentization" (*Zhinenghua zhanzeng huhuan zhihui zhinenghua;* 智能化战争呼唤指挥智能化), *China National Defense (Zhongguo Guofang Bao; 中国国防报）*, June 6, 2019, accessed June 26, 2019, http://www.mod.gov.cn/jmsd/2019-06/26/content_4844369.htm.

[52] Wang and Zuo, "Recognize the Winning Elements of Intelligent Warfare."

[53] Yang, "Exploring the Way to Victory in Amidst Changing and Unchanging Intelligent Warfare."

[54] He, "Intelligent Warfare Is Not Far Away."

[55] Fu, Yang, and Xu, "Intelligent Warfare, What Stays the Same."

Chapter 4: The Intelligent Warfare Battlefield

PRC writers argue that the prominence of AI and autonomy in warfare will result in profound changes on the battlefield. According to these writers, the prominence of AI and autonomy will result in unmanned systems becoming the dominant force on the battlefield. The removal of humans from weapon systems and the versatility of unmanned systems will enable the battlespace to be expanded to areas where it is difficult or impossible for humans to operate. The removal of humans from weapon systems will result in a reduction not only in the size of platforms but also in the number of platforms necessary to carry out missions. The subsections below elaborate on each of these ideas.

Unmanned systems become the main combat force

Writers are uniform in their assessment that AI and autonomy will reduce the need for a human presence on the battlefield.[56] According to one writer, unmanned systems will automatically detect targets and independently launch operations based on the location, size, and state of the target.[57] Writers discuss several types of operations conducted by autonomous systems in intelligent warfare. These include the following:

- **Intrusive lone wolf operations (*qinrushi du lang zuozhan;* 侵入式独狼作战).** A single unmanned system operating independently.[58] This operational type is not well developed by the writers surveyed for this report.
- **Trojan horse operations (*mumashi zuozhan*; 木马式作战).** Unmanned systems covertly maneuvering to a preset position to achieve surprise.[59]
- **Swarm operations (*fengqunshi zuozhan*; 蜂群式作战).** The coordinated use of a large number of low-cost unmanned platforms.[60]

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[56] Lu, "Draw a Picture of the Future Intelligent Warfare"; Shi, "Intelligent Warfare Forms and Countermeasures"; and Chen, "Deeply Grasp the Winning Mechanism of Intelligent Warfare."

[57] Lu, "Draw a Picture of the Future Intelligent Warfare."

[58] Li, "Where is the Winning Mechanism of Intelligent Warfare?"

[59] Lu, "Draw a Picture of the Future Intelligent Warfare."

[60] Lu, "Draw a Picture of the Future Intelligent Warfare."

- **Mothership swarm operations (*mujian fengqun jiqun zuazhan*; 母舰蜂群集群作战).** The use of a larger platform to transport and command smaller assets in manned and unmanned combinations to conduct saturation attacks.[61]

Swarm Operations

In the articles we read, the unmanned operation discussed most often is swarms. One author, writing in the *PLA Daily,* surmises that in the future, swarm attacks can be used to effectively strike targets, turning quantitative advantages into quality advantages.[62] Another author, writing in *Study Times,* predicts that the nature of swarm warfare will result in "wars of attrition of swarms."[63] Swarms will be low cost, highly efficient, and capable of self-organization and coordination; will jointly attack targets; and will be resistant to destruction. Unmanned swarms can conduct close-in reconnaissance, autonomous jamming, deception, and distributed and coordinated attacks. A low-cost unmanned swarm composed of thousands of unmanned systems could conduct saturation attacks to exhaust high-value defense systems in order to achieve "maximum combat effectiveness at a minimal cost."[64]

Other analysis runs counter to this assessment, however. Some writers argue that the increased effectiveness of combat operations driven by AI will enable smaller units to achieve higher order effects. According to this analysis, the efficiencies brought about by intelligent warfare will require fewer units to achieve the same effects achieved in previous wars. These smaller units will be able to operate globally and jointly across multiple domains in either machine-machine grouping or human-machine groupings.[65]

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[61] Dong, "Are you ready for intelligent warfare?"

[62] Lu, "Draw a Picture of the Future Intelligent Warfare."

[63] Tao Liang, "Grasp the Winning Mechanism of Intelligent Warfare" (*Bawo zhinenghua zhanzheng de shengli jili*; 把握智能化战争的制胜机理), *Study Times (Xuexi Shibao; 学习时报)*, Aug. 22, 2018, https://www.sohu.com/a/249445093_465915.

[64] Tao Liang, "Grasp the Winning Mechanism of Intelligent Warfare."

[65] Li Minghai, "Deducing the Face of Intelligent Warfare" (*Tuiyan zhinenghia zhanzheng mianmao*; 推演智能化战争面貌), *China Military Online (Zhongguo junwang; 中国军网)*, Apr. 2, 2019, http://www.81.cn/jfjbmap/content/2019-04/02/content_230747.htm.

An expanded battlespace

PRC writers tend to view intelligent warfare as occurring in an expanded battlespace involving traditional, nontraditional, physical, and nonphysical domains.[66] Several writers view the battlespace of intelligent warfare as expansive, in part because the traditional battlespace has already expanded to "space, the Internet, and spiritual will."[67] Two writers, for example, assert that AI and autonomy are playing an increasingly important role in space warfare, cyber warfare, cognitive warfare, and biological warfare.[68] Additionally, autonomous weapons may expand the "breadth and depth" of operations because they can maneuver in spaces humans cannot easily operate in. For example, an autonomous system may secretly maneuver in deep space or the deep sea near key targets or important chokepoints in order to engage the enemy.[69] In discussing specific platforms that may be advantageous in such an expanded battlespace, one article states that the US X-37B space plane and the X-51A and HTV-2 hypersonic vehicles could enable the US military to achieve effects across domains and seize the strategic initiative.[70]

Prominence of cognitive warfare

Writers view cognitive warfare (*renzhi zhan*; 认知战), or influencing enemy perceptions, to be an important—in some cases, the most important—component of intelligent warfare.[71] Because warfare will remain a fundamentally political endeavor conducted by humans, achieving political goals through the manipulation of human cognition will be the most

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[66] About one-fifth of articles in the sample discussed the future battlefield. Examples are the following: Tao, "Grasp the Winning Mechanism of Intelligent Warfare"; Chong Zhiqiang, "The Winning Mechanism of Intelligent Warfare in the Cognitive Domain" (*Ren zhi yu xia zhinenghua zhanzheng zhisheng jili*; 认知域下智能化战争制胜机理), *China Military Online*, Dec. 24, 2019, http://www.81.cn/xue-xi/2019-12/24/content_9704780.htm; Yin and Cheng, "Intelligent Warfare is Knocking, Are You Ready?"; Li, "How to take advantage of intelligent warfare"; Yang, "Exploring the Way to Victory in Amidst Changing and Unchanging Intelligent Warfare"; Chong, "The Winning Mechanism of Intelligent Warfare in the Cognitive Domain"; and Chen, "Deeply Grasp the Winning Mechanism of Intelligent Warfare."

[67] Yin and Cheng, " Intelligent Warfare is Knocking, Are You Ready?" Similar sentiments are expressed by Chen and Cong, "Talking about the "Intelligence" in Intelligent Warfare."

[68] Yin and Cheng, "Intelligent Warfare is Knocking, Are You Ready?"

[69] Chong, "The Winning Mechanism of Intelligent Warfare in the Cognitive Domain."

[70] Li, "Deducing the Face of Intelligent Warfare."

[71] Liang, "Grasp the Winning Mechanism of Intelligent Warfare"; Dong, "Are you ready for intelligent warfare?"; and Wang, "Insight into The Future of Intelligent Warfare."

effective means of winning intelligent wars.[72] As a result, cognitive warfare opens up new opportunities for "winning without fighting" by reducing enemy morale and will to fight.[73]

According to one writer, the goal of cognitive warfare is to "conquer the mind."[74] Several writers suggest that future cognitive warfare may employ "methods of mental guidance and control," to "exert influence on the enemy's cognitive system," and in real time, "analyze the enemy's behavioral characteristics and operational determination."[75]

Writers predict that the ubiquity of AI and autonomy on the intelligent warfare battlefield will give prominence to operations that deny or degrade the data, algorithms, and computing power on which their operational decisions are based. In particular, operations that shape enemy thinking by falsifying, preventing access to, and manipulating data can reduce an adversary's situational awareness, slow its reaction time, and cause it to make errors in judgment; such operations will become more prevalent in intelligent warfare.[76] These attacks can be carried out in multiple ways:

- Influencing enemy perceptions by fabricating or altering online sounds and images, conducting pervasive cyberattacks, and using immersive virtual reality

- Tampering with computer programming, such as those belonging to enemy C2 systems

- Directly controlling adversary systems through cyber and electromagnetic warfare[77]

An early example of a cognitive warfare attack provided by one writer is the December 2017 drone attack against a Russian air base in Syria in which Russian troops were able to use electronic warfare to gain control of 6 of the 13 attacking drones. The author describes this event as the prototype of "attacking the mind and controlling the brain."[78]

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[72] Li, "How Do You Fight an Intelligent War."

[73] Zhu Xueling and Zeng Huafeng, "Mental Control Operations: New Model of Future Wars" (*Zhinao zuozhan: weilai zhanzheng jingzheng xin moshi*; 制脑作战：未来战争竞争新模式), *PLA Daily*, October 17, 2017, http://military.people.com.cn/n1/2017/1017/c1011-29592326.html.

[74] Liang, "Grasp the Winning Mechanism of Intelligent Warfare."

[75] Wang Yonghua, "On Cyberspace Architecture and Confrontation Levels," (*Lun wangluo kongjian de tixi jigou ji duikang cengci*; 论网络空间的体系机构及对抗层次), *China Military Science* (*Zhongguo Junshi Kexue*; 中国军事科学), no. 1 (2017); Zhou Dewang, Fu Xiaodong, and Li Rui, "On Cyberspace Confrontation," (*Lun wangluo duikang*; 论网络对抗), *China Military Science* (*Zhongguo Junshi Kexue*; 中国军事科学), no. 4 (2014); and Liang, "Grasp the Winning Mechanism of Intelligent Warfare"; and Li, "How Do You Fight an Intelligent War?"

[76] Wang Yonghua, "On Cyberspace Architecture and Confrontation Levels"; and Zhou, Fu, and Li, "On Cyberspace Confrontation."

[77] Chong, "The Winning Mechanism of Intelligent Warfare in the Cognitive."

[78] Dong, "Are you ready for intelligent warfare?"

Other writers describe more futuristic intelligent warfare methods that involve direct control or influence of individuals. One author, writing in *China National Defense*, suggests that the fields of biology, medicine, engineering, information, and manufacturing may be valuable for developing new combat methods in intelligent warfare that achieve "blindness, deafness, and paralysis."[79] According to another writer, "With the rapid development of AI and brain science, new forms of warfare aimed at directly attacking, changing, and controlling the psychology, cognition, and thought of enemy soldiers and the public through high-technology means will become the key to victory in war."[80]

Other writers discuss brain reading and brain-control technologies that can reveal an enemy commander's intentions and "even directly act on the opponent's brain" or "'inject' one's consciousness into an adversary's brain through the use of brain electrical coding."[81] Two writers in separate articles discuss the use of electroencephalograms (EEGs) to "inject" a different cognition into the human brain in order to control the person's thinking and consciousness.[82]

According to another writer, the United States and Russia have already developed such weapons. Citing unnamed media reports, the researcher states that the US military used a brain-control weapon to force the surrender of a large number of Iraqi insurgents in 2007, while Russia is said to have developed a "zombie gun" that can control people's thoughts and behavior.[83]

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[79] Dong, "Are you ready for intelligent warfare?"

[80] Lu Shaode, "Strengthen military political work in the era of military intelligence (*Jiaqiang junshi zhinenghua shidai de jundui zhengzhi gongzuo*; 加强军事智能化时代的军队政治工作)," *China Social Science Net (Zhongguo shehui kexue wang; 中国社会科学网)*, Nov. 21, 2019, http://news.cssn.cn/zx/bwyc/201911/t20191121_5046101.shtml.

[81] Liang, "Grasp the Winning Mechanism of Intelligent Warfare."

[82] Dong, "Are you ready for intelligent warfare? and Wang, "Insight into The Future of Intelligent Warfare."

[83] Lu, "Strengthen military political work in the era of military intelligenization."

Chapter 5: PRC Views of the Implications of Intelligent Warfare

PRC writers draw a number of potential implications from their analysis of intelligent warfare. These are discussed below.

AI and autonomy increase the speed and effectiveness of combat

Several writers argue that advances in AI and autonomy will lead to improved combat effectiveness. Whereas informatized warfare emphasizes the acceleration of the transmission of information, intelligent warfare will bring about an acceleration of the entire OODA loop process.[84] According to one article, the advantage of AI lies in its faster response speeds, stronger computing power, and larger storage space.[85] As one article explains, "After big data is processed through high-performance and highly efficient algorithms, the data is quickly converted into useful intelligence."

Shortened response times will be achieved through the extension of early warning times and the simultaneous employment of integrated, multidomain, self-organizing ISR assets.[86] Therefore, the party with the algorithmic advantage can dispel the "'fog of the battlefield' caused by the inability to process data in a timely manner." As a result, the use of AI command decision-making systems will, at least partially, remove humans from elements of decision-making and reduce decision-making from seconds to milliseconds or nanoseconds.[87]

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[84] Chai, "The Essence of Winning an Intelligent War." See also, Lu, "Draw a Picture of the Future Intelligent Warfare." Li, "Where is the Winning Mechanism of Intelligent Warfare?"

[85] Wang and Zuo, "Recognize the Winning Elements of Intelligent Warfare"; and Dong Zhiqiang, "The Winning Mechanism of Intelligent Warfare in the Cognitive Domain" (R*enzhi yuxia zhinenghua zhanzheng zhisheng jili*; 认知域下智能化战争制胜机理), *China Military Online*, Dec. 24, 2019, http://www.81.cn/xue-xi/2019-12/24/content_9704780.htm.

[86] Li, "Where is the Winning Mechanism of Intelligent Warfare?"; Li, "How to take advantage of intelligent warfare"; and Wang and Zuo, "Recognize the Winning Elements of Intelligent Warfare."

[87] Li, "Where is the Winning Mechanism of Intelligent Warfare?" and Wang and Zuo, "Recognize the Winning Elements of Intelligent Warfare."

AI and autonomy facilitate first strikes

Some writers assess that the increased effectiveness of AI and autonomy will enable rapid strike capabilities that could facilitate first strikes. [88] Indeed, one writer assessed that intelligent warfare will further strengthen the ability to strike first, calling this capability the "eternal winning mechanism" in warfare.[89] AI command decision-making will also allow for a variety of flexible options in regard to changing battlefield situations. [90] For example, unmanned systems can switch between different types of combat roles, making combat operations more "daring and risky" and unpredictable.[91] Similarly, another writer emphasizes the ability of autonomous systems to launch and coordinate surprise attacks, stating that autonomous weapons have the advantages of stealth, the ability to be widely distributed, and the ability to wait in ambush. As a result, they can be pre-deployed over a wide area in multiple domains and employed at an appropriate time to conduct surprise attacks.[92]

AI and autonomy increase the likelihood of war

According to some writers, the prominent use of lower cost robotic systems will increase the likelihood of war by reducing its human and economic costs.[93] Low-cost robotic systems and the increased effectiveness of AI described above may also increase the likelihood of war by enabling weaker countries to "even the odds" against more powerful adversaries. They will also provide nonstate actors with more capabilities to carry out terrorist attacks.[94]

There are, however, some dissenting voices to these assessments. These authors argue that the destructive capabilities of AI-enabled systems, likened to the destructive capabilities of nuclear war, coupled with the interconnectedness of human society brought about by AI and the

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[88] Zhao and Zhang, "An Ethical Review of Intelligent Warfare."

[89] Chong, "The Winning Mechanism of Intelligent Warfare in the Cognitive Domain."

[90] Li, "Where is the Winning Mechanism of Intelligent Warfare?"

[91] Li, "Where is the Winning Mechanism of Intelligent Warfare?"

[92] Wang, "Insight into The Future of Intelligent Warfare."

[93] Zhao and Zhang, "An Ethical Review of Intelligent Warfare' and Chen, "Deeply Grasp the Winning Mechanism of Intelligent Warfare."

[94] Lu, "Draw a Picture of the Future Intelligent Warfare and Zhao and Zhang, "An Ethical Review of Intelligent Warfare."

Internet of Things will raise the effects of intelligent war to such a degree that it will lead states to take measures to curb its effects.[95]

AI and autonomy increase exposure to related vulnerabilities

While acknowledging that AI-enabled operations may improve combat effectiveness, writers also emphasize the drawbacks of relying on AI. These drawbacks stem from the inherent reliance of AI on computers and networks and from the fact that AI is still in its early stages of development. Some of the main issues with intelligent systems in warfare identified by writers include the following:

- ***Vulnerability to attack and destruction:*** AI relies on electricity, information networks, and command centers. An attack on any of these elements can degrade the normal operation of an intelligent warfare system.[96] These attacks can be kinetic, use electronic warfare methods (including electromagnetic pulse weapons), or be conducted through cyber means.[97]

- ***Vulnerability of data:*** AI may be unable to cope with corrupted data. Two writers argue that due to the shortcomings of deep-learning algorithms, artificial intelligence systems based on big data have inherent defects in interpretability and credibility and are thus "extremely vulnerable to attacks." Errors in voice and image recognition can also lead to mistakes. As a result, autonomous weapon systems may have difficulty identifying disguises and deception.[98]

- ***Inflexibility:*** According to two writers, even though AI can master games such as Go, combat creates uncertainty through incomplete information and inconsistent intelligence. Based on current technology levels, AI can only solve problems within a specific range and lacks the ability to respond to new situations. As a result,

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[95] Zhao and Zhang, "An Ethical Review of Intelligent Warfare" and Fu, Yang, and Xu, "Intelligent Warfare, What Stays the Same."

[96] Luo Fengqi, "Military Intelligentization Also Has "Shortcomings" (*Junshi zhinenghua yeyou "duanban";* 军事智能化也有"短板")," *PLA Daily*, Dec. 27, 2020, http://www.81.cn/jfjbmap/content/2020-02/27/content_255048.htm and Chen and Dong, "Military Intelligentization in the Dialectical Perspective."

[97] Chen and Dong, "Military Intelligentization in the Dialectical Perspective"; and Luo, "Military Intelligentization Also Has 'Shortcomings.'"

[98] Luo, "Military Intelligentization Also Has 'Shortcomings.'"

autonomous systems may not be able to respond or may respond less effectively to attacks using new weapons and/or tactics.[99]

AI presents new ethical issues

Discussion of ethical issues in intelligent warfare was a notable theme among writers.[100] Some of the most prominent ethical issues highlighted by authors are discussed below.

Indiscriminate killing by AI

An earlier section in this paper discussed the prospect of reduced casualties in intelligent warfare if machines become the main combat force. Several writers, however, also discuss the prospect of indiscriminate killing of humans by autonomous systems.[101] They highlight several reasons that intelligent systems can harm humans, such as their inability to distinguish between civilian and military personnel.[102] Writers also emphasize that autonomous systems have no capacity for emotion, compassion, regret, and guilt. [103] These issues could lead autonomous systems to violate the norms of war that prohibit unnecessary pain and destruction and that call for the humane treatment of civilians and of wounded and captured persons.[104] Claiming that "one-third of the deaths caused by the US military's overseas drone strikes in recent years are civilians," authors highlight that traditional institutional rules and ethical principles have found it difficult to restrict these types of killings.[105]

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[99] Luo, "Military Intelligentization Also Has 'Shortcomings.'"; Wang, "Let Military Intelligence Enter the Track of Scientific Development."

[100] Of the 52 articles in the dataset, 11 of them (21%) raised these issues.

[101] Yuan Yi, "The Development of Military Intelligentization Calls for Relevant International Rules" (*Junshi zhinenghua fazhan huhuan xianggguan guoji guize*; 军事智能化发展呼唤相关国际规则), *PLA Daily*, Oct. 16, 2019, http://www.81.cn/jfjbmap/content/2019-10/16/content_245362.htm.

[102] Zhao and Zhang, "An Ethical Review of Intelligent Warfare."

[103] Fengbo Zhang, "If You Want to Become a Comrade-In-Arms of Mankind, Military Intelligent Weapons also need to be Ethical" (*Ruo xiang bian cheng renlei de hao zhanyou junshi zhinenghua wuqi yexu shou lunli*; 若想变成人类的好战友 军事智能化武器也需守伦理), *Science and Technology Daily*, Sept. 17, 2019 http://www.xinhuanet.com/mil/2019-09/18/c_1210284048.htm; Yuan, "The Development of Military Intelligentization Calls for Relevant International Rules"; Zhao and Zhang, "An Ethical Review of Intelligent Warfare."

[104] Zhao and Zhang, "An Ethical Review of Intelligent Warfare."

[105] Chen and Li, "Pay Attention to the Security issues of Military Intelligence Development."

Numbness toward killing

PRC writers raise concerns about humans becoming increasingly numb to killing as they become more removed from the battlefield. Writers highlight that research has shown that people become bolder and more violent in a virtual world, because they cannot experience the fear or pain of death.[106] This runs the risk of people treating unmanned operations like a video game.[107] Writers characterize the "rain of bullets" in war being reduced to a "byte" or a "line of code," and highlight that long-term presence in a virtual battlefield may result in a lack of human morality and a distortion of the concept of war itself.[108]

Deciding responsibility for wartime actions

Writers also highlight the complexity of assigning accountability for wartime actions resulting from the use of AI and autonomy. Challenges in assigning accountability stem from issues such as the numerous actors involved in the manufacture and use of autonomous weapons and the varying levels of autonomy these types of weapons may have. Accountability may fall on the controllers, arms dealers, programmers, purchasers, field commanders, maintainers, and even the weapons themselves.[109] Writers, however, caution that the distribution of responsibility across many actors may dilute a sense of guilt for the actions caused by these weapons.[110]

One writer, for example, drills down on which autonomous systems may carry responsibility based on the degree to which they interact with humans. The first type occurs in air defense and other operations where systems are required to make quick decisions autonomously. In this situation, humans may have been removed from the decision-making process. If so, any liability lies with the developer of the system. In the second category, in which humans make decisions in a human-machine teaming system, humans will be accountable for any of the consequences of human error. In the third category, AI systems simply aid human decision-making with data, simulation technology, and predictions, and play no direct role in

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[106] Zhao and Zhang, "An Ethical Review of Intelligent Warfare"; Wu Jiaxi and Qiao Pu, "Pay Attention to the Ethical Black Hole under the Intelligent War" (*Guanzhu zhinenghua zhanzheng xia de lilun heidong*; 关注智能化战争下的伦理黑洞), China Military Online, Apr. 28, 2020, http://www.81.cn/2020fdqj/2020-04/28/content_9842086.htm.

[107] Zhao and Zhang, "An Ethical Review of Intelligent Warfare."

[108] Wu and Qiao, "Pay Attention to the Ethical Black Hole under the Intelligent War"; and Chen and Li, "Pay Attention to the Security issues of Military Intelligence Development."

[109] Zhao and Zhang, "An Ethical Review of Intelligent Warfare."

[110] Wu and Qiao, "Pay Attention to the Ethical Black Hole under the Intelligent War."

decision-making. In this situation, commanders are ultimately responsible for the actions taken.[111]

Some articles assert that current international norms around war are insufficient to regulate intelligent warfare. They suggest that international standards for AI and autonomy should be developed, although they tend not to provide specific norms and implementation regimes.[112] One writer highlights that responsibility to promote international rules should fall on the major powers, since they are the main developers and users of autonomous weapons. This writer is a proponent of a major power taking the initiative to be the first country to make an international commitment to not develop or offensively use highly automated weapons, although he does not specifically name which countries should consider this option.[113]

In a joint article with Brookings Institution president John Allen, Ambassador Fu Ying—chairperson of the Center for International Security and Strategy at Tsinghua University, and a former PRC vice minister of foreign affairs—called for several measures to guide the development and use of AI. These included criteria for assigning accountability, retaining some degree of human control, and defining different classes of autonomous weapons. Ambassador Fu then advocated for the US and the PRC to start official negotiations to build international norms and regimes governing the development and use of AI and autonomous weapon systems.[114]

China's official stance at the United Nations, however, indicates that it only supports very limited arms control measures for lethal autonomous weapon systems (LAWS). A 2018 Chinese position paper to the United Nations Group of Governmental Experts on LAWS indicates that China is only interested in banning the most advanced form of LAWS—what it calls "fully autonomous lethal weapon systems," meaning those operating with no human control. The position paper also described arms control measures for LAWS as "very complex" and stated that, because of the widespread use of AI and autonomy in civilian and commercial applications, there should be no restrictions on the development of AI technologies. As a result,

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[111] Chen Cong, "Chen Cong: Legal Response to Military Intelligence" (C*hen cong: junshi zhinenghua de falu yingdui*; 陈 聪 ： 军 事 智 能 化 的 法 律 应 对), *China Social Sciences,* Jan. 31, 2018, http://www.cssn.cn/fx/201801/t20180131_3834371.shtml.

[112] Chen Cong, "Chen Cong: Legal Response to Military Intelligence"; Chen and Dong, "Military Intelligentization in the Dialectical Perspective"; and Yuan, "The Development of Military Intelligentization Calls for Relevant International Rules."

[113] Yuan, "The Development of Military Intelligentization Calls for Relevant International Rules."

[114] Fu Ying and John Allen, "Together, The U.S. And China Can Reduce The Risks From AI," *Noema Magazine*, Dec. 17, 2020, https://www.noemamag.com/together-the-u-s-and-china-can-reduce-the-risks-from-ai/.

the PRC's position would permit the development of the vast majority of semi-autonomous and autonomous weapon systems and do little to restrict their operational use.[115]

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[115] *China Position Paper submitted to the Group of Governmental Experts of the High Contracting Parties to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects,* Apr. 11, 2018.

Chapter 6: Conclusions and Implications

Chinese discussions of intelligent warfare indicate that the PLA is aware of the potential benefits, risks, and ethical challenges of AI and autonomy. As the PLA continues to debate the nature of intelligent war, these three factors will shape how the PLA employs these technologies in future wars. The extent to which international competition will affect the debate within the PLA on intelligent warfare and the deployment and use of AI and autonomy remains to be seen.

PRC discussions of intelligent warfare regard AI and autonomy as central to future warfare.

Although the PLA does not appear to have reached an official understanding of intelligent warfare, the articles surveyed for this report indicate that the PLA is exploring the implications of the widespread integration of AI and autonomy into its operations.

PRC discussions of intelligent warfare reflect an ongoing debate over the nature and effects of the widespread use of AI and autonomy in warfare.

The development of a doctrine for the integration of AI and autonomy into PLA warfighting and a concept of operations for their use would appear to be dependent on first reaching a consensus on its fundamental attributes. The differing opinions on the nature, conduct, and implications of intelligent warfare found in the dataset collected for this report suggest that the PLA has yet to reach an official consensus on those attributes.

PRC writers may envision AI and autonomy as providing capabilities to defeat the United States.

Assessments that AI and autonomy will enable weaker militaries to defeat stronger militaries suggest that PRC writers may view AI and autonomy as new technologies that could play a significant role in defeating the US military. They may also be a recognition that autonomous weapon systems may enable weaker militaries to better defend themselves against PRC military action.

Although several articles argue that the development of AI and autonomous technologies can allow the PLA to catch up with or surpass the US military technologically, no article surveyed for this report argued that AI and autonomy should be used to compensate for the type of PLA

deficiencies that cast doubt on the professionalism of the PLA officer corps, such as the "five incapables."[116]

Most PRC writers envision a hybrid command and control system involving humans and machines.

A minority of PRC writers contend that over time machines will completely replace humans. They argue that future war will become too complicated and too rapid for humans without the aid of machines. Most PRC writers, however, envision humans remaining in command of autonomous systems, especially at the strategic level, while exerting only limited control of machines at tactical levels.

In general, PRC writers seem to be influenced by Marxist and Maoist teachings that humans will remain the most decisive factor in war. These writers make several arguments:

- No matter how advanced intelligent weapons and equipment become, they still require human innovation, design, production, and management.

- War is still a conflict between people—and war is ultimately about the ability to influence a human enemy.

- Machines cannot replace the ingenuity, creativity, and flexibility of humans.

Most PRC writers conclude that AI and autonomy will reduce direct human involvement in war.

An emphasis on the development of AI and autonomous technologies may focus the PLA on the development of human capital to sustain innovation in these areas and may lead to the creative employment of autonomous weapon systems to achieve victory. The widespread adoption of AI and autonomy by the PLA could diminish the effect of political indoctrination and human will in warfare that the PLA has traditionally stated as inherent advantages over potential adversaries.

PRC characterizations of AI and autonomy may lead to actions that increase instability.

The conclusion of PRC writers that AI and autonomy will facilitate militaries to seek a first mover advantage through first strikes, including preemption, suggests that the PLA may seek to strike first using autonomous systems. The facilitation of first strikes by AI and autonomy

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[116] Dennis J. Blasko, "The Chinese Military Speaks to Itself, Revealing Doubts," *War on the Rocks*, Feb. 18, 2019, https://warontherocks.com/2019/02/the-chinese-military-speaks-to-itself-revealing-doubts/. The "five incapables" are the inability of some PLA officers to judge situations, understand higher authorities' intentions, make operational decisions, deploy troops, and deal with unexpected situations.

could be also encouraged by the PLA's active defense military strategy, which has a strong offensive component that includes first strike and possibly preemption.[117]

This report found no discussions of the escalatory implications of first strike in PRC writings, a finding that corresponds to other CNA work. PRC descriptions of intelligent warfare as more daring, risky, and unpredictable than previous forms of warfare appear to run counter to other PLA writings that emphasize strategic and political stability.[118]

PRC characterizations of intelligent warfare may lead the PLA to emphasize cognitive warfare.

Assessments by PRC writers that the cognitive domain will become more prominent in intelligent warfare suggest that the PLA may increase its capabilities to influence outcomes in this domain.

- PRC writings on the growing importance of cognitive warfare and the ability of operations in the cognitive domain to allow China "to win without fighting" suggest that the PLA may increase efforts to influence competitors and potential adversaries through propaganda and disinformation in order to further CCP goals.

- PRC writings on the growing importance of cognitive warfare suggest that the PLA will focus on the denial and degradation of adversary data, programming, and computer systems that enable AI and autonomous systems, regardless of the domains they serve.

- Assessments of the importance of the cognitive domain in intelligent warfare also suggest that writers view operations there as cutting across all other domains. As a result, the PLA's conception of warfare may move from emphasizing operations in the physical domains of the land, air, sea, and outer space to the nonphysical domains of cognition, cyber, and the electromagnetic sphere.

- An increased emphasis on operations in the nonphysical domains would appear to provide a greater role for the PLA's Strategic Support Force, which has responsibilities for conducting outer space, cyber, electronic warfare, and psychological warfare operations.[119]

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[117] Office of the Secretary of Defense, *Military and Security Developments Involving the People's Republic of China 2020*, 2020, 27.

[118] Alison Kaufman and Daniel Hartnett, *Managing Conflict: Examining Recent PLA Writings on Escalation Control*, CNA DRM-2015-U-009963-Final3, Feb. 2016, v.

[119] Office of the Secretary of Defense, *Military and Security Developments Involving the People's Republic of China 2020*, 2020, 61.

China may seek to establish international norms for the ethical wartime use of AI and autonomy.

Ethical concerns by PRC writers regarding the prevalence of AI and autonomous systems and the resulting dehumanization of warfare suggest that China is open to dialogue on how to govern the military use of AI and autonomous systems. Although the restrictions proposed by PRC writers appear to be limited, further discussions could reveal areas of common ground that could be beneficial to US national security interests.

Abbreviations

AI	Artificial intelligence
AMS	Academy of Military Sciences
C2	Command and control
C4ISR	Command, control, computers, communication, intelligence, surveillance, and reconnaissance
CCP	Chinese Communist Party
EEG	Electroencephalogram
ISR	Intelligence, Surveillance, and Reconnaissance
LAWS	Lethal autonomous weapon systems
OODA	Observe, orient, decide, act
PLA	People's Liberation Army
PRC	People's Republic of China

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