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People's Liberation Army Operational Concepts

In his report to the 19th Chinese Communist Party (CCP) Congress in 2017, President Xi Jinping called for the People's Liberation Army (PLA) to complete its force modernization effort by 2035 and field a world-class military capable of fighting and winning wars in any theater of operations by 2050 ("Full Text of Xi Jinping's Report at 19th CPC National Congress," 2017). The PLA has

KEY FINDINGS

- Lacking recent examples of the People's Liberation Army (PLA) in combat, the operational concepts developed in accordance with Chinese Communist Party (CCP) strategic guidelines provide the best indication of how the PLA would fight.
- Strategic guidelines direct the PLA to win "Informatized Local Wars," recognizing the centrality of information both as a domain in which war occurs and as the central means to wage military conflict when the dominant mode of warfare is confrontation between "information-based systems-of-systems." One of the most notable efforts toward "informatization" is the PLA's establishment of the Strategic Support Force, which is responsible for integrating cyber data and capabilities with electromagnetic and space warfare information and operations.
- Three interlinked operational concepts likely underpin doctrine and establish principles by which the PLA will seek to accomplish its given missions through 2035, the date that President Xi Jinping assigned for the PLA to achieve "fully modernized" status: (1) War control (and, therefore, campaign success) depends on information dominance; (2) combat space is shrinking, but war space has expanded; and (3) target-centric warfare provides the means to defeat an adversary's operational system.
- Xi and his strategists are looking beyond his 2035 fully modernized milestone to develop military theory and concepts for a "world-class military" by 2050. At the center of this innovative effort is the PLA's leveraging of national defense big data and artificial intelligence (AI) to support an evolved system-of-systems or algorithm-based approach to great-power competition and armed conflict.
- The extent to which Chinese aspirations for an innovative military strategy and doctrine become reality will largely rest on the application of emerging big data and AI technologies to military purpose and the marriage of any ensuing new capabilities to existing concepts of joint force operations in system-of-systems warfare.

already made impressive progress in force development and restructuring efforts over the past three decades, but it is unclear how these efforts will translate to battlefield performance—particularly given that China's leaders have not sent PLA forces into major combat operations for four decades. Despite this lack of experience, the PLA today is considered by most defense analysts to be far more capable than the ground force–centric, technologically unsophisticated PLA that invaded Vietnam in 1979.

Lacking examples of the PLA in combat, the operational concepts that underpin PLA doctrine and planning provide the best indication of how the PLA would fight should it be called on by CCP leadership to do so. Study of these concepts involves mapping out the hierarchy of thought that produces them. The military theory promulgated by the CCP over the years, or more specifically by the leader of each successive generation of power, stands at the top of the hierarchy. Military theory provides the logic that guides the development and employment of the PLA in a manner that reinforces CCP political authority. Chinese military theory is the "logical system of knowledge regarding war and national defense, produced from military experience. It serves as a guide to military experience and is testable" (PLA Academy of Military Science, 2011). As one PLA researcher explained, the party's military theory "deeply reveals the stage, characteristics and laws of military development" (PLA Academy of Military Science, 2011). According to PLA writers, military theory must be updated to incorporate the latest findings from scientific research and CCP ideology (PLA Academy of Military Science, 2011).

The "CCP military guiding theory" [党的军事指导理论] is the party's systematic thinking about warfare and national defense issues, incorporating the thoughts of Karl Marx, Mao Zedong, Deng Xiaoping, Jiang Zemin, Hu Jintao, and now Xi (PLA Academy of Military Science, 2011). Every leadership change and attendant update to CCP guiding theory requires an update to the People's Republic of China (PRC) military thought (see Figure 1). Moreover, military theory evolves and is developed based on an understanding of the changing form of war as understood by China's supreme command and includes "guiding principles" that drive the next level of the hierarchy—military strategy (see Table 1 for a summary of the generational evolution of Chinese military theory, principles, and strategy). For decades, authoritative CCP documents and speeches have delineated "active defense" as the country's military strategy (PLA Academy of Military Science, 2011).

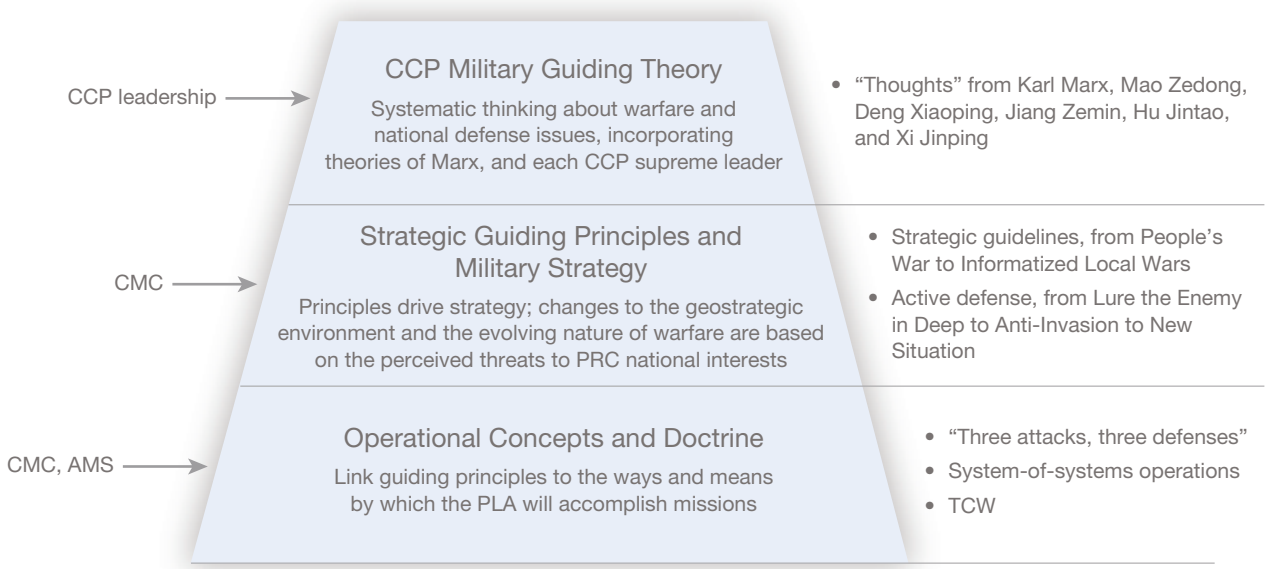
Active defense has deep roots, traced back to Mao's military writings, wherein the Red Army

Abbreviations

AI	artificial intelligence
C2	command and control
C4ISR	command, control, communications, computer, intelligence, and reconnaissance
CCP	Chinese Communist Party
CMC	Central Military Commission
CONOP	concept of operations
DoD	U.S. Department of Defense
EW	electronic warfare
ISR	intelligence, surveillance, and reconnaissance
MR	Military Region
PLA	People's Liberation Army
PLAAF	People's Liberation Army Air Force
PLAN	People's Liberation Army Navy
PLARF	People's Liberation Army Rocket Force
PLASSF	People's Liberation Army Strategic Support Force
PRC	People's Republic of China
RMA	revolution in military affairs
SMS	*Science of Military Strategy*
TCW	target-centric warfare

FIGURE 1

Hierarchy of PRC Military Thought



SOURCES: PLA Academy of Military Science, 2011; People's Liberation Army, Nanjing Army Command College, 2013; Heath, 2016; Finkelstein, 2007; Mulvenon, 2005.

NOTE: CMC = Central Military Commission; AMS = Academy of Military Science; TCW = target-centric warfare.

TABLE 1

Characterization of Military Strategy and Generations of PLA Doctrine

Concept	Doctrine					
CCP Strategic Guidelines (year)	People's War Defending the Motherland (1956); Resist in the North, Open in the South (1960); Lure the Enemy in Deep (1964)	People's War Under Modern Conditions (1977)	Local Wars Under Modern Conditions (1985)	Local Wars Under Modern, High-Tech Conditions (1993)	Local Wars Under Informatized Conditions (2004)	Informatized Local Wars (2015)
Key strategic concept	Imminent war, major war, nuclear war	Active defense (Lure the Enemy in Deep)	Active defense (Anti-Invasion)	Active defense (New Era)	Active defense (New Era)	Active defense (New Situation)
Doctrine generation (year)	First-generation combat manual (1961–1965)	Second-generation combat manual (1974–1982)	Third-generation combat manual (1985–1994)	Fourth-generation operational manual (1999)	Fifth-generation (developed but not formally issued)	New generation operational manual (in development)
Key doctrinal concepts	Positional defense, mobile offense	Positional defense	Seize the initiative; mass forces for decisive, early battle	"Three attacks, three defenses"; key node strikes; noncontact warfare	Informatization; system-of-systems operations	Information dominance; TCW

SOURCE: PLA Academy of Military Science, 2016, pp. 39–52.

wearies an invading enemy by trading space for time using guerilla tactics. In Deng Xiaoping's military thought, active defense involved pushing China's defensive perimeter away from coastal economic centers of gravity while building longer and stronger lines of support for operations in offshore maritime and air domains. Active defense from Jiang to Xi has evolved to include a mix of offensive, defensive, and deterrent concepts encompassing operations further from China's periphery and also in the space and cyber domains. It is defensive at the strategic level of war but often offensive at the operational and tactical levels.

Several guiding principles determine how active defense as a strategy has evolved and maintained currency over the years. These principles at the level of military strategy, in turn, drive the development or refinement of the next level in the hierarchy of military thought, military doctrine, and operational concepts.[1] Guiding principles are promulgated in CCP strategic guidelines, which delineate China's military strategy in the context of perceived threats to PRC national interests given changes to the geostrategic environment and the evolving nature of warfare (Fravel, 2015). The CMC, the military's top leadership, issues "military strategic guiding principles" [军事战略指导方针] based on CCP leadership guidance that encapsulates PLA military strategy and directs force construction and operations (Finkelstein, 2007).

Party threat perceptions indicate an acute sense of vulnerability in the "informational" (electromagnetic, space, cyber and cognitive) and maritime domains.

Mao's "People's War" principles guided the PLA from the founding of the PRC through the early 1980s with the issuance of one major set of strategic guidelines and two minor revisions. Mao directed the PLA to prepare to fight "imminent war, major war, nuclear war" [早打, 大打, 打核战争], employing active defense in the form of guerilla warfare against an invading force to set the conditions for a PLA counteroffensive. A shift to "People's War Under Modern Conditions" in the mid- to late 1970s adjusted active defense to focus on winning early battles closer to China's borders to facilitate more-rapid transition to offensive operations and relying on China's new nuclear capability to deter a more powerful adversary from crossing the nuclear threshold.

Deng's characterization of the early 1980s as a period of "peace and development" [和平與发展] indicated a shift in CPP thinking that downplayed the threat of invasion. In 1985, Deng directed the military to prepare to conduct "Local War Under Modern Conditions," emphasizing speed, mobility, and lethality rather than the attrition and protraction of People's War (Godwin, 1992). As a consequence, this period also saw the most dramatic troop cuts in the history of the PLA.

Jiang made another major change to strategic guidelines in 1993 with "Local Wars Under Modern, High-Tech Conditions," which emphasized the principle of "three attacks, three defenses" (i.e., attacking enemy stealth, cruise missiles, and helicopters, while defending against precision strikes, electronic warfare [EW], and reconnaissance) (U.S. Department of Defense [DoD], 2005; DoD, 2017). Jiang and his strategists observed U.S. operations in the first Gulf War and assessed that "networked" precision strike capabilities represented a "revolution in military affairs [RMA]" that China was ill-prepared to deal with in the context of potential conflict with the United States over Taiwan. This threat analysis drove research, development, and acquisition of more-advanced weaponry to extend air and maritime defensive perimeters beyond China's coast, prioritizing advanced weapons systems for the PLA Second Artillery, PLA Air Force (PLAAF), and PLA Navy (PLAN) while continuing the downsizing of ground forces.

In 1999, Jiang updated the strategic guidance of "Local War Under Modern, High-Tech Conditions"

to "Local War Under Modern Informatized Conditions." He signed a new set of doctrinal publications, "The New Generation Operations Regulations," prioritizing PLA development of capabilities and concepts for joint campaigns encompassing air, sea, space, land, and electromagnetic domains (Mulvenon and Finkelstein, 2005). In 2004, Hu promulgated the principles for "Local Wars Under Informatized Conditions," emphasizing concepts and capabilities to respond to threats from technologically superior foes. In 2005, Hu was credited with directing the PLA to master "system-of-systems operations," which focuses on joint units with integrated command networks enabling key node strikes against the combat networks and systems of an advanced adversary (PLA Academy of Military Science, 2010).

Most recently, Xi revised the guidelines in 2015 by directing the PLA to win "Informatized Local Wars," recognizing the centrality of information both as a domain in which war occurs and as the central means to wage military conflict when the dominant mode of warfare is confrontation between "information-based systems-of-systems" (Engstrom, 2018). Guidance in 2015 also stressed the development of capabilities and concepts for maritime operations. Party threat perceptions indicate an acute sense of vulnerability in the "informational" (electromagnetic, space, cyber and cognitive) and maritime domains (Ross, 2009). As a consequence, a major tenet of China's informatized approach is to build capabilities to deny an advanced maritime power, such as the United States, to gain and maintain access to operating areas that hold Chinese interests at risk (Cooper, 2011).

Discussions of military theory, strategy, and guiding principles are more than an academic pursuit—they provide a window through which to observe the development of PLA combat capability and assess the likelihood of its employment by China's leaders. In the first three decades of the PRC, the CCP employed its military in combat operations against the United States, the Soviet Union, India, and Vietnam. In the four decades since the Vietnam invasion, the PLA has been in an extended period of "peacetime army building" with no major combat missions. Although there are myriad political and economic determinants for CCP choices to turn to other than military tools to accomplish national objectives over this period, it is also likely that CCP leaders from the mid-1980s on felt that the PLA lacked the necessary capabilities to employ force on the modern battlefield to achieve or reinforce political goals.

Chinese military theory from the 1990s forward posits that joint operations are the "basic form" of war.

Comprehensive military modernization efforts over this period, culminating in the PLA restructuring initiative set in motion by Xi in 2015, may bridge the gap between PLA capabilities and China's long-term strategic objectives, which include resolutions in Beijing's favor of several territorial and sovereignty disputes. Should CCP leaders assess that the PLA is an increasingly attractive and potentially effective tool to resolve these disputes, it will be important for U.S. security strategists and military planners to understand the operational concepts and principles that will guide any PLA use of force.

Guiding Principles for the Current Active Defense Strategy

Chinese professional military education materials make clear that China has absorbed lessons learned from U.S. performance in contemporary conflicts and harnessed those insights to shape its development of a joint reconnaissance-strike capability (Chase, Garafola, and Beauchamp-Mustafaga, 2017, p. 5). Chinese military theory from the 1990s forward posits that joint operations are the "basic form" of war. The major trends that inform how joint warfare is conducted are informatization, driven by the impact of advanced information technologies on combat operations, and system-of-systems

Another guiding principle underpinning PLA strategy is the need for superiority in three main domains—information, air, and maritime—with the information domain as first and foremost in importance.

confrontation, which is driven by a Chinese assessment that outcomes in modern warfare are decided by confrontation between complex networks rather than by force-on-force or platform-on-platform combat. When speaking of a "fully modernized" force in 2035, Xi no doubt envisions a PLA capable of conducting joint informatized operations in the context of systems destruction warfare, giving the CCP a tool to achieve political objectives while controlling the scope and scale of conflict.

Integrated Joint Operations

Throughout the 1990s, PLA research focused on operational requirements necessary for campaigns in different environments, including amphibious, mountain, urban, and airborne warfare. PLA campaign concepts from the same period outlined a mix of traditional, ground-centric constructs, such as positional defense and maneuver warfare alongside new concepts geared specifically toward these environments (张玉良 [Zhang Yuliang], 2006, p. 96; 王厚卿 [Wang Houqing] and 张兴业 [Zhang Xingye], 2001). This emerging body of literature recognized joint capabilities as essential to waging modern warfare, focusing on several joint campaign types [联合战役] as distinguished from service campaigns [军种战役] (《联合战役学教程》 [*Lectures on the Science of Joint Campaigns*, 2012). The PLA has campaigns for the air, sea, and land domains in the event of conflict on China's periphery, campaigns for conflict over Taiwan, and campaigns for maritime claim missions.[2]

Following PLA-wide conferences in 1996 and 1997, military leaders agreed on basic guidance for joint operations (Bi, 2005). After four years of study and work by the PLA Operations Regulations Compilation Committee, the CMC issued the "New Generation Operations Regulations,"[3] marking the first incarnation of an actual Chinese joint doctrine. A 2004 defense white paper subsequently stated, "The PLA takes as its objective to win local wars under the conditions of informatization" and explained that to "meet the requirements of integrated and joint operations," the PLA would "establish a modern operational system" (Information Office of the State Council, 2004, p. 6).

Highlighting that the dramatic change in requirements for the PLA also required new command structures and operational approaches, the Academy of Military Science in 2013 published *The Science of Military Strategy* (SMS), which discussed the basic principles of organizing joint theater commands and operational methods between joint forces. The book defined *integrated joint operations* as "completely linked (multiservice) operations that rely on a networked military information system, employ digitized weapons and equipment, and employ corresponding operational methods in land, sea, air, outer space, and cyber space" (Shou, 2013, p. 125). It explained that integration requires the PLA to "fuse" joint operational strength involving "all services and branches." Importantly, the book expressed an ambition to "break through the hierarchical differentiation between strategic, operational, and tactical levels," suggesting a focus on developing multiservice integration at every level of command (Shou, 2013, p. 124).[4]

Informatized War

Another guiding principle underpinning PLA strategy is the need for superiority in three main

domains—information, air, and maritime—with the information domain as first and foremost in importance. Ideally, superiority can be established comprehensively throughout a campaign's duration, but PLA researchers understand that, in most cases, episodic dominance in key domains during critical campaign phases would be a more likely condition. In PLA campaign constructs, the "three superiorities" are a core element of PLA doctrinal thinking and operational planning. The necessary precondition for embarking on any operation revolves around the ability to defend one's own capabilities in these domains, while also coordinating intelligence, surveillance, and reconnaissance (ISR) efforts to maximize the efficiency and effect of offensive firepower and accurately assess the operational impact and readiness of an adversary's combat systems. Thus, the critical lynchpin for achieving the three superiorities is timely, high-fidelity information.

PLA literature since the 1990s frequently stresses the criticality of information dominance to winning current and future wars. Chinese analysts have closely observed past U.S. conflicts and still point to Operation Desert Storm, Operation Allied Force, and Operation Iraqi Freedom as examples of wars in which control over information equaled holding the initiative in a high-tech battlefield environment.[5] Furthermore, PLA research and experimentation on integrated joint operations (2001–2005) and information-based system-of-systems operations (2005–2010) laid the developmental foundations for more-complex concepts of operation that would operationalize "integrated operations, key point strikes." Throughout this period, PLA leaders prioritized development and deployment of a PLA-wide integrated electronic information system to make joint command and control (C2) and networked precision strike a reality (Pan Jinkuan, 2006).

The 2013 SMS emphasizes the primacy of information and information networks:

> in the military field, computer-centered network systems serve as the nerve centers of modern military forces and military activity, and interlink the various operational strengths, as well as military activity of different types and in different spaces, into an organic integrated whole, which is a decisive factor and basic condition in the transformation of the form-state of war into informatized war (Shou, 2013).

In 2015, the PLA unveiled the concept of "Winning Informatized Local Wars," replacing the seemingly similar 2004 doctrine of "Local Wars Under the Conditions of Informatization." This new doctrine enshrines the centrality of information as an instrument in prosecuting and winning contemporary wars rather than as a condition to contend with when fighting them. It also reflects a PLA assessment that taking away information superiority from an advanced adversary, such as the United States, can degrade the key advantages enjoyed by that adversary. According to the 2015 defense white paper on China's military strategy, informatized wars require attaining information dominance within the cyber, space, and electromagnetic domains and relies on application of advanced information technologies for carrying out all operational and support activities,

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not just information warfare (Information Office of the State Council, 2015).

PLA campaign literature indicates that current doctrine builds on aspirations for a joint force that employs a mix of offensive and defensive concepts to gain information dominance at the outset of conflict; the PLA then uses this advantage to conduct long-range precision strikes against an enemy's critical command, information, and logistics nodes and key power-projection systems (王厚卿 [Wang Houqing] and 张兴业 [Zhang Xingye], 2000). Limited targeting to achieve strategic campaign goals while avoiding excessive risk is inherent in these networked operations. This concept prioritizes enough disruption of an adversary's operations to accomplish specific, limited political goals. It also encapsulates Chinese thinking about maintaining control of the war situation and escalation.

System Destruction Warfare

To implement an informatized vision of warfare, the Chinese since 2005 have been developing an integrated "system confrontation" [体系对抗] approach to operations, akin to but broader than U.S. network-centric warfare.[6] Systems thinking has pervaded every aspect of the PLA's approach to training, organizing, and equipping for modern warfare (Liu Yazhou, 2013; 党崇民 [Dang Chongmin] and 张羽 [Zhang Yu], 2009). The PLA's aim for creating an informatized force is to build a system of systems that can coordinate activities across the military and inside and between military theaters, arms, and services (Wang Zhengde, 2007). The central warfighting system in this concept is the operational system [作战体系], a linkage of organizations, functional processes, and networks enabling integrated joint service warfighting across all domains (任连生 [Ren Liansheng] and 乔杰 [Qiao Jie], 2013). The operational system is made up of five component systems: the command system, firepower strike system, information confrontation system, reconnaissance-intelligence system, and support system (PLA Academy of Military Science, 2011).

The PLA's current approach incorporates the idea of waging "system destruction warfare" to paralyze the functions of an enemy's operational system (Shou, 2013; Zhang Xiaojie and Liang Yi, 2010; Dang and Zhang, 2009).[7] According to this theory of victory, one side "will be able to attain victory in war without massively annihilating the enemy's vital strengths and will be able to realize the goal of war through controlling and paralyzing enemy systems to make the enemy lose its integrated-whole resistance capabilities" (Shou, 2013, p. 117). System destruction warfare emphasizes striking selectively but precisely and decisively against critical aspects of the enemy's capabilities, in particular "centers of gravity in enemy systems, including leadership institutions, command and control centers, and information hubs" (Shou, 2013, p. 118).[8]

Modern military conflict is thus perceived by the PLA to be a confrontation between opposing operational systems (Ma and Yang, 2013; Shou, 2013; 李有升 [Li Yousheng], 李云 [Li Yin], and 王永华 [Wang Yonghua], 2012; 刘兆忠 [Liu Zhaozhong], 2011). Systems confrontation is waged not only in the traditional physical domains of land, sea, and air but also in outer space and the nonphysical cognitive, cyberspace, and electromagnetic domains (Liu Yazhou, 2013; Dang and Zhang, 2009, pp. 98, 122). In fact, Chinese military authors frame their overall approach to warfare in terms of information: "Information system-based system-of-systems operations are the basic form of wars in the information age and reflect the main characteristics of wars in the informatization age" (Geng and Zhu, 2011). Initiatives enabling this approach to warfare include

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updating theory and doctrine, developing units and platforms optimized for system-of-systems warfare, and revamping training and education for joint informatized operations.

A related principle in PLA theory focuses on the requirement to integrate capabilities from across the PLA to identify and hold at risk an adversary's most-critical functions. PLA literature discusses at length "integrated operations, key point strikes" as a "basic campaign guiding concept" directed by the *National Military Strategic Guidelines for the New Era* (Wang and Zhang, 2001, p. 2). The overarching principle behind this concept was the need to bring together military and nonmilitary elements essential for operational success by concentrating campaign strengths based on time and space (Wang and Zhang, 2001, p. 5). Integrated campaign strengths could then be focused on "strikes against targets that are vital to sustaining and supporting the enemy's operational system," thus "paralyzing the enemy's operational system . . . and . . . achieving campaign victory" (Wang and Zhang, 2001, p. 9). Awareness, precision, and flexibility are all core characteristics of this new PLA approach to campaign operations.

Current Operational Concepts

Three interlinked operational concepts likely underpin current doctrine and link guiding principles to the ways and means by which the PLA will seek to accomplish its given missions. Although notional, these concepts figure prominently across the range of Chinese military science and professional military educational materials dealing with campaign, or operational, issues (see the appendix for an overview of these materials). They are both directly and indirectly referenced in the sources and are often linked in doctrinal discussions. We assess that these are the general operational concepts that PLA commanders will have internalized over the course of careers that span the past 15 years and the next 15 years; they will thereby guide force development out to Xi's 2035 milestone for the PLA to become a fully modernized force. These three concepts can be summarized as follows:

SMS frequently cites the need for the PLA to build information systems and networks that will allow it to seize the advantage early in combat and ultimately defeat a more technologically advanced adversary.

- War control (and therefore campaign success) depends on information dominance.
- Combat space is shrinking, but war space has expanded.
- TCW defeats the adversary's operational system.

War Control Depends on Information Dominance

One of the core strategic command tasks that the PLA describes is war control (or controlling the pace and intensity of conflict and escalation). Discussions on this strategic task—a common theme in PLA military science literature since the early 2000s—highlight the tension between controlling a war's intensity and seizing the initiative in a conflict. Although escalating a conflict by striking strategic targets may be necessary to seize or maintain initiative in certain cases, such actions are accompanied by great risk to war objectives and potentially to the long-term development of the state (Cha, 2012). Chinese strategists have reached the conclusion that the surest path to maintaining escalation control and attaining campaign success is through information

The key requirement of system destruction conflict is to paralyze the functions of an enemy's operational system—whether or not that enemy subscribes to a systems approach to conflict.

dominance—with the broadest possible definition of "information."

Operationally, information collection, processing, and transmission—and the denial of the same to the adversary—are critical for success in a modern high-tech war. Information dominance is achieved when friendly forces can "seize and preserve the freedom and initiative to use information" on the battlefield, while "simultaneously depriving an opponent" of that freedom and initiative (Shou, 2013, p. 245).[9] SMS frequently cites the need for the PLA to build information systems and networks that will allow it to seize the advantage early in combat and ultimately defeat a more technologically advanced adversary. It states:

> On the basis of continuously enhancing information network system defense capability, [the PLA must] speed up building information operations units that employ information warfare weapons and equipment as the main operational means and specialize in carrying out information warfare tasks and strive to develop diversified information operations attack and defense means to effectively guard against and deter an enemy from initiating a large-scale information invasion (Shou, 2013, pp. 118–119, 143–144).[10]

Seize Information Dominance Through Network Warfare

The key requirement of system destruction conflict is to paralyze the functions of an enemy's operational system—whether or not that enemy subscribes to a systems approach to conflict (檀松 [Tan Song] and 穆永朋 [Mu Yongpeng], 2014; Shou, 2013; Zhang and Liang, 2010; Dang and Zhang, 2009).[11] The central component of this effort is the requirement to effectively wage network warfare, as follows:

> The side holding network warfare superiority can adopt network warfare to cause dysfunction in the adversary's command system, loss of control over operational strengths and operational activities, and incapacitation or failure of weapons and equipment, and thus seize the initiative within military confrontation and create the conditions for effectively achieving military activities goals and gaining ultimate victory in war (Shou, 2013, p. 243).

PLA campaign design will thus emphasize detecting, identifying, and attacking enemy networks to achieve this paralysis. Primary targets will be leadership, C2 nodes, sensors, and information hubs (Shou, 2013, p. 118). Paralysis can occur through kinetic and nonkinetic attacks, because both types of attacks may be able to destroy or degrade key aspects of the enemy's operational system. At the same time, PLA commanders must protect their own network warfare capabilities, because the Chinese understand the inherent vulnerabilities of their systems to similar attacks by the adversary. The Chinese campaign design will include detailed planning for protecting networks in both the physical (e.g., personnel, equipment, and facilities) and nonphysical (e.g., cyber, electromagnetic, informational) domains (Shou, 2013, p. 248).

Enabling Rapid and Effective Decisionmaking

Chinese military writings hold that command speed enabled by information dominance determines the outcome of a battle in modern conflict. PLA leaders point out that holding the initiative on the battlefield requires "precise decisionmaking based on accurate information and rapid decisionmaking at a pace quicker than the enemy" (Wang Yinfang, 2016, p. 7).

In combat operations under modern conditions, Chinese commanders understand that operational information is constantly changing, requiring rapid troop movements and frequent adjustment of operational patterns. Furthermore, because of these rapid changes on the battlefield, the conventional command method (i.e., primarily relying on manual planning and coordination rather than networked coordination) does not suit the needs of most modern combat operations (Wang Yinfang, 2016).

When looking at past wars, Chinese assessments emphasize that the speed of combat is much more rapid than in the past because of the increased use of high-tech weapons and instantaneous communications (Wang Yinfang, 2016). The 2013 SMS highlights this trend and the drivers behind it: "The informatization of war means has provided an unprecedented possibility to pick up the operational pace and shorten the war progress. High speed and fast pace in the time dimension can effectively compress the enemy's defense space" (Shou, 2013, pp. 123–124). Shortening the decision cycle is now seen as key to winning in battle.

Another aspect related to speed of operations is the need to accelerate the "reconnaissance-control-attack-evaluation" cycle. Guidance to PLA commanders will emphasize accelerating intelligence operations:

> Timeliness is crucial—as the complexity and confrontation of future wars escalate, the timeliness of intelligence information becomes very important. Time-sensitive intelligence must play its role the first time; information past its useful time is of no value and may even become wrong or harmful information (Qin Weijang, 2010).

Speed in decision cycles will also be stressed as part of the operational guidance. Finally, commanders will likely be directed to minimize the "sensor-to-launcher" cycle to make strikes "fast and highly efficient" (Hu and Xie, 2008).

PLA commanders will thus emphasize speed as the critical characteristic in decisionmaking. Speed will be achieved without sacrificing precision by integrating command functions via networks, so decisionmakers are able to quickly glean combat operational data, make "precise operational calculations," and ideally assess the results of operations in real time (Li, 2016; Hu, 2016, p. 6). Campaign plans will stress the early establishment of networks, achieving information dominance, and leveraging advantages in these domains to outpace enemy decisions and actions.

Enabling Efficient Operations

Seizing information superiority will accelerate commanders' decisionmaking process and shorten the time it takes for commanders to relay orders to subordinates, thus making operations more efficient. Chinese analysts note that new command, control, communications, computer, intelligence, surveillance, and reconnaissance (C4ISR) technologies enable instantaneous information-sharing, and robust and redundant communications networks provide commanders with improved situational awareness. PLA authors also state that more sharing of intelligence in "real time" makes operations more efficient under "complex enemy conditions" because the command has a clearer picture of enemy activity (Li, 2016).

Future PLA campaigns will be based on networks that "seamlessly link" all components of the

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operational system (Ren and Qiao, 2013; Zhang and Liang, 2010; Information Office of the State Council, 2015). Indeed, the intent, although still aspirational, is that "all functions of every element are integrated" in this way (Zhang and Liang, 2010, pp. 15–16). The PLA believes it can eventually achieve a true joint warfighting capability through network integration of all units, formations (both service and joint formations), and elements (Ren and Qiao, 2013, pp. 233–234). This integration of networks and forces enables efficiency in two aspects. First, it allows commanders to more rapidly pass decisions down the chain of command to the operational units and for subordinates to pass information up to the commander, thus improving the speed of decisions. Second, it permits precise selection of objectives and synchronization of actions, creating operational efficiencies across the joint force. In PLA campaign design, quantity of activity will be less important than timing, targeting, and quality of effects. Efficient and integrated joint operations will employ "precise selection of targets, streamlined forces, precision strike, and precision support" (Shou, 2013, p. 161).

The campaign design will attempt to deny an adversary use of its computer networks and information systems, "blinding" the enemy through use of capabilities that can disable the acquisition of timely and accurate information

Degrade Enemy Decisionmaking for Operational Advantage

Another priority for the PLA is to degrade or deny an adversary's information processing, transmission, and collection capabilities, thereby clouding the adversary's decisionmaking process. This includes strikes to degrade or disrupt the flow of information within the adversary's operational system. To paralyze information flow, the PLA literature mentions kinetic and nonkinetic targeting against key data links and vital information network sites to disrupt the adversary's command system, degrade situational awareness, and delay decisionmaking (Li, Li, and Wang, 2012; Dang and Zhang, 2009).

The campaign design will attempt to deny an adversary use of its computer networks and information systems, "blinding" the enemy through use of capabilities that can disable the acquisition of timely and accurate information (Yu, 2016). By carrying out strikes against these capabilities, Chinese officials believe they can "information isolate" an adversary and render that adversary unable to function (Li, Li, and Wang, 2012, p. 72). We can thus expect a PLA campaign against U.S. forces in a regional contingency to prioritize degrading C4ISR systems, with main effort directed against the ability to acquire and distribute information across U.S. C2 systems.

Combat Space Is Shrinking, War Space Expanding

A second notional concept guiding PLA commanders is spatial. The PLA describes this concept as the need to contest the enemy across the full spectrum of conflict. This includes use of new technologies across all domains (i.e., land, air, sea, space, electromagnetic, and cyber) and beyond purely military actions to encompass political, economic, and diplomatic spheres. The 2005 SMS describes the expansion of conflict beyond the military sphere:

> The future high-tech local war is not just a competition of military forces, but an overall contest of political, economic, diplomatic, cultural, and other forces. The competitions in the nonmilitary fields . . . coordinate directly or indirectly with military operations . . . pure

PLA writings also discuss the expansion of the war space from "multidimensional," or occurring on land, air, and sea, to "full-dimensional," which includes these previous three dimensions plus space and cyber.

> military operations cannot get final victory without the powerful cooperation and support of the competitions in every non-military field (Peng and Yao, 2001, p. 471).

The PLA's concept of the modern battlespace has evolved since the early 2000s. In Chinese military writings, *combat space* is the geographic area where actual physical conflict occurs, while *war space* encompasses both the physical and nonphysical domains of the war, including the political, economic, diplomatic, and informational spheres. Chinese military strategists describe the present-day combat space as smaller and more limited than before, while the war space has expanded into new domains because of new technologies.

This shift in thinking can be traced back to Chinese leaders' changing assumptions of the nature of modern conflict. PLA writings describe the difference between the "total wars" of the past and the "local wars" of the present. The 2013 SMS states that total wars were aimed at defeating the enemy's capacity to fight and taking over its economy and territory. Therefore, warfighting involved "large-scale warfare" and "mass destruction," "attacking cities and invading territory," and a zero-sum attitude (Shou, 2013, p. 50). Today's local wars, by comparison, are more limited in nature and rely on "controlled use of military force to achieve a limited strategic goal" (Shou, 2013, p. 122). PLA strategists also assume that these limited, high-tech conflicts should be, in theory, more controllable and less escalatory than the all-out warfare of the past because local wars by nature have more limited political objectives and because of the advances in military technologies (such as precision strike capabilities and improvements in ISR) and the use of noncontact attack capabilities (such as cyber and EW capabilities) (Kaufman and Hartnett, 2016).

PLA writings also discuss the expansion of the war space from "multidimensional," or occurring on land, air, and sea, to "full-dimensional," which includes these previous three dimensions plus space and cyber (Pan, 2013; PLA Academy of Military Science, 2010). A PLA major general noted that the effect of integrating all of these domains means that "conventional time-space constraints on military operations is dwindling," and "operations relying on specific battlefield space and a specific branch of the military at a specific time will be replaced with integrated joint operations taking place over a broad range of space and time with highly integrated forces" (Pan, 2013, p. 41). PLA writings emphasize that these new dimensions have transitioned the battlefield from "tangible space" to "intangible space." They argue that, with cyber and EW capabilities, the battlefield becomes "intangible," and dominating this intangible space is an essential part of winning a conflict. Thus, supremacy in the information, space, and electromagnetic domains becomes as important, and perhaps more important, as the other dimensions of combat (Pan, 2013).

The 2016 formation of the PLA Strategic Support Force (PLASSF) is evidence of the deliberate organizational efforts to concentrate capabilities to deliver these effects when and where needed. In a 2016 interview published by official Chinese media, PLAN Rear Admiral Yin Zhuo stated that the PLASSF's main mission is to enable battlefield operations by ensuring that the military can "maintain local advantages

The use of propaganda to influence public opinion can reinforce the stratagem of "making a feint to the East and attacking in the West" and can have a strong "psychological frightening force against an adversary."

in the aerospace, space, cyber, and electromagnetic battlefields." Specifically, he stated, "The [PLASSF] will be responsible for all aspects of information in warfare, including intelligence, technical reconnaissance, cyber-attack/defense, electronic warfare, and aspects of information technology and management" (China Military News, 2016; Kania, 2017a).

Managing Effects Within the Combat Space

The Chinese view that the overall war space has increased while kinetic space is not as expansive as it was in the past guides PLA operations and plans. When discussing this assessment, PLA authors consistently bring up several points that they view as essential to fighting and winning in the more limited modern battlespace environment. First is the criticality of information-based systems and networks, which gives commanders a real-time view of the battlefield and allows them to make more-accurate decisions within a smaller geographic area. Second is the use of precision-strike capabilities and intelligent munitions that have reduced the "concept of distance on the battlefield," allowing for target-centric warfare, limiting nontarget collateral damage, and "reducing the need for widespread destruction and civilian casualties" (Shou, 2013, p. 100).

PLA campaign design will emphasize using the full expanse of the war space, conducting operations, and striving for effects across all warfare domains. PLA commanders will be required to integrate actions across the physical and informational domains while synchronizing with larger political and diplomatic lines of effort in the conflict. Traditional warfare activity in local informatized wars will be limited in relation to its application in past conflicts, not from any inherent aversion to kinetic action, but because these actions will be applied in a more measured and precise manner. Campaign guidance will direct commanders to conduct activities in the nonphysical domains to sense and shape the battlespace for the employment of physical action at the time, manner, and place when those actions will achieve the greatest effect.

Full-Dimensional Campaigns

One consequence of the expanding war space is that PLA commanders will be required to plan and execute operations across all domains, emphasizing actions in the intangible space. Initial phases of a campaign are likely to focus on intelligence and shaping activities in the space, electromagnetic, and cyber dimensions. Kinetic activities, such as attacks on adversary space or ISR assets, may be conducted to enable operations in the information domain, but major conventional attacks may be withheld until commanders feel that they have established information superiority and set conditions for rapid and decisive application of kinetic capabilities.

As the campaign progresses, commanders will seek to increase or at least sustain tempo of activities across the intangible space. Success or setbacks in the information domain will likely dictate the timing, location, and intensity of kinetic operations. Commanders will emphasize integration across space, cyber, and EW operations and between informational and other conventional or kinetic military operations.

Employing the Three Warfares in the Cognitive Space

PLA authors further discuss how the "cognitive space" has become increasingly important in modern conflict where war is multidimensional. Engaging the cognitive space requires employment of what the Chinese call the "Three Warfares": public opinion warfare, psychological warfare, and legal warfare. The objective of the Three Warfares is to control public opinion, organize psychological offense and defense, engage in legal struggle, and fight for popular will and public opinion. This requires efforts to unify military and civilian thinking, divide the enemy into factions, weaken the enemy's combat power, and organize legal offensives (Kania, 2016). Although the Three Warfares is not a new concept, recent Chinese military writings highlight its potential impact on military operations. SMS (2013, p. 167) states that diplomatically seizing the initiative, can "provide a powerful pillar to support the whole operational activity." The use of propaganda to influence public opinion can reinforce the stratagem of "making a feint to the East and attacking in the West" and can have a strong "psychological frightening force against an adversary" (Shou, 2013, p. 131).

These descriptions illustrate the emphasis the PLA places on the "cognitive space" and their view that these capabilities are critical to establishing favorable conditions across the enlarged war space. Success in the cognitive space requires taking advantage of prior peacetime preparation to establish favorable conditions—particularly in the realms of diplomacy and public opinion. Increasingly, war in the cognitive space also considers attacks against adversary personnel and leaders' cognitive functions through a variety of means.

During a conflict, military campaign activities will have to be synchronized with public opinion and psychological and legal warfare activities to ensure the consistency of the narrative presented to adversaries, partners, and the larger regional and international communities. Civil-military cooperation will be crucial because local military leaders will need to coordinate their messaging with the CMC. The military must stay in synch with the overall political leadership and the state and party's information organs and the foreign ministry. Actions in the information domain may be prioritized for their effects on public opinion or their psychological impacts rather than military benefit, especially early in the campaign.

TCW: Destroying the Adversary's Operational System

TCW is the concept of attacking critical points in the enemy's operational system to achieve decisive effects with minimal collateral damage. PLA literature uses various terms to describe this concept, including "key target warfare" and "trump card and data link–centric warfare," all of which highlight the importance of identifying key vulnerabilities in the enemy's system and attacking those vulnerabilities with speed, precision, and intensity (Hu and Xie, 2008). In the Chinese vision of system destruction warfare,

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the key warfare components are integrated systems of sensors, C2 platforms, and precision weapons: "integrated combat forces will be employed to prevail in system-versus-system operations featuring information dominance, precision strikes, and joint operations" (Information Office of the State Council, 2015; People's Liberation Army, Nanjing Army Command College, 2013). In a conflict, TCW is meant to provide the basis for integrating electronic information systems and organizing PLA forces in tailorable force packages based on the objectives being pursued in a specific phase of operations (Dong, 2015).

Chinese military writings increasingly emphasize the importance of precision strike. Chinese analyses point out that the roles of high-tech weapons and systems have become increasingly prominent and have driven the development of new tactics. The role of precision strike in warfare is embodied in the idea of "the precise controls the imprecise" and the Chinese conception of "noncontact warfare," which is the art of employing "all kinds of long-range precision strike forces, with space combat systems as the principal agent, to attack the important targets of the opposing states in order to carry out a highly concentrated and precise sudden assault" (Peng and Yao, 2001). PLA strategists also emphasize intensity as a means of keeping the enemy off-balance, overwhelming C2, and preventing recovery and response:

> Strategic, campaign, and tactical activities are blended into one to directly achieve strategic goals through precision strikes against vital site targets; operations are implemented to conduct synchronous strikes against targets in all depths, leaving the enemy no room and no time to adjust and adapt (Shou, 2013, pp. 117–118).

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Maintaining operational tempo throughout the course of the campaign also will be crucial, with commanders being urged to sustain precision and intensity for the duration of the conflict:

> Along with the gradual advance of the war's progress, [we] must continue strikes at enemy targets which have newly restored functioning after being attacked, as well as at newly detected targets, so as to continually maintain powerful pressure against the enemy (Shou, 2013, pp. 164–165).

Operationalizing TCW: Experimentation and Testing

Before 2009, PRC programs to develop system-of-systems concepts were focused on theoretical research and nonoperational programs. In 2009, however, the PLA initiated an operationally focused research and experimentation effort in the Jinan Military Region (MR), which is now part of the Central Theater, to develop a TCW concept to "operationalize" system destruction warfare ideas. The first major training event, held in October 2010, focused on a joint capital air defense operation directed by the Jinan MR Air Force and designed to concurrently test the emerging system-of-systems and TCW concepts (Du, Shixian, and Hongtao, 2010). This initial test involved all three MR service elements and focused on new integrated command platform data and communications systems and expanding staff use of and skill with these systems.

The formal experimentation process for TCW began in 2011, with exercises designed to test new information systems that supported a wide variety of functions, including targeting, analysis, and command decisionmaking. This entire process spanned multiple years and training events, culminating with a capstone-type exercise to demonstrate the concept's overarching validity. Experimentation began during the Vanguard-2011 exercise at the Queshan test range. The exercise involved long-distance

maneuvers and an airborne offensive in mountainous terrain to seize "strategic points," including an airfield. The exercise explored real-time target reconnaissance, command methods and planning, the integrated employment of army strike forces, and the coordinated use of ground and air firepower (Sang, Weikuan, and Xihe, 2011; Zhang and Xihe, 2011). One of Vanguard-2011's most interesting training objectives included the use of a new "battlefield intelligence report process and analysis system" that generated a target list. The system, which contained target types, numbers, and characteristics, was used to grade targets using indices that calibrated the required level of destruction and likelihood of casualties (Sang, Weikuan, and Xihe 2011; Zhang and Xihe, 2011). In addition, the system provided commanders with a decisionmaking aid that allowed them to identify and calculate the tasks and attack capabilities required for achieving operational objectives.

The following year, PLA education and experimentation continued with three major events in the Jinan MR. The first event—called the "five leaders group training"—was an educational seminar with nearly 100 leaders from command staffs at the division, brigade, and regiment level from across the MR (Meng, Jian, and Guanghui, 2012).[12] Two major exercises followed this seminar, building on the themes of information systems–based system-of-systems operations and TCW. The first of the two exercises, Joint-2012, emphasized information acquisition, target planning and selection, force application, precision strike, and effects assessment as core elements of the TCW concept; and, two months later, Penglai-2012 explored system-of-systems operations in more depth through a joint operations scenario with maritime operations involving "combined battalions and shore defense operations by reinforced coastal defense companies" (Ma and Xihe, 2012). Most notably, the "battlefield intelligence report process and analysis system" appears to have been used again along with a "combat target checklist" (Ma and Xihe, 2012).[13] Commanders used these tools to grade targets, set damage criteria, perform calculations for strike missions, and transmit messages to fire strike terminals.

The theoretical development phase for TCW concluded with the Decisive Victory 2012A exercise at the Queshan test range. According to PLA press reporting following this exercise, TCW was comprehensively implemented (Zhu and Feng, 2012). One of the key areas for emphasis during the exercise was "operational command under informatized conditions" using the integrated command platform and a decisionmaking support system (Zhu and Feng, 2012). The results from this experimentation effort were integrated into later exercises and the PLA training instructions.

TCW places a premium on information-sharing, delegated decisionmaking, and adaptable units capable of working in new environments using "new type operational forces."

TCW Operational System

TCW is described as a system rather than simply a concept—a "complex, self-adapting system made up of multiple mutually affecting subsystems" that operate in an organizational structure guided by overarching objectives, missions and tasks (Dong, 2015, pp. 8–9). In practical terms, this means that TCW places a premium on information-sharing, delegated decisionmaking, and adaptable units capable of working in new environments using "new type operational forces" (Zhang and Zhao, 2010). The TCW operational systems consist of five core operational subsystems, all of which were tested during the PLA's experimentation program: (1) an information support system, (2) an early warning and reconnaissance system, (3) a real-time C2 system, (4) an

integrated offensive and defensive force system, and (5) an integrated support system (Dong, 2015).

Information Support Subsystem

The information support subsystem is the foundation for the TCW operational system. It enables secure communications, battlefield awareness, C2 information architecture, and information processing and dissemination (Dong, 2015). The resulting information network consists of a series of platforms for coordinating C2 for reconnaissance and early warning, firepower strikes, information offense and defense, and other integrated support functions, such as logistics and maintenance. This comprehensive command information system reportedly provides common ISR and PLA combat posture reporting to the commanders and staffs of PLA, PLAN, PLAAF, and PLA Rocket Force (PLARF) units in addition to all staff elements and organizations with political work, logistics, and armaments responsibilities (Shan, Zhang, and Li, 2012).

Another key element of the information support system involves an array of software and hardware platforms for targeting and battlefield assessment. These targeting and assessment tools are used to "analyze, verify, and integrate" information from disparate sources and databases to generate a target list (Zhang and Xihe, 2011). This "battlefield intelligence report processing and analysis system" provides commanders with target types, numbers, functional descriptors, and provided "target grades" and damage indices necessary for determining the best force/weapons mix to satisfy operational objectives and mission requirements (Zhang and Xihe, 2011). The outputs—calculations needed for mission and strike decisions based on target grades and damage criteria—reportedly are transmitted directly to the fire strike terminals at individual units (Ma and Xihe, 2012).

Early Warning and Reconnaissance Subsystem

The improved information technology and increasingly networked battlefield provides PLA organizations and units with greater access to early warning and reconnaissance information. TCW marks a significant departure from earlier models of intelligence collection, analysis, and dissemination in the PLA. Early intelligence architectures were based primarily on service and geographic lines, limiting the dissemination of critical information to all units within the joint campaign architecture (Dong, 2015). PLA services were forced to replicate functions that limited the PLA's overall efficiency and effectiveness. The information support subsystem provides a basis for collating, storing, analyzing, and disseminating the vast amounts of intelligence and early warning data being collected by PLA early warning and reconnaissance systems.

PLA efforts to develop the key elements of the information support subsystem are heavily focused on using these new platforms and tools to integrate and provide intelligence information to joint forces at various levels (Du and Hongtao, 2010). During experimentation, exercises also demonstrated the need for the integrated use of collection platforms under varying operational scenarios. Furthermore, the Queshan test range enables development of tactics, techniques, and procedures for real-time reconnaissance operations, permitting early warning and reconnaissance experimentation on a more sophisticated level than other ranges allow (Zhang and Xihe, 2011).

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Real-Time Command and Control Subsystem

The command organization for TCW consists of a "one command, six centers" model under which the command refers to the "joint operations command" and the six centers responsible for (1) operational C2, (2) intelligence information, (3) network communications, (4) action coordination, (5) political work, and (6) integrated support (Dong, 2015, p. 54). The joint operations command is responsible for integrating core operational functions, assigning tasks, coordinating specific responsibilities, and planning current and future operations. Within this structure, integrated command platforms—reflected in PLA training and experimentation—are used to construct a "mission-based three-level command structure" that consists of the supreme command (strategic), joint operational command (operational), and mission units (tactical) (Dong, 2015, p. 53).

Each of the six centers that fall under the joint operations command comprises elements from all services participating in the joint operation. Of importance is the action coordination center that has multiple action coordination centers, including centers for (1) firepower strikes, (2) air defense operations, (3) ground operations, (4) information operations, and (5) special operations (Dong, 2015). This mix of operation types within an PLA command post was tested on multiple occasions between 2010 and 2012. For example, Penglai-2012 focused on the integrated employment of PLAAF and PLA units, including electronic countermeasures units, special operations, air defense, armor, and artillery (Ma and Xihe, 2012). Joint-2013C similarly focused on "strengthening operational guidance" by experimenting on methods for "combat mission guidance . . . and surveillance, reconnaissance, and intelligence gathering" (Li, Shilong, and Xiaogang, 2013).

The PLA's ambitious thinking about the real-time C2 subsystem stems from the lessons it has taken away from recent conflict. Modern warfare requires the flexible and adaptable generation of combat force tailored to specific mission objectives and conditions that can change rapidly. This concept is embodied in the PLA's thinking on the combat power–generation model—a concept that is closely connected to TCW (Guo, Xianguo, and Jingwei, 2012). In essence, the rapidity and flexibility

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required for modern combat have forced the PLA to examine command structures and techniques that "shorten the command chain, optimize C2 processes, and establish command patterns that are distributed" (Dong, 2015, pp. 53–54). This level of adaptability—which relies on increased systemic trust, transparency, and integration—is a significant departure from past PLA command theories and a significant challenge for implementing TCW.

Integrated Offensive and Defensive Subsystem

According to PLA researchers, earlier models of warfare place an inordinate emphasis on offensive operations, largely because of the limitations (e.g., range, mobility, and lethality) of earlier weapons systems. As the action coordination cell in the joint operations center suggests, a core element of TCW is the effective management of and planning for both offensive and defensive operations. The importance of this offensive-defensive balance was demonstrated throughout experimentation and development of TCW because exercise scenarios and force-on-force training events were tailored to permit both Red and Blue forces to focus on both areas (Ma and Xihe, 2012).

Integrated Support Subsystem

The final TCW subsystem is the integrated support subsystem, which is divided into (1) operational support, (2) rear area support, and (3) social support

The PLA's recent reorganization highlights the limits of PLA personnel talent, particularly in the realm of planning and leading complex operations.

(Dong, 2015). This diverse set of tasks includes such areas as consolidating surveys and maps; developing spectrum management guidelines; managing guidance, navigation, and positioning services; and providing meteorological and hydrological support among several other areas. In addition, the social support system is designed to serve as the interface responsible for consolidating local troop mobilization, technical mobilization, and coordinating armaments and transportation support. As with the other subsystems, integrated support functions figured prominently in all phases of PLA experimentation and concept development.

TCW in PLA Operations and Planning

TCW likely is the key enabler for integrated joint and information systems–based system-of-systems operations, but it also contains several new approaches that cut against traditional PLA practice. First, TCW is the embodiment of integrated joint operations and removes the PLA Army from its privileged place. Although recognizing the key role that ground forces play, TCW emphasizes other services and branches, particularly the PLAAF and PLARF. Similarly, it has used the idea of "new type combat forces" as a general model for devising innovative methods for using more traditional service branches, such as the infantry, in new roles to compliment special operations and airborne forces alongside information, electromagnetic, and air capabilities. These new combinations are part of a broader effort to flexibly configure force packages based on the specific target, the operation type, and the overarching mission objectives.

Another key change that TCW represents is the method of command. The architecture and scenarios being tested during experimentation and subsequent exercises are marked departures from past PLA practice. Although the tools available in the TCW toolkit could be seen by leaders at the top of the PLA as levers to maintain top-down control over operational commanders in whom they have little trust, the system is designed to optimize decision speed at lower levels. Operational and even tactical commanders and staffs notionally will have considerably more information at their disposals, more discretion in their abilities to make operational decisions, more flexibility, and more authority to tailor operations based on the situation. Whether these changes will take hold is uncertain at this point. The PLA's recent reorganization highlights the limits of PLA personnel talent, particularly in the realm of planning and leading complex operations. Similarly, PLA exercises during TCW development highlighted a culture that is struggling to adapt to the sheer volume of information and the need for initiative and creativity that this fast-paced, rapidly changing environment dictates.

Finally, TCW is a target-based approach that challenges the PLA's ability to identify the specific roles and values that individual targets represent in an enemy's operational system. This focus has led the PLA to pursue analytic and decision aids to identify critical targets and assess requisite damage levels. These tools and models require significant amounts of accurate data to perform their core functions and rely heavily on navigation and timing assets, ISR data, and an effective network. Furthermore, TCW requires a level of near real-time information-sharing that has not been part of the PLA's operational practice to date.

PLA commanders will be charged with establishing and maintaining robust reconnaissance-intelligence systems for the detection, the identification, and locating enemy systems; an effective intelligence-processing system to analyze and classify key components within the enemy systems; and command information systems to disseminate target information and manage the battle (Li, Li, and Wang, 2012, p. 155). Planners and operators will be told to focus

their efforts on the identification and engagement of vital systems, sites, and nodes, with particular emphasis on the enemy's leadership institutions, C2 centers, and information hubs (Shou, 2013, pp. 117–118, 160–161). Against the enemy's C2 system, the operational focus is likely to be on disrupting the flow of information within that system, attacking the critical nodes of the system, interfering with critical system functions (such as reconnaissance and surveillance or decisionmaking), and disrupting the time sequence or tempo of adversary operations (Li, Li, and Wang, 2012; Dang and Zhang, 2009; 蔡风震 [Cai Fengzhen] and 田安平 [Tian Anping], 2004; Shou, 2013).

Envisioning Future Concepts of Operation

Although the operational concepts noted earlier will likely guide the PLA toward a networked precision-strike capability for integrated joint operations in informatized local war over the next decade, Xi and his strategists are looking beyond his 2035 "fully modernized" milestone to develop military theory and concepts for a "world-class military" by 2050 ("Full Text of Xi Jinping's Report at the 19th CPC National Congress," 2017). This world-class military objective coincides with the 100th anniversary of the founding of the PRC (2049) and stands as a central component of Xi's larger objective to realize the "rejuvenation of the Chinese nation" by that milestone. Many analysts consider this milestone one by which the CCP expects the PLA to be on par with U.S. forces, perhaps mirror-imaging a force capable of global power projection. Whether this will be an outcome of, or is even an objective for, Chinese force development, it is important for analysts to carefully study evolving PLA theory, principles, and doctrinal concepts.

Xi clearly does not envision Chinese military modernization as simply a game of "catch-up"—2050 objectives envision China as a leader or instigator of the next major RMA rather than simply a reactive agent. This view is encapsulated in Chinese references to "intelligentized" (智能化) warfare. Compared with informatized war, the confrontation mode in a future intelligentized war evolves from "system confrontation" to "algorithm confrontation." The side with the algorithm advantage dominates war with human-computer hybrid operations and neural network decisionmaking, "cloud brain," and "virtual warehousing" technologies and capabilities. Although most PLA scholars currently do not assess that artificial intelligence (AI) will replace human operational commanders completely, they do believe that it can act as a "digital staff officer" capable of gathering and presenting intelligence, identifying enemy intent, and monitoring operations (袁艺 [Yuan Yi], 2017).

Future Chinese military doctrine will almost certainly emphasize innovation, and Xi's promotion of military-civil fusion to a "national development strategy" in 2015 is meant to spark more effective flow of dual-use technological innovation into the defense sector (Lafferty, 2019).[14] Attempts to innovate Chinese military strategy and doctrine will be focused on emerging domains of warfighting, including outer space, cyberspace, and the human cognitive domain.[15] At the center of innovative effort is the PLA's leveraging of national defense big data to support an evolved system-of-systems or algorithm-based approach to armed conflict.

Informatization to Intelligentization: Big Data and AI for the PLA

In support of 2050 objectives, China considers big data analytics to be a strategic resource. Chinese

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sources indicate that big data—and, ultimately, AI—will drive improvements to PLA capabilities and position China to prevail in future conflict (国防大数据) (何友 [He You] et al., 2016). Big data and AI presage a new era in warfare, in which joint operations focused on data offense and data defense determine victory. Therefore, the PLA is exploring programs to collect, process, integrate, and share data across the force for a variety of applications, including C4ISR, equipment acquisition, logistics, mobilization, training, modeling and simulation, and cyber operations. This effort involves first building a big data infrastructure, then using a systems engineering approach to employ the data collected, stored, and transmitted within that infrastructure (韩明 [Han Ming], 杨继宝 [Yang Jibao], and 卢祥 [Lu Xiang], 2017).

The PLA is focused on using big data analytics and deep learning tools to improve targeting capabilities in the context of precision strike operations in systems destruction warfare (Information Office of the State Council, 2019). Improving battlefield situational awareness for PLA commanders at all levels is integral to data integration and dissemination efforts, with emphasis on enabling long-range strike under conditions of fragmentary targeting information from a wide variety of sensors and sources. (<海军预研-基于大数据的卫星信息数据挖掘技术> ["Naval Research: Satellite Data Mining Technology Based on Big Data"], 2016).[16]

Network warfare is also a focus area in the PLA's big data program, with research agendas across the force prioritizing network security and cyber defense technologies (<重点实验室基金-61421030206-大数据安全及隐私保护技术研究> ["Key Lab Fund—61421030206—Research on Big Data Security and Privacy Protection Technology"], 2017). However, PLA restructuring and modernization efforts go beyond network defense to encompass broader cyber warfare applications designed to accomplish information superiority missions and to enhance operations in other warfighting domains. One of the most notable efforts toward informatization is the PLA's establishment of the Strategic Support Force, which is responsible for integrating cyber data and capabilities with electromagnetic and space warfare information and operations.

Big data and AI presage a new era in warfare, in which joint operations focused on data offense and data defense determine victory.

One of Xi Jinping's milestones on the road to Chinese "national rejuvenation" by mid-century is for China to be the global leader in AI technologies and applications by 2030. Chinese sources indicate that this includes using AI to build an "intelligentized military" (中国军事科学 编辑部 [China Military Science Editorial Department], 2016). AI is seen as essential to the development of future warfighting capabilities, to include automated decision aids to enhance the speed and accuracy of operational decisions. Chinese military strategists also assess that AI applications will provide the basis for advanced cruise missiles; autonomous air, ground, surface and sub-surface drone systems; anti-artillery, air, and missile defense systems; and a range of C2 and other systems (Kania, 2017c; Singh, 2016; <陆军预研-0243-无人机多机自主协同技术> ["Army Advanced Research—0243—Independent Coordination for Multiple Drones"], 2016; Lin and Singer, 2014; Lin and Singer, 2015; <重点实验室基金-61422150101-面向水中无人航行器的人工智能方法> ["Major Laboratory Fund—61422150101—AI Navigation Methods for Unmanned Maritime Navigation"], 2017; Information Office of the State Council, 2017; <重点实验室基金-61423011001- 异构多无人机协同任务分配、资源优化和 路径规划系统> ["Major Laboratory Fund—61423011001—Distribution And Resource Optimization and Path Planning for Multiple Drone Cooperative Missions"], 2017).

The extent to which Chinese aspirations for an innovative military strategy and doctrine become reality will largely rest on the application of emerging big data and AI technologies to military purpose and the marriage of any ensuing new capabilities

to existing concepts of joint force operations in system-of-systems warfare. CCP leadership has clearly prioritized and resourced the development of the requisite technologies and systems, but it remains to be seen whether the PLA will be first to develop an operational construct to fit the future battlespace, whether in China's neighborhood or on a more global scale.

Appendix: Source Overview

The assessments in this report are derived from analysis of authoritative Chinese government, military, media, and scholarly sources, supplemented by a literature review of Western scholarship. The authors analyzed these sources to understand PRC policy and strategic direction regarding PLA force development over time. These authoritative sources include official Chinese government publications, press statements from government officials on China's national security priorities, and work reports from CPP congresses. This report relied most heavily on the collection, synthesis, and analysis of Chinese military publications, including newspapers, journal articles, books, and defense white papers. Many of these works are published by the PLA's top publishing houses and are written or edited by well-known thought leaders within the PLA.

To provide context and insight into the meaning and logic of government and military directives and guidelines, the authors also reviewed commentary in official media and analysis and scholarly articles by experts affiliated with party, government, and military research institutes. Chinese academic and scholarly works do not necessarily represent official policy, but they do represent the thinking and analysis that likely informed the formulation of military theory, strategy, and doctrine. The report also considers the analysis of Western scholars with many decades of experience writing about China's national security and the PLA for additional insight regarding key military developments.

Our characterization of PLA operational concepts is notional but formulated based on specific PLA publications focused on how the PLA envisions prosecuting regional warfighting campaigns. We only know what is readily available in the literature, newspaper, and journal articles aimed at the PLA's rank and file members and professional military education textbooks aimed at its future corps of senior officers. Because this is an inductive survey of open sources, significant doctrinal or conceptual advances may have occurred that we do not currently know about. The following questions address some of the obvious knowledge gaps:

> AI is seen as essential to the development of future warfighting capabilities, to include automated decision aids to enhance the speed and accuracy of operational decisions.

- Do the concepts in classified doctrinal publications (e.g., PLA's combat regulations) match the open PLA literature?
- What future capabilities or systems might drive major doctrinal change?
- Is the current PLA restructuring effort on track to allow the PLA to employ the concepts described if asked to do so in the next decade? In particular, are the services actually preparing forces for integrated joint operations in a system-of-systems context?

Despite these limitations, authoritative PRC government and military literature is rife with references to the main components of the concepts described in this report. Current and future PLA leaders are being educated and trained to plan for and execute campaign missions and tasks in accordance with these concepts.

Notes

[1] PLA doctrine is contained in combat regulations, which are referred to in open sources but not openly available. Authoritative PLA campaign literature and other sources, however, discuss at length operational concepts that tell the PLA "how to fight" and are thus clearly representative of doctrine.

[2] For a description of the PLA's campaigns and mission sets, see Chase et al., 2015.

[3] For more information, see Kania, 2017a.

[4] The 2013 edition is the third in a series dating back to 1987.

[5] For examples of Chinese analysis of U.S. military performance in previous conflicts, see Guangkai, 2003; Hiramatsu, 2004; and Wei and Li, 2000.

[6] DoD's 2013 China report describes the system-of-systems concept as follows: "This concept requires enhancing systems and weapons with information capabilities and linking geographically dispersed forces and capabilities into an integrated system capable of unified action" (DoD, 2013, p. 12).

[7] For earlier discussions in the literature on paralyzing operational systems, see Peng and Yao, 2001, pp. 493–495.

[8] For an overview of the PLA's systems of systems approach, see Engstrom, 2018.

[9] Information dominance is one of "three dominances" identified in the SMS as necessary for seizing battlefield initiative; the other two are air and naval dominance. SMS is an authoritative text published and occasionally updated by the PLA Academy of Military Science. It is one of the best open-source references available on Chinese military doctrine and strategic thought.

[10] For more information, also see Chase and Chan, 2016, p. 126.

[11] For earlier discussions of the literature on paralyzing operational systems, see Peng and Yao, 2001, pp. 493–495.

[12] The "five leaders" designation included commanders, chiefs of staff, and operations and training section or subsection of divisions, brigades, and regiments.

[13] In reports on both Vanguard-2011 and Penglai-2012, this particular system was referred to as "the map and five tables." In addition, the functionality of both systems was described in very similar terms.

[14] Kania, 2017b, also highlights a PLA event that took place in summer 2014 designed to support revision of operational regulations. Billed as an "all-military research and discussion activity," the event focused on innovation and development of new strategies to deal with "important operational difficulties and problems."

[15] For example, writing in 2013, Roger Cliff speculated that PLA writings from 2009 stating the military had to "open up new domains of struggle with an enemy in wartime" probably encompassed psychological warfare. For more, see Cliff, 2013, as quoted in Yang, 2009, p. 115.

[16] For a more detailed overview of Chinese views of and plans for using "national defense big data," see Grossman et al., 2020.

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About This Report

In 2017, Chinese President Xi Jinping called for the People's Liberation Army (PLA) to complete ongoing force modernization efforts by 2035 and become a world-class military capable of fighting and winning wars in any theater of operations by 2050. Although the PLA has made impressive modernization progress over the past three decades, it is unclear how this effort would translate to battlefield performance between now and Xi's 2035 goal. PLA forces have not conducted major combat operations for four decades. Therefore, lacking recent historical examples, the operational concepts that underpin PLA doctrine and planning offer the best vantage point to assess how the PLA might fight should it be called on by Chinese Communist Party (CCP) leaders to do so. This requires mapping out the hierarchy of thought that produces these concepts, and CCP military theory stands at the top of that hierarchy. Chinese military theory evolves with each leadership generation and the supreme leader's understanding of the changing nature of war. Theory provides guiding principles that drive the next level of the hierarchy and military strategy.

In this report, the authors assess China's current military theory, strategy, and guiding principles, and they delineate notional doctrinal or operational concepts that likely underpin PLA military planning. The findings are derived from analysis of authoritative Chinese government, military, media, and scholarly sources, supplemented by a literature review of Western scholarship. This report is intended as a primer for U.S. Department of Defense strategists and planners as they conduct campaign planning and formulate responses to China's evolving military strategy and doctrine.

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