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Subcommittee Chairman Babin, Ranking Member Edwards, and Members of the House Subcommittee on Space. My name is Dean Cheng, and I am the Senior Research Fellow for Chinese political and security affairs with The Heritage Foundation. The views I express in this testimony are my own and should not be construed as representing any official position of The Heritage Foundation.

My comments today will be about the evolving Chinese views on space operations, with a particular focus on Chinese military thinking.

It is important to first recognize that the United States and the People's Republic of China (PRC) are not in a "space race," as was the case between the United States and the Soviet Union from 1957 through at least 1969. The Chinese are not competing with the United States to set new "firsts." Instead, the PRC is pursuing a methodical program of space exploitation, building upon both its own experiences, and those of the United States, the Soviet Union, Russia, and Europe.

Where there is a clear competition, however, is in the arena of military space.

The Chinese People's Liberation Army (PLA) has been a close observer of other nations' wars. Since the early 1990s, Chinese military analysts have carefully analyzed such conflicts as the first Gulf War (Operation Desert Shield/Desert Storm), the NATO

intervention in the Balkans, the American invasion of Afghanistan, the 2003 Iraq War, as well as earlier conflicts such as the 1973 Arab-Israeli War and the 1982 Falklands conflict.¹

From their analysis, Chinese military thinkers and planners have concluded that future wars will be very different from those of the past. This is in part because of the larger changes in technology, society, and economics. In the Chinese view, we are now in the Information Age, rather than the Industrial Age. The comprehensive shift towards an information society is inevitably reflected in how wars are fought, just as Industrial Age wars were different from those fought in the age of feudalism. Moreover, because of the changes in technology, future wars will involve not only the traditional domains of land, sea, and air, but also outer space (and the electromagnetic spectrum). Indeed, outer space is seen as playing a key role in fighting and winning future wars.

This emphasis on the military importance of space is reflected in a range of Chinese military publications. Many of these are textbooks and teaching materials, used to teach the importance of space to the PLA.

For example, the 2005 volume *Military Astro-nautics* was a PLA textbook for space operations. Its author, General Chang Xianqi, was formerly director of the General Armament Department's (GAD's) Academy of Equipment Command and Technology (

装备指挥技术学院), described as the main training site for China's space operators. It may have been renamed the Academy of Equipment (装备学院).

In the 2011–2013 period, the PLA's Academy of Military Science (AMS) issued a series of teaching materials for its master's degree candidates. This series of 65 volumes included ones focused on the conduct of space operations, joint campaign command, and outlining what kinds of operational capabilities need to be built in the future.

Finally, the PLA has published *The Science of Military Strategy*, authored by the AMS Military Strategy Research Department as a PLA textbook, and a follow-on to an earlier 2001 edition (which the AMS translated into English in 2005).

Based on a review of these and other PLA writings, it is clear that there has been a steady evolution of how the PLA views future warfare, which provides the context for the progression in how the PLA thinks about space operations.

PLA analyses concluded, first, that future wars will involve joint operations. From observations stemming back to the first Gulf War, the PLA's analysis indicated that current, and therefore future, conflicts would involve not only land, sea, and air domains, but also outer space and cyberspace. This is based upon a number of factors, including the deployment of land-based, sea-based, and air-based precision-guided munitions and the ability of military forces to observe opponents from over the horizon. Thus, future wars would be “local wars under modern, high-technology conditions.” In order to fight such wars, the PLA would have to jettison the old ideas of relying on masses of obsolescent equipment, and instead field more sophisticated, high-tech weapons that would allow them to fight on an even footing against opponents.

This expansion of warfare would also therefore require the participation of all the various services, operating in those domains, in order to achieve victory. Few wars will be won through land, sea, or air-power alone. Instead, it will be necessary to employ diverse forces, operating across multiple domains, both in order to overwhelm enemy defenses and to compensate for weaknesses in any particular set of forces.

These forces would engage an adversary through coordination of joint operations. That is, forces at

the *juntuan* level, group armies, military region air forces, and entire fleets would be brought into the same area and coordinate their respective operations to generate synergies that would allow them to match, and hopefully overwhelm, their enemies.

But the ability to conduct joint operations, spanning millions of cubic kilometers, reaching from outer space to the ocean depths and crossing continents, requires common situational awareness, which in turn involves extensive communications networks and arrays of networked sensors. Thus, future wars will not be based on contests between individual weapons or even weapon systems, but conflicts between systems of systems (*tixi*; 体系).² These systems of systems, in turn, will be bound together through information.

As the relative importance of information grew, the PLA has concluded that wars in the Information Age will typically be “local wars under informationized conditions (*xinxihua tiaojian xia jubu zhanzheng*; 信息化条件下局部战争),” much as wars in the Industrial Age were mechanized wars. The forces required to fight such local wars under informationized conditions, in turn, could no longer be individual services coordinating their activities, but instead would have to be integrated, unified forces, with joint activities pushed ever further down to the operational and even tactical level. Thus, from “coordinated operations (协同联合战役),” the PLA has sought to field forces capable of conducting “integrated, or unified, joint operations (一体化联合战役).”

The key to being able to fight such operations rests upon the ability to gather, transmit, manage, analyze, and exploit information faster and more accurately than your adversary, while preventing them from doing the same. This is termed establishing “information dominance (*zhi xinxi quan*; 制信息权).”

To this end, space plays an essential role. Based on PLA assessment of recent “local wars” (which encompasses most wars since at least the Vietnam War and the 1973 Arab–Israeli war), space has been of steadily growing importance. More and more essential data, from meteorological information to weapons guidance and communications, is gathered from or transmits through satellites. Consequently, establishing “space dominance (*zhi tian quan*; 制天权)” has assumed greater importance, as it is

1. Throughout this paper, Chinese names are provided surname first. These are capitalized.

2. BAI Bangxi and JIANG Lijun, “Systems Combat” Is Not the Same as “System Combat,” *China National Defense Newspaper*, January 10, 2008, http://www.chinamil.com.cn/site1/xwpxdw/2008-01/10/content_1084469.htm (accessed September 21, 2016).

seen as an essential element of achieving “information dominance.”

This higher profile is reflected in some of the most recent official documentation regarding the PLA and Chinese national security. In the new National Security Law, passed in July 2015, outer space is specifically mentioned as an area where Chinese security interests must be preserved. In the 2015 Chinese defense white paper, outer space is referred to several times as a “commanding height” in the international strategic competition. In the newest edition of *Science of Military Strategy*, a chapter is devoted to discussing military conflict in the space and cyber (as well as nuclear) domains, where it is noted that the importance of space has grown significantly for both military and broader national purposes.³

This growing emphasis on the importance of space builds upon a longer term Chinese analysis of other peoples’ wars dating back to the 1990s, where the Chinese concluded that space plays an increasing role in American warfighting. It also builds on Hu Jintao’s 2004 “new historic missions” speech to the Central Military Commission, where he talked about the tasks before the military. Hu observed that China’s national interests and security had gone beyond the traditional land, sea, and air and shifted towards the oceans, space, and the electromagnetic domain. “Maritime security, space security, electromagnetic spectrum security,” he noted, “are already vital regions for national security,” where a small number of major powers are seeking to secure the advantage. Hu elevates space security, along with maritime security and electromagnetic security, to the equivalent of the security of land, sea, and air territories.⁴

Evolution in the Guiding Thoughts for Military Space Operations

What is consistent in these various PLA writings is an emphasis on securing space dominance as part of any joint campaign. At this point in time, it is still not yet clear, based on open-source materials, whether the PLA has promulgated a formal doctrine

for military space operations to support securing space dominance. However, PLA writings do discuss key attributes that any doctrine would likely contain. For example, it would appear that there is a “guiding thought (*zhidao sixiang*; 指导思想)” for space operations. For the PLA, the “guiding thought” establishes certain principles that are expected to inform doctrine, activities, and acquisition. In the case of the PLA, the “guiding thought” for space operations, like the assessment of the importance of space dominance, appears to have been evolving over the past decade.

The View from 2005

In 2005, GAD General Chang Xianqi published the second edition of *Military Astronautics*, which was used as a textbook for teaching the PLA about military space operations. In that volume, General Chang proposed a “guiding thought” that for space operations of “unified operations, key point is space dominance.”⁵

Unified Operations

According to Chang, the establishment of space dominance (*zhitian quan*; 制天权) will entail unified operations (*yiti zuozhan*; 一体作战), which will in turn involved unified forces, techniques, and operational activities.⁶

Unified Forces. Unified forces involves two aspects. One is the integration of civilian and military space systems, both in prewar planning and wartime application. This provides a more robust capability, at a lowered cost. The other is unifying space forces with land, sea, air, and electromagnetic forces in joint operations. Terrestrial forces benefit from space support—they can both degrade opponents’ space forces (e.g., through attacks against ground stations) and preserve one’s own space capabilities (by defending against comparable attacks).⁷

Unified Techniques. Unified techniques refer to combining soft-kill and hard-kill methods. It should be noted that both hard-kill and soft-kill techniques serve the same ends, which is to reduce

3. AMS Military Strategy Research Department, *The Science of Military Strategy* (Beijing: Military Science Publishing House, 2013), pp. 178–188.

4. HU Jintao, “Understanding Our Military’s New Historic Missions in the New Phase of the New Century,” December 24, 2004, <http://gfjy.jxnews.com.cn/system/2010/04/16/011353408.shtml> (accessed September 21, 2016).

5. CHANG Xianqi, *Military Astronautics*, 2nd ed. (Beijing: Defense Industries Press, 2005), pp. 273–279.

6. Note that *yiti* may be translated as either “integrated” or “unified.” While the former translation is common, in the context here the latter would seem to be more appropriate. For that reason, as well as to avoid confusion with the term *zhengti*, which is also translated as “integrated,” we will use the translation “unified” in the body of the paper.

7. CHANG Xianqi, *Military Astronautics*, 2nd ed., pp. 275 and 276.

an opponent's advantage in space while preserving one's own, in order to secure space dominance. Soft-kill techniques such as dazzling or cyber attacks are less likely to incur international repercussions, but may allow an opponent to recover.⁸ Hard-kill techniques may also be aimed at destroying not only satellites (such as in the 2007 anti-satellite (ASAT) test), but also includes physical attacks against tracking, telemetry, and control (TT&C) facilities and launch sites.

Unified Operational Activities. Unified operational activities involve coordinating offensive and defensive operations. Offensive activities, which may include both soft-kill and hard-kill methods, are likely to be undertaken at the earliest possible moment, in order to seize the initiative and force the enemy into a reactive mode.⁹ Defensive activities, meanwhile, will also be implemented from the onset of operations, so as to limit the effectiveness of enemy efforts to interfere with, seize, destroy, or disrupt one's own space systems.¹⁰ These will include active defenses such as air defense, and passive measures such as camouflage and concealment of space-related facilities, as well as redundancy and mobility. Mobile TT&C facilities, for example, should be developed and deployed to concealed locations, ready to replace fixed sites should the latter be attacked.¹¹

Key Point Is Space Dominance

The purpose of the unified operations outlined above is to establish space dominance or space superiority (*zhitian quan*; 制天权): the ability to exploit space for one's purposes, at times and places of one's choosing, while denying an opponent that same freedom of action. In order to obtain space dominance, one needs to sustain the uninterrupted operation of space information collection and transmission systems. This includes the smooth operation of satellites, launch facilities, TT&C systems, and the attendant data-links that bind the components together. Successful efforts at establishing space dominance therefore must also take into account

the sustainment of this entire structure of terrestrial and space systems and associated data and communications links, while striving to degrade or destroy an opponent's.¹²

To this latter end, Chang proposed that one needs to conduct unified operations against an opponent's most important space targets. These are the key information and space assets which will most affect the enemy's capabilities, located in the main strategic direction. They should be attacked by one's best forces, at the crucial moments of the campaign, with the aim of degrading the enemy's ability to field unified space power.

The View from 2013

In the 2013 *Science of Space Operations Teaching Materials*, the "guiding thought" has evolved. It is now described as: "active defense, all-aspects unified, key point is dominating space."¹³ Each of these phrases embodies a number of essential concepts.

"Active Defense." Active defense is integral to all Chinese military strategy, and is not limited to space-related operations. While assuming the strategic defensive, the PLA concept of active defense emphasizes the importance of seizing the initiative at the tactical and operational level. In the context of space operations, active defense again assumes a more strategically defensive stance, although one which nonetheless seeks to deter aggression and maintain national security and interests. At the same time, however, it involves the PLA undertaking space-combat preparations so as to be able to seize the initiative in space-related operations. In particular, it presumes "offensive actions at the campaign and tactical level to secure strategically defensive goals."¹⁴

While there are always references to the "active defense" in Chinese writings, its inclusion in the "guiding thought" may reflect the elevation of space operations to a strategically significant role.

"All Aspects Unified." All aspects unified refers to the need to unify thinking about a number of

8. Ibid., p. 290.

9. Li Daguang, "The Characteristics and Rules of Law of Space Strategy," *China Military Science*, Vol. 1 (2002).

10. FAN Xuejun, "Militarily Strong Nations Are Steadily Developing 'Space Information Warfare,'" *People's Liberation Army Daily* (April 13, 2005).

11. GUAN Weiqiang, QIN Daguo, and XIAO Lianggang, "Research on Requirements for Aerospace TT&C Systems for Integrated-Style Joint Operations," *Journal of the Academy of Equipment Command and Technology*, Vol. 17, No. 6 (2006).

12. CHANG Xianqi, *Military Astronautics*, 2nd ed., pp. 278-279.

13. JIANG Lianju, *Space Operations Teaching Materials* (Beijing: Military Science Publishing House, 2013), p. 40.

14. Ibid.

different aspects of space operations. As in the earlier version, it involves viewing the various domains of military activity, including not only outer space, but land, sea, air, and the electromagnetic spectrum (e.g., cyber and electronic warfare operations), in a joint fashion. Space operations support terrestrial operations, while land, sea, air, and computer network operations can help achieve space superiority. But a further important aspect of all aspects unified is the integration of space operations into the larger joint campaign planning and command and control functions. Space operations must also be integrated into larger, joint campaign plans to help achieve terrestrial objectives; command and control of space operations must therefore reconcile space-related requirements, timing, and structure with those of the overarching joint campaign.¹⁵

At the same time, the phrase also signals the PLA officer to view all the various space activities, including offensive and defensive operations, provision of information support and fire support, and hard-kill and soft-kill methods, in an integrated or unified fashion. The PLA officer should not view it as either hard-kill or soft-kill, for example, but employing the best tool for the task at hand.

“Key Point Is Establishing Space Dominance.”

Key point is establishing space dominance in part builds upon the PLA’s emphasis on striking the enemy’s key points (*zhongda yao hai*; 重打要害), especially those nodes within the enemy’s combat system of systems (*zuozhan tixi*; 作战体系). One must concentrate one’s best forces and capabilities to precisely strike such key targets with a combination of hard-kill and soft-kill weapons, with the goal of paralyzing the adversary. At the same time, one must be able to exploit space for one’s own ends, whether in the provision of information support to friendly terrestrial operations, undertaking space deterrence, or engaging in operations against remaining enemy space assets.¹⁶

Key point is space dominance therefore has several meanings. On the one hand, it is reminding PLA officers and staff that *an important priority must be securing space dominance over an opponent*. Resources must be applied against an enemy’s space systems (e.g., terrestrial facilities, orbiting platforms, data links) to disrupt and deny an opponent

the ability to exploit space over the course of the entire campaign.

As important, *one must also be prepared to defend one’s own space infrastructure, since the enemy is likely to be striving to secure space dominance as well*. This is essential since even with the full range of national space assets it provides only a limited resource base. Chinese analysts recognize that space systems are fragile; as important they are extremely expensive, so even wealthy nations are unlikely to have a substantial reserve of platforms. Nor do many nations have a multiply redundant terrestrial space launch and mission control network. (In this regard, it is worth noting that, with the inauguration of the Hainan Island space port, China will have four space launch facilities.) Therefore, the other aspect of key point is space dominance is that *space operations need to be focused, with a specific focus, a key point, and not scattershot*. Attacks against adversary space infrastructure need to be carefully coordinated and undertaken at essential moments in the overall campaign to maximize effect.

Mission Areas Associated with Space Operations

PLA analysts believe that military space operations are likely to entail five broad styles (*yangshi*; 样式) or mission areas: space deterrence, space blockades, space strike operations, space defense operations, and provision of space information support.¹⁷ While the tasks have not changed between 2005 and 2013, the ordering, reflecting importance, has.

Space Deterrence (*kongjian weishe*; 空间威慑).

Space deterrence is the use of space forces and capabilities to deter or coerce an opponent, preventing the outbreak of conflict or limiting its extent should conflict occur. By displaying one’s own space capabilities and demonstrating determination and will, the PLA would hope to induce doubt and fear in an opponent so that they would either abandon their goals, or else limit the scale, intensity, and types of operations. It is important to note that space deterrence is not aimed solely, or even necessarily, at deterring actions in space, but rather, in conjunction with nuclear, conventional, and informational deterrence capabilities and activities, they seek to influence an opponent’s overall perceptions and activities.

15. Ibid., p. 43.

16. Ibid., p. 44.

17. This section draws upon *ibid.*, pp. 126–154.

Both the earlier textbook and more recent teaching materials suggest that there is a perceived hierarchy of space deterrence actions, perhaps akin to an “escalation ladder” involving displays of space forces and weapons; military space exercises; deployment or augmentation of space forces; and employment of space weapons.

Displays of Space Forces and Weapons (kongjian lilian xianshi; 空间力量显示). Displays of space forces and weapons occur in peacetime or at the onset of a crisis. The goal is to warn an opponent in the hopes of dissuading them from escalating a crisis or pursuing courses of action that will lead to conflict.

Military Space Exercises (kongjian junshi yanxi; 空间军事演习). Military space exercises are undertaken as a crisis escalates if displays of space forces and weapons are insufficient to compel an opponent to alter course. They can involve actual forces or computer simulations, and are intended to demonstrate one’s capabilities but also military preparations and readiness. At the same time, such exercises will also improve one’s military space force readiness. Examples include tests for ballistic missile defense, tests for ASAT units, exercises demonstrating space strike (*kongjian tuji; 空间突击*) capabilities, and displays of real-time and near-real-time information support from space systems.

Space Force Deployments (kongjian lilian bushu; 空间力量部署). Space force deployments are seen as a significant escalation of space deterrent efforts. It occurs when one concludes that an opponent is engaged in preparations for war and involves the rapid adjustment of space force deployments. As with military space exercises, this measure is not only intended to deter an opponent, but should deterrence fail, is seen as improving one’s own preparations for combat. (Such deployments, which may involve moving assets that are already in orbit and/or reinforcing current assets with additional platforms and systems, are intended to create local superiority of forces so that an opponent will clearly be in an inferior position.) It may involve the recall of certain space assets (e.g., space shuttles), either to preserve them from enemy action or to allow them to prepare for new missions. This may be akin to the evacuation of dependents from a region in crisis as a signal of imminent conflict.

The Chinese term the final step of space deterrence as “space shock and awe strikes (*kongjian*

zhenshe daji; 空间震慑打击).” (The term *zhenshe*, however, can be found in Tang Dynasty writings, so they did not get this from our 20th Century discussions.) If the three previous, non-violent deterrent measures are insufficient, then the PLA suggests engaging in punitive strikes so as to warn an opponent that one is prepared for full-blown, comprehensive conflict in defense of the nation. Such strikes are seen as the highest and final technique (*zuigao xingshi he zui hou shouduan; 最高形式和最后手段*) in seeking to deter and dissuade an opponent. Employing hard-kill methods, soft-kill methods, or a combination, one would attack an opponent’s physical space infrastructure or data links, respectively. If this succeeds, opposing decision makers will be psychologically shaken and cease their activities. If it fails, an opponent’s forces will nonetheless have suffered some damage and losses.

Space Blockade (*kongjian fengsuo zuozhan; 空间封锁作战*). Space blockades involve the use of space and terrestrial forces to prevent an opponent from entering space, and from gathering or transmitting information through space. Chinese writings suggest that there are several different varieties of space blockade activities. One is to *blockade terrestrial space facilities*, including launch sites, TT&C sites, and mission control centers. They can be disrupted through the use of kinetic means (e.g., special forces or missiles), or through computer and information network interference.

Orbit Obstruction. Another means is to obstruct orbits. This can include actually destroying satellites that are in orbit, or else obstructing orbits, such as by creating clouds of space debris or deploying space mines.

Launch Window Obstruction. Another alternative is the obstruction of launch windows. If one can delay a launch, whether through interfering with its onboard systems or otherwise disrupting the schedule, then a satellite may not be able to reach its proper orbit. In the past, some American space launches have been delayed because fishing and pleasure boats were present down-range.¹⁸ This alternative also includes the possibility of a boost-phase intercept of a space launch vehicle.

Information Blockade Imposition. Finally, one can impose an information blockade. By interfering with and disrupting an opponent’s data links

18. “Atlas 3 Scrubbed to Tuesday,” *Space Daily*, May 21, 2000, <http://www.spacedaily.com/news/eutelsat-00g.html> (accessed September 21, 2016), and Jessica Orwig, “A Rocket Launch Monday Was Delayed Because of a Boat,” *Business Insider*, October 28, 2014, <http://www.businessinsider.com/why-rocket-launch-delayed-by-a-boat-2014-10> (accessed September 21, 2016).

between terrestrial control stations and the satellite, one can effectively neutralize an orbiting satellite by hijacking the satellite's control systems or preventing ground control from issuing instructions. Alternatively, one can interfere with the data that the satellite is transmitting, i.e., rather than tampering with the satellite's controls, one can contaminate or block the data that it is gathering or transmitting. A third form of information blockade involves "dazzling" a satellite using low-powered directed-energy weapons against sensors or other systems. In each case, the intent is to effect a "mission kill," whereby the satellite cannot perform its functions, but is not necessarily destroyed.

Space Strike Operations (*kongjian tuji zuozhan*; 空间突击作战). Space strike operations involve space and other forces undertaking offensive operations against an enemy's land, sea, air, and space assets. They are therefore not limited to attacks against the space infrastructure, and certainly not only against orbital platforms. In general, space strike operations are expected to be against vital strategic and operational targets, i.e., "key points."

Space strike operations, in the Chinese view, are marked by "integrated operations; stealth and surprise; key point strikes; rapid, decisive action." Integrated operations reflects all the aspects discussed earlier, with an additional emphasis on exploiting stealth and surprise.

Key point strikes are part of what might be the guiding thought for space operations in general. An additional consideration in this context is that neither side is likely to field large numbers of space systems, so planning for maximum effect and efficiency is important.

Rapid, decisive action denotes the need to use space strikes to seize the overall initiative in a campaign. By overwhelming an opponent, and then sustaining strikes afterwards, one cannot only retain the initiative, but ideally achieve operational goals and conclude the conflict. At the same time, due to the limited numbers of space platforms and weapons likely to be available, their fragility, and their expense (which limits numbers acquired), space strike operations are likely to be of relatively limited duration.

Defensive Space Operations (*kongjian fangyu zuozhan*; 空间防御作战). Defensive space

operations are intended to counter an opponent's space strike operations by safeguarding one's own space forces and defending key strategic and campaign targets from enemy space strike capabilities. Defensive space operations include defense against ballistic and cruise missiles, spacecraft defensive operations, and defense of space-related bases and infrastructure.

Spacecraft defensive operations involve a combination of active and passive defensive measures. These include camouflage and reduction of spacecraft radar, infrared and electronic signatures so that their capabilities and identity are obscured; shifting to "swarms" of small satellites, to improve resilience in the event one or more component satellites are lost; and hardening of satellite systems to allow them to survive attacks from directed energy weapons. In addition, ground controllers can move satellites if there are indications that they might be attacked.

Space Information Support Operations (*kongjian xinxi zhiyuan zuozhan*; 空间信息支援作战). In the 2005 edition of *Military Aerospace*, a PLA textbook on military space activities, provision of information support by space systems was listed as the second task, after space deterrence.¹⁹ In the 2013 PLA teaching materials, it is now the fifth of five tasks. This would suggest that space information support operations, while still important, are being eclipsed by more active space offensive and defensive measures. Indeed, as one Chinese assessment observes, as space resources become ever more important, and military aerospace technology, especially those related to offensive space operations, steadily develop, space force development will shift from providing information support towards securing space dominance.²⁰

The New PLA Strategic Support Force

The massive overhaul of the PLA announced at the end of 2015 saw the creation of the PLA Strategic Support Force (PLASSF). This entity is arguably better labeled the PLA's Information Warfare Force, as it brings under a single structure China's space, electronic warfare, and network warfare forces. As one of the earliest adopters of the concept of integrated network and electronic warfare (INEW), the PLA has long had a holistic view of warfare in the

19. CHANG Xianqi, *Military Astronautics*, 2nd ed., pp. 304–309.

20. TAN Rukun, *Operational Strength Construction Teaching Materials* (Beijing, PRC: Military Science Publishing House, 2012), p. 170.

electromagnetic domain. As important, the PLASSF is consistent with the two decades of evolving PLA views on the role of information and future warfare.

As the PLA prepares to fight and win “informationized local wars,” it has repeatedly emphasized the importance of establishing “information dominance (*zhi xinxi quan*.)” This is achieved through achieving a combination of space dominance (*zhi tian quan*), network dominance (*zhi wangluo quan*), and electronic dominance (*zhi dianzi quan*). That the forces associated with establishing dominance in these domains are now assigned to a single service is unlikely to be a coincidence. As important, by grouping them together, Chinese doctrinal developers can look for synergies and areas of mutual support, in pursuit of information dominance.

The creation of the PLASSF suggests that the Chinese military is putting into place the organizational structures necessary to undertake a concerted effort to establish information dominance. The PLASSF is therefore likely to hone its skills not only in the conduct of offensive and defensive space operations, but coordinate them with electronic and network warfare activities. As important, INEW operations are likely to be waged at both elements of adversary space infrastructure, as well as terrestrial systems.

Chinese Assessment of Required Space Capabilities

In order to meet the demands of the “guiding thought” for space operations and fulfill the various mission areas, PLA analysts conclude that a nation must be able to fulfill certain tasks. These include the ability to enter space, to exploit space, and to control space. PLA assessments on requirements for “army-building” (i.e., military modernization) include several areas for improving China’s military space capabilities.

Rapid Space Launch Capability. In terms similar to how American analysts describe “operationally responsive space,” Chinese analysts cite the need for rapid launch of satellites to augment current constellations in time of crisis, and to replace lost assets

in time of conflict. Intriguingly, it is also suggested that it may not be necessary to deploy a complete constellation in peacetime; if one possesses a rapid launch capacity, it would be possible to augment a minimal peacetime constellation in time of crisis or conflict.²¹ In this regard, Chinese development of the Kuaizhou solid rocket space launch system would seem to suggest that the PLA has already prioritized improvements in this area.²²

More Robust Space Situational Awareness. An important likely focus in the coming years will be improving China’s space situational awareness (*kongjian taishi ganzhi*; 空间态势感知) (SSA) and strategic early warning capacity. This will include both ground-based and space-based sensors to provide PLA planners with better strategic early warning about changes in the space environment.²³ At the same time, there is recognition that China’s growing investment in countering orbiting systems requires improved SSA to ensure that it can identify the right targets and then engage them successfully. Improved SSA will also benefit efforts at space defense, as adversary orbital ASATs can be detected and characterized earlier, allowing Chinese space operators more time to move their own assets.²⁴ The PRC is therefore likely to develop space surveillance systems that will provide real-time tracking data on the tens of thousands of space objects currently in orbit.

Improved Offensive and Defensive Space Capabilities. China is clearly developing a number of ASATs, including a demonstrated capacity for direct-ascent kinetic-kill vehicles, co-orbital ASATs, and cyber tools that could interfere with space control systems. Future developments may include more soft-kill options that would lead to “mission kills” on satellites, preventing them from gathering or transmitting information, rather than physically destroying the system. The PLA suggests that these efforts might include co-orbital jammers and satellites that could eavesdrop on a target satellite’s control and data transmission in peacetime, and perhaps hijacking or other interference with the satellite in time of crisis or conflict.²⁵

21. *Ibid.*, p. 157.

22. Rui C. Barbosa, “China Launches Kuaizhou-2 in Second Launch Within 24 Hours,” *NASASpaceflight.com*, November 21, 2014, <http://www.nasaspaceflight.com/2014/11/china-launches-kuaizhou-2-second-launch-24-hours/> (accessed September 21, 2016), and Richard Fisher Jr., “China Launches Second Kuaizhou Mobile SLV,” *Jane’s Defence Weekly*, November 26, 2014, <http://www.janes.com/article/46360/china-launches-second-kuaizhou-mobile-slv> (accessed September 21, 2016).

23. TAN Rukun, *Operational Strength Construction Teaching Materials*, pp. 158–159.

24. *Ibid.*, pp. 161–162.

25. *Ibid.*, p. 161.

Other areas that the PLA is likely to pursue include defensive measures that would counter adversary attempts at establishing space dominance by allowing Chinese space systems to either survive enemy space attacks or repair and otherwise ameliorate damage. These might include robots capable of on-orbit repairs, or a greater emphasis on small satellites that could allow rapid reconstitution of key space information support functions.²⁶

Prospects for U.S.–China Space Competition

All of these developments reflect the reality that the U.S. and China are engaged in a competition regarding the ability to access and exploit space in support of national security objectives. For the Chinese, it seems clear that they hope to limit our ability to employ space systems, while ideally preserving their own capacity. This is an asymmetric situation, however, because the United States is far more reliant on space to conduct military operations than the PRC. Most American conflicts, after all, occur at a significant distance from our own shores and the Western Hemisphere. Communications, intelligence gathering, even weather prediction all rely more on space assets.

By contrast, the PRC is mostly focused on military operations in the land, sea, and air spaces adjacent to continental China. The PLA can therefore rely on a variety of non-space platforms, whether it is unmanned aerial vehicles, aerostats, aircraft, or fishing boats to gather and relay information.

This does not mean that the U.S. and China are necessarily locked in only a zero-sum relationship in outer space. There can be benefits from engagement, in at least gaining some familiarity with each other's organizational patterns and behavior. However, the expectations need to be tempered. China's space capabilities are intended first and foremost to serve the interests of the PRC, including the PLA, and those interests are often not congruent to our own.

Identifying where there is real interest, based on analysis of Chinese doctrine and policies and not mirror-imaging, is essential. At the same time, recognizing where our interests are at odds, including in the security arena, is vital. And maintaining the ability of the United States to establish space dominance, meaning preserving our own access to space as well as denying it to an adversary, is central to that.

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26. *Ibid.*, p. 158.