# Chinese Concepts of Space Security

# 25

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## Contents



**Abstract**

China views space as enhancing many aspects of comprehensive national power, including not only its military capabilities but its economic development and diplomatic outreach. In the military dimension, its space capabilities have strategic, operational, and tactical impact.

## 25.1 Introduction

With the 18th Party Congress in November 2012, China ushers in a new generation of leaders, led by Xi Jinping and Li Keqiang. While it is impossible to predict the precise policies that they will pursue for the coming decade, it is likely that they will

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K.-U. Schrogl et al. (eds.), *Handbook of Space Security*,
DOI 10.1007/978-1-4614-2029-3_42,

sustain the long-standing interest in space capabilities that their predecessors have displayed.

That consistent support over the intervening six decades since the founding of its space program has allowed the People's Republic of China (PRC) to become a true space power. It fields an array of launch vehicles, controls multiple constellations of satellites, and is a member of the exclusive club of nations that can orbit their own astronauts. This is supported by a substantial space industrial complex, which remains part of China's state-owned enterprise system.

Not surprisingly, as China's space capabilities have grown, its encounters and interactions with other space powers have also expanded. Chinese space activities influence and affect other nations, not only in the physical sense of debris-generation and orbital deconfliction but in the policy realm as well. How China envisions the role of space for its own security will affect other nations' security efforts, both in space and terrestrially.

China's concept of space security is embedded within the larger context of Chinese conceptions of national security. Chinese discussions of national security, in turn, are usually undertaken within the construct of "comprehensive national power (*zonghe guojia liliang*; 综合国家力量)." Space capabilities affect many different aspects of comprehensive national power, so Chinese concerns about space and security include economic, and diplomatic considerations, as well as military ones.

## 25.2 Comprehensive National Power

The PRC defines its national interest not only in terms of military or economic factors but across a broad range of metrics. As the PLA textbook *Science of Military Strategy* notes, "In the period of our socialist modernization construction, national interest and the general line and principles of the Party focus on increasing social productive forces, revitalizing economy and strengthening comprehensive national power" (Peng and Yao 2005, p. 167) By "comprehensive national power," the Chinese are referring to all of the elements of national power that can affect national survival and standing, including military capabilities, economic development, popular support, diplomatic respect, and ideological motivation and coherence. According to the China Institutes of Contemporary International Relations (CICIR), a Chinese think tank associated with the Ministry of State Security, comprehensive national power is the "total of the powers or strengths of a country in economics, military affairs, science and technology, education, resources, and influence" (China Institute of Contemporary International Relations 2000). Space capabilities make a major contribution, because it touches on virtually every aspect of comprehensive national power.

### 25.2.1 Economic Development

Chinese leaders have long seen space as contributing to national economic development in both direct and indirect ways. When the Chinese first examined the idea of developing a space capability, Dr. Qian Xuesen wrote "A Proposal to Establish China's Defense Aviation Industry" which recommended creating an aerospace industrial sector (which, for security reasons, was referred to as the "aviation industry [*hangkong gongye*; 航空工业]") that could produce rockets and missiles indigenously (China National Space Administration 2011). He was supported by Mao Zedong, Zhou Enlai, and Marshal Nie Rongzhen. The Fifth Academy of the Ministry of Defense was established in 1956 – generally considered the birth of China's space program – while the creation of a missile industrial base was incorporated into the "National Long-Term Plan for the Development of Science and Technology, 1956–1967" (Chen 1999; Deng 1993, p. 32).

Although China's initial space development, especially under Mao, was not always linked to economic considerations, that changed after Deng Xiaoping succeeded "the Great Helmsman." Under Mao, after China launched its first satellite in April 1970, it followed with only a handful of scientific satellites. After Mao's death in 1976 and Deng Xiaoping's rise to power in 1978, space development was further retarded, with Deng demanding that the Chinese space effort "concentrate on urgently needed and practical applied satellites" (Li 1999). This was consistent with his overall approach of "Reform and Opening," where economic development had assumed highest priority.

This stance shifted in 1986, however, when four top Chinese scientists argued to Deng that China needed to foster science and technology, as the foundation for future economic and technological advances. The scientists were Wang Daheng, an optics specialist who had designed some of China's first ground-imaging cameras; Wang Ganchang, one of the chief scientists on China's atomic bomb effort; Chen Fangyun, an expert in radio electronics who designed satellite control systems; and Yang Jiachi, who had helped automate Chinese satellites (Deng 1993, p. 152; Feigenbaum 2003, p. 141). Deng was persuaded by this argument and authorized the creation of Plan 863, formally termed the National High-Technology Research and Development Plan (*guojia gao jishu yanjiu fazhan jihua*; 国家高技术研究发展计划).[1] The seven key areas under Plan 863 continue to benefit from additional financial and human resources – including aerospace.

China's space program benefits the Chinese economy in several ways. In the first place, the manufacturing of space-related systems, including not only satellites and launchers but associated equipment and subsystems, represents a direct contribution to the growth of the Chinese economy. The two main Chinese space conglomerates, China Aerospace Science and Technology Corporation (CASC) and China Aerospace Science and Industry Corporation, are each believed to employ some 90–100 thousand workers.[2]

Additional commercial frontiers are constantly opening, to help maximize Chinese productivity. Precision agriculture, for example, uses satellite navigation

[1]For further discussion of the creation of Plan 863, see Feigenbaum (2003), esp. pp. 141–143.

[2]Figures compiled from various articles drawn from *China Aerospace* and CASC and CASIC websites

information to tailor the application of pesticides and fertilizers to crops, as well as configuring crops to specific soil and topographical conditions. Distance learning and telemedicine facilitate the leveraging of scarce intellectual capital and can reach every corner of the PRC. Meanwhile, the introduction of the Beidou/Compass navigation system is helping to expand further China's satellite navigation market. Between 1998 and 2006, that market grew at the rate of 50 % per year (Lin and Shi 2006).

Space technology is also seen as providing the basis for many "spin-offs," technological advances that ultimately benefit the entire economy. The original impetus to develop better microchips, advanced materials, and new metals was based in part on the space program. Nor is it just physical products that may be spun off. Given the requirements for operating in the harsh environment of space, production of space systems requires a level of precision manufacturing, quality control, and advanced design. These qualities, in turn, may benefit non-space industries and products.

Similarly, by maintaining a high-profile interest in space, Chinese leaders hope to continue attracting talented students into aerospace-related fields. When the Chinese were debating whether to undertake a manned space program in 1992, for example, Yang Shangkun, then China's president and vice chairman of the powerful Central Military Commission, threw his support behind the program because it would help nurture a new generation of designers and engineers. Without a new mission, he observed, there could be a break from the older generation that had completed the "two bombs, one satellite" effort (referring to the indigenous development effort supporting China's atomic bomb, hydrogen bomb, and first satellite) (Zuo 2009).

Participation in the international space market also provides additional business opportunities. In the 1990s, China provided launch services for a variety of customers, competing successfully with the USA, European Space Agency, and Russia. It was only the Loral-Hughes incident, which led to American export controls on any satellite containing American parts that curtailed China's commercial space launch efforts. In recent years, however, China has gotten around this problem by offering a soup-to-nuts approach to satellite sales, designing and building the satellites for foreign customers, as well as launching the satellite and conducting in-orbit checks, before handing over the system to the customer. The first such sale, of a communications satellite to Nigeria, was valued at approximately $250 million, including satellite construction, launch, and insurance (deSelding 2005). A similar sale in 2010 to Bolivia, including training Bolivian scientists and operators, was valued at about $300 million, much of it financed by the China Development Bank (Garcia 2010).

### 25.2.2 Diplomacy

China's sales of satellites also serve diplomatic purposes. China's satellite customers have tended to be states that have strategic significance to the PRC. Some could serve as sources for key raw materials: oil from Nigeria and Venezuela and lithium from Bolivia (Piette 2009). Others are major strategic partners, such as Pakistan, or are in strategic locations, such as Sri Lanka (deSelding 2012). The reporting by *China Aerospace* (*Zhongguo Hangtian*) of the launch of the Pakistan communications satellite PAKSAT-1R, for example, notes that the launch involved two good friends, on the 60th anniversary of their establishing relations (Huang 2011)

Indeed, Chinese space development has long been motivated, in part, by concerns about international prestige and international standing. Mao committed the PRC to developing strategic capabilities (nuclear weapons and long-range rockets) on the grounds that "nuclear weapons are such a major item that without it, people will say that you don't count" (People's Daily 1999). Space developments were seen in the same light, as Mao declared, in May 1958, "we should also manufacture satellites" (Deng 1993, p. 356).

Prestige also influenced China's initial satellite designs. Mao demanded that the first Chinese satellite should be more capable than either the first American or Soviet ones. It should not be "like the chicken egg the Americans had launched [Explorer-1, the first US satellite, weighed 14 kg]. Rather, they should build a much larger one" (Chen 1999, p. 164). This besting of other nations' firsts appears to be at least a tacit goal even today, as most Chinese firsts have had longer endurance, more orbits, or more capability than other nations' firsts.

The recognition that China fields world-class space systems is a matter of pride to the Chinese. Chinese descriptions of the Fengyun series of satellites, for example, emphasize that China's Fengyun weather satellites are incorporated into the World Meteorological Organization's weather satellite network.[3]

But China has also used space as a means of expanding its influence. In 2003, China established the Fengyun Satellite Data Broadcasting System, or FENGYUNCast. The system, which is managed by the China Meteorological Administration (CMA), distributes data collected from China's Fengyun weather satellites to receiving stations. As one Chinese official noted, "the system has a daily satellite broadcasting bandwidth of 23 GB" and provides not only weather information but earth observation data suitable for environmental monitoring, natural disaster surveillance, and agricultural support (Zhang 2012). Moreover, the station can also download information from non-Chinese systems, allowing recipients to receive data from US and Japanese satellites as well (Lin 2007).

In 2006, and again in 2007, China donated receiving stations to a number of countries. The initial group of recipients included Bangladesh, Iran, Mongolia, Pakistan, Thailand, Peru, as well as Indonesia in 2006. China donated another 11 stations in 2007, including Malaysia, Nepal, Sri Lanka, Tajikistan, and Vietnam.

The initial groups of FENGYUNCast receiving stations, not coincidentally, were all donated to states that had expressed intent on joining the Asia-Pacific Space Cooperation Organization (APSCO). In 1992, Chinese, Pakistani, and Thai

[3]See, for example, Fengyun Satellite Data Center (2012)

officials proposed the creation of an Asian grouping to discuss space matters. In November 2005, representatives from these three nations, as well as Bangladesh, Indonesia, Iran, Mongolia, and Peru, signed the APSCO Convention. In December 2008, the organization was formally launched, with the addition of Turkey (China National Space Administration 2005). China, which serves as host for the organization, clearly dominates this group. It is not only the largest state, economically, but it has the most advanced space capabilities of all the members. Moreover, it is notable that neither India nor Japan and the other major Asian aerospace powers are full members of this organization.

APSCO has proposed a number of joint projects, including a ground-based Asia-Pacific Optical Space Observation System (APOSOS), which would link member states' major optical telescopes into an integrated space observation network. The goal was to provide all the member states, at low cost and investment, a means of tracking objects in low Earth orbit (Guo 2011). It would also acclimatize the various participants to cooperating with each other and with the PRC.

China also established its first permanent overseas facilities as part of their space program. In support of the Shenzhou manned space program, Chinese tracking facilities were initially established in Namibia and Kiribati, although the latter facility was subsequently closed (Shie 2006). Additional ones were later established in Kenya and Pakistan.

## 25.3 Military Aspects of Chinese Security

While comprehensive national power includes a wide variety of factors in its calculus, an obvious one is the military component of national security. Chinese concepts of space security similarly exist within the broader context of Chinese concepts of military security. In particular, the role of space has risen, as the Chinese have observed changes in the shape of modern warfare, and in turn evolved their views on the form of future wars.

Under Mao Zedong, the keynote of the times was said to be "War and Revolution." Mao emphasized the need to prepare for "early war, major war, nuclear war." Future conflicts would be massive, global affairs, involving nuclear weapons. The Chinese would have to be prepared to conduct an extended guerrilla war in the wake of such a conflict, against either American or Soviet occupying forces.

When Deng Xiaoping succeeded Mao, the PRC altered its view of the global strategic situation. In 1978, the PRC formally altered its worldview, concluding that the prospects of world war were negligible and China no longer faced immediate, major military threats. Instead, the main concern was more limited conflicts, in terms of both scope and duration (Joffe 1987). At the same time, modern weapons were altering the shape of war. Weapons had greater reach and significantly improved lethality.

By the early 1990s, China's assessment of future wars was further refined. The continued information technology revolution now not only affected weapons but tactics and even strategic outcomes. Modern weapons, as seen in the first Gulf War, shifted the emphasis from the destruction of opponents to paralyzing them.

High-technology weapons mean that future conflicts will be all-encompassing, involving not only air, land, and sea areas but also outer space and cyberspace.

To fight such wars, the PLA, like the US, Soviet, and German militaries had in the past, increasingly focused on fighting campaigns and conducting the operational level of war. (Battles occur at the tactical level of war. Campaigns occur at the operational level of war. Wars occur at the strategic level of war.) In 1993, the PLA produced a new set of "Military Strategic Guidelines for the New Period," introducing the concept of "Local Wars Under Modern, High-tech Conditions." These guidelines constitute "the highest level of national guidance and direction" to the Chinese armed forces (Finkelstein 2007).

In a subsequent, December 1995 speech to the CMC, Party General Secretary Jiang Zemin, who had been designated to replace Deng Xiaoping, emphasized the importance of these new guidelines. He charged the PLA with undertaking the "Two Transformations (*liangge zhuanbian*; 两个转变)." These entailed a shift from a military focused on quantity to one focused on quality and from a military preparing for "local wars under modern conditions" to one that was preparing for "local wars under modern, high-tech conditions" (Zhang and Li 1997).

The core of this new type of war would be the conduct of joint campaigns, in recognition that future operations would not be conducted by single services in combined arms operations, but by multiple services operating together. Indeed, in June 1999, the PLA issued "New Generation Operations Regulations," which made joint operations the capstone (Finkelstein 2005). In essence, the PLA was stating that individual service campaigns are subordinate to joint campaigns and would train and equip itself to that effect (Gao 2001, pp. 12–25).

Integral to joint operations is the utilization of space. PLA assessments of the first Gulf War note that the USA deployed substantial space assets in support of coalition forces and that this was a major factor in the war's outcome (Chang 2005, p. 249). PLA writings conclude that some 70 satellites were employed, providing the USA with 70 % of its data transmission capacity and 90 % of its strategic intelligence (Gao 2001, p. 54).

Based on these observations, Chinese writings conclude that, in order to wage future "Local Wars Under Modern, High-Tech Conditions," PLA commanders would need:

A. Reconnaissance/surveillance capabilities. Commanders need to be able to better determine an enemy's situation, geography, and other related combat information.
B. Mobile firepower. The ability to undertake rapid yet ferocious attacks against an opponent, throughout the depth of the theater, based upon assets drawn from all available forces.
C. Electronic warfare. Necessary to both preserve one's own ability to utilize electronic systems and disrupt an opponent's ability.
D. Command and control capabilities, which can be sustained in combat. These command and control capabilities are essential for allowing commanders to coordinate the various forces, drawn from different services, in a mutually supporting fashion.

E. Deterrent capabilities. To limit the enemy's responses.
F. The ability to join disparate forces and elements together. Forces from different services and different locations must be able to interact promptly, in a coordinated, mutually supporting manner (Wang and Zhang 2000, pp. 44–48).

By 2004, there had been yet another evolution in the PLA's views of future wars. Having carefully observed US and allied operations in the Balkans, Afghanistan, and the march to Baghdad, Chinese military thinkers concluded that not all high technologies are created equal. Of particular importance are those related to information; indeed, according to the 2004 PLA defense white paper, future wars were now likely to be "Local Wars Under Informationized Conditions."

The "campaign guiding concept," the basis for planning operational level activities, is "integrated operations, precision strikes to control the enemy (*zhengti zuozhan, jingda zhidi*; 整体作战, 精打制敌)." "Integrated operations" refer to not only integrated forces, i.e., joint operations, but also combining offensive and defensive operations, hard-kill and soft-kill techniques, in the air, on land, at sea, in space, and in cyberspace. "Precision strikes" are described as those involving the use of precision munitions to attack vital targets. The goal is not only destroying key points but also precisely controlling the course and intensity of a conflict (Zhang 2006, p. 81). It also entails disrupting the enemy's system, and not just individual weapons or forces, so as to effect paralysis and not simply attrition (Wang and Zhang 2009, pp. 202–203).

Central to the conduct of such strikes is the ability to establish superiority, or dominance, over the information realm. Seizing information superiority or dominance (*zhi xinxi quan*; 制信息权) is seen as vital (Zhang 2006, p. 81). An essential means of attaining information dominance, in turn, would be through military space operations. "Establishing space dominance, establishing information dominance, and establishing air dominance in a conflict will have influential effects" (Zhang 2006, p. 83).

This growing emphasis on establishing space dominance is rooted, in part, on the conclusion that dominance of the information domain is predicated on the ability to control space. In the opinions of some PLA analysts, without control of space, any attempt at dominating the information domain, or exercising combat in the electromagnetic spectrum, is made much more difficult, if not outright impossible (Hong and Liang 2002).

The PLA's conclusion, based on both the Gulf War and Kosovo, was that space, therefore, represents the new strategic high ground (*xin de zhi gao dian*; 新的制高点). The combination of modern information technology and military space systems has created the means of coordinating land, sea, and air forces; control of space (and the information domain) is now crucial for coordinating joint operations (Gao 2001, p. 33). Whoever gains space dominance will be able to influence and control other battlefields and will be likely to retain the initiative. Thus, the US deployed extensive space forces early in the Gulf War, ensuring that the US retained "its initiative in the war. This played a key role in seizing victory" (Zhao 1998).

By contrast, loss of control of the space and information domains will likely lead to a reactive, passive stance. For both the Iraqis and Serbians, the result was combatants who were constantly subject to manipulation and utterly unable to respond effectively (Li 2002).

## 25.4 Space as a Strategic Factor

As noted earlier, conflict occurs at the strategic, operational, and tactical levels. Space capabilities contribute to all three.

At the strategic level, China's possession of space capabilities, in and of itself, constitutes a fundamental factor affecting its strategic situation. Unlike the vast majority of states that have confronted the USA or other western nations since the end of the Cold War (e.g., Iraq, Serbia, Libya), China possesses a complete array of space systems that are under its sovereign control. China does not depend upon external suppliers for technology, support, maintenance, or access to space. Consequently, Beijing can employ space systems to support its own ends, unlike most other countries.

Not only does this potentially alter the strategic calculus in any confrontation involving the PRC directly, but it also introduces a potential source of leverage, should Beijing choose to support other countries that are engaged in a confrontation. China, as noted previously, already provides weather and disaster information to various states through its FENGYUNCast network. It could choose to provide more refined information derived from its space systems as well (although not necessarily through FENGYUNCast).

Furthermore, strategic security is influenced by what Chinese analysts term "political warfare." This entails efforts to shape and influence both adversary popular perceptions and sentiment and those of the enemy leadership. Such efforts include "political combat styles under informationalized conditions (*xinxi tiaojian xia de zhengzhi xing zuozhan yangshi*; 信息条件下的政治性作战样式)," involving the use of various resources, not just military ones, to secure the political initiative and psychological advantage over an adversary (Academy of Military Sciences Operations Theory and Regulations Research Department and Informationalized Operations Theory Research Office 2005, p. 403). These "political combat styles," as specified in the "Political Work Regulations of the Chinese People's Liberation Army," include the "three warfares (*san zhan*; 三战)" of psychological warfare, public opinion warfare, and legal warfare.

- *Public opinion/media warfare* is the struggle to gain dominance over the venue for implementing psychological and legal warfare. While the news media plays a key role, public opinion/media warfare involves all the instruments that inform and influence public opinion (e.g., movies, television programs, books).
- *Psychological warfare* seeks to disrupt an opponent's decision-making capacity by creating doubts, fomenting anti-leadership sentiments, and generally sapping an opponent's will. It can include measures aimed at the political, military, economic authorities, or the general population.

- *Legal warfare* seeks to justify one's own actions in legal terms while portraying an opponent's activities as illegal, thereby creating doubts among adversary and neutral military and civilian authorities and in the broader population, about the wisdom and justification of an opponent's actions.

China's possession of a global communications capacity, including satellite systems, provides it with the ability to wage all forms of political warfare across the globe. Indeed, China's efforts to facilitate Xinhua's creation of a 24-h English language news service to counter CNN and Fox News and the expansion of state-owned China Central Television (CCTV) could not hope to gain a global audience without a robust satellite communications infrastructure to support it (Xinhua News Agency 2010; Branigan 2011).

### 25.4.1 Space Deterrence Operations

Another key strategic mission for space forces is to effect space deterrence. PLA thinking is that deterrence may be based upon nuclear, conventional, space, or information strength. It may also be based upon space-based strength. In each case, the intent is to "demand the opponent to submit to the deterrer's volition" (Peng and Yao 2005, p. 215). It is worth noting that the Chinese term for deterrence, *weishe*, and the underlying conception does not necessarily differentiate between dissuasion and coercion. Deterrence by whatever means, including space, is seen as providing the opportunity to achieve one's own strategic goals and to defeat an opponent without having to resort to the actual use of force.

Space capabilities can multiply the effects of other deterrent forces, by enhancing the effectiveness of nuclear and conventional forces. In conjunction with nuclear forces, for example, they can enhance one's own nuclear capabilities, while potentially neutralizing an opponent's (Hong and Liang 2002). Similarly, space systems can dramatically improve the lethality and range of conventional forces, enhancing its deterrent capabilities.

Space systems may also intimidate an opponent on their own. Given their expensive nature, threatening an opponent's space systems may suffice to dissuade an opponent, much as nuclear deterrence threatens to impose very heavy costs. Of course, threatening satellites is not the same as threatening nuclear destruction of cities; yet, the possibility that significant portions of a state's space infrastructure may be destroyed or damaged imposes a cost-benefit analysis that otherwise would not have to be made. The lack of human casualties also makes space deterrence more credible – there is less likelihood of strategic escalation if space systems, rather than cities, are attacked.

Moreover, given the expense, and the lack of spares, destroying or damaging an opponent's space systems will likely have effects that will be felt for many months, if not many years. This, in turn, can affect a state's long-term economic, political, and diplomatic well-being. Because space affects so many aspects of comprehensive national power, any damage inflicted upon space systems will, in turn, have repercussions across those same elements of comprehensive national power.

Chinese authors, in thinking about how to effect space deterrence, appear to have developed something akin to an "escalation ladder" of actions, each rung a more serious attempt to dissuade or coerce an opponent into altering their course of action. The more serious the measure, the more they are also intended to improve war-fighting capabilities, so that should deterrence fail, Chinese forces will be in a better position to conduct military operations. The rungs on this "escalation ladder" for space deterrence comprise testing space weapons, undertaking space exercises, shifting the deployment of space forces, and actually employing space weapons.

**Testing Space Weapons**. The first rung of the Chinese space deterrence ladder appears to be testing space weapons in peacetime. Successful testing demonstrates capability, so that potential opponents will have to incorporate that threat into their cost-benefit calculus in any future confrontation. Even a failed test, however, can nonetheless influence potential adversaries, since they cannot know if the causes of any failure have been resolved by the time of a new crisis. Moreover, by undertaking such tests, whatever the outcome, there is demonstrated a certain level of scientific and technical capability. This, in turn, not only can enhance political and diplomatic standing but will also show any potential adversary the rising level of comprehensive national power (Li and Dan 2002).

**Undertaking Space Exercises**. The next level of deterrence involves space force exercises. This can include not only offensive and defensive space operations but also antimissile exercises with an exo-atmospheric component. It also can involve the use of space forces to support conventional and/or nuclear forces, especially in joint operations-type environments. Not only do such exercises provide an object lesson in capability, but they also provide an opportunity for one's own forces to engage in realistic training.

Such exercises are differentiated from testing space weapons by their timing. PLA writings suggest that the most effective time to conduct such exercises is in a crisis, to maximize deterrent effect and to demonstrate resolve and commitment. By contrast, tests of space weapons are best undertaken in peacetime, in order to maximize the opportunity to shape others' perceptions. To further add to their effect, such exercises might be held in regions of space that are especially sensitive or strategic, such as in geosynchronous orbit. Doing so both further sensitizes any potential opponent and further demonstrates will (Chang 2005, p. 303).

**Shifting the Deployment of Space Forces**. Should further escalation be necessary in order to deter an opponent, the next rung would involve both reinforcing current space forces and shifting their location as necessary. Both moves would signal that the situation is becoming ever more dangerous, thereby demonstrating resolve.

Moreover, by deploying additional satellites, one's own capabilities are improved, which may not only provide additional deterrence but also complicate an opponent's targeting. Furthermore, if additional reconnaissance systems are deployed or shifted, this will also probably increase the chances that opponent force deployments and activities will be detected, also contributing to deterrence by denying the chance for surprise. Should an opponent nonetheless remain committed to their course, increased deployments can provide the additional capabilities necessary to help secure space and information dominance (Chang 2005, pp. 303–304). This last aspect will not necessarily generate a deterrent effect, but is expected to help war-fighting capacity.

**Actual Use of Space Forces.** There are two ways in which space forces might be actually used; each has a different effect on deterrence. One is to have employed space capabilities in other conflicts. In this view, previous displays of actual capabilities can serve to deter future conflicts.

Other analyses, however, suggest that the deterrence involved in actual attacks is not based on prior experience, but on the effective implementation of actual attacks in an ***ongoing*** crisis. One author describes such operations as reprimand or punishment strikes (*chengjie daji*; 惩戒打击). The actual employment of space forces, in this view, constitutes the strongest kind of deterrent (*zuigao qiangdu de weishe*; 最高强度的威慑). The aim is to "cow the enemy with small battles (*yixiaozhan er quren zhibing*; 以小战而屈人之兵)" (Chang 2005, pp. 302–304).

The use of space weapons does not have to be destructive. For example, one could interfere, suppress, or otherwise disrupt enemy space systems, such as by jamming communications and data links or damaging their command system through computer network attacks (Chang 2005, p. 304). By inflicting confusion and disruption on their space systems, an opponent may yet decide to cease hostilities. At the same time, such moves would not necessarily generate debris (and, indeed, may even be publicly deniable), thereby limiting the diplomatic impact on third parties.

But the PLA is not committed to purely soft-kill forms of weapons employment in support of deterrence. PLA authors also suggest that this rung might involve implementing sudden, short-duration strikes against enemy space systems, such as space information systems, command and control centers, communications nodes, and other key facilities.

Such attacks would inflict a greater psychological blow than the option of jamming and interfering with an opponent's systems, since there could be actual physical destruction of hard-to-replace facilities and equipment. Moreover, by destroying such targets, other elements of the opponent's space infrastructure will likely be affected, whether they are themselves targeted or not. It would likely require extensive efforts and delays, for example, before orbiting satellites could be shifted, or new systems launched, in the wake of attacks on mission control facilities. The logic seems to be that the ability to inflict punishment is the greatest deterrent; "the foundation of space deterrence must be preparation for real war (*bixu yi shizhan zhunbei zuowei kongjian weishe de jichu*; 必须以实战准备作为空间威慑的基础)" (Chang 2005, p. 302).

The divergence of views on how to execute a policy of space deterrence, however, raises questions about the extent to which the PLA necessarily governs larger Chinese space policy. This is underscored by the discrepancy between how PLA authors describe the utility of testing space weapons and how the PRC actually behaved at the time of the January 2007 ASAT test. Not only was there no prior publicity, but the PRC Foreign Ministry seemed to handle the aftermath in a singularly hesitant fashion. Consequently, one must wonder whether the Chinese political leadership (which is composed of civilians) necessarily subscribes to the same view of deterrence as that laid out by Chinese military space analysts.

## 25.5 Space as an Operational Factor

While space forces can have a strategic impact, their greatest contribution to Chinese military operations may be at the operational level of conflict. China's growing inventory of space assets provides the PLA with an expanding set of capabilities, facilitating the conduct of joint campaigns. China's space systems are likely to provide substantial support for the planning, conduct, and sustainment of joint campaigns.

As noted earlier, for the PLA, joint operations are seen as a hallmark of future Local Wars Under Informationized Conditions. A core element of joint operations is "integrated operations (*zhengti zuozhan*; 整体作战)," which entails integrating forces, domains, and activities.

- *Integrating forces* involves coordinating the activities of all the participating services, as well as mobilizing relevant civilian resources.
- *Integrating domains* involves linking activities within all the relevant battlespaces, including not only land, sea, and air but also outer space and cyberspace.
- *Integrating activities* means linking offensive and defensive operations by all forces, as well as coordinating positional warfare, mobile warfare, air and naval operations, and combat operations with combat support and combat service support functions.

In order to integrate the various forces, domains, and activities, it is essential that the PLA's commanders operate within a unified command system, capable of creating a common situational awareness among all the participating forces. This, in turn, requires a unified command, control, communications, computers, and intelligence (C4I) structure, linking together all the various forces. This command system will have several main tasks, each of which is likely to rely upon space systems.

### 25.5.1 Grasp the Situation

The first and most basic task is understanding the situation (*zhangwo qingkuang*; 掌握情况). All subsequent efforts and activities are built upon this foundation. Grasping the situation, in turn, entails collecting, processing, and distributing information about both adversary and friendly forces. It also includes collecting background material and providing longer-term assessments, so as to understand not just the immediate situation but the strategic context as well. Reconnaissance and surveillance capabilities, employing a variety of systems, are therefore essential, as well as the ability to collate the collected information, analyze it, and then exploit it.

The PRC currently fields a variety of space systems to provide information support to their commanders. These include:

*Meteorological satellites*. The conduct of military operations is often affected by weather. The success of D-Day, for example, rested in part upon superior allied ability to predict the weather in the English Channel. China fields the Fengyun (Wind and Cloud) constellation, which includes both sun-synchronous (FY-1, FY-3 series) and geosynchronous (FY-2 series) satellites. The 2007 ASAT test targeted FY-1C, the third of the FY-1 series of satellites.

*Earth observation satellites*. The Ziyuan (Resource) and Tianhui (Satellite Mapping) series of Earth observation satellites can transmit their data to Earth, providing much more responsive coverage. The first Ziyuan satellites, also known as the China-Brazil Earth Resource Satellite (CBERS) had a charge-coupled device camera (CCD camera) with a 20 m resolution, among other sensors. The Ziyuan-II and Ziyuan-III series are believed to be military reconnaissance satellites, also referred to as the Jianbing series, with higher-resolution sensors (Cliff et al. 2011, pp. 98, 100–101). The Tianhui Earth observation satellites are also believed to be military satellites, with a five-meter resolution CCD camera, and may be related to the Ziyuan-III satellites (Chinese Academy of Surveying and Mapping 2011).

*Other intelligence-gathering satellites*. China also fields a number of other satellite systems that provide commanders with a range of information. The Haiyang (Ocean) series of small satellites currently provide oceanographic data, including wave heights and water temperature (Clark 2011a). These will be supplemented by at least two maritime radar surveillance satellites by 2020 (China Daily 2012).

There have been 17 Yaogan (Remote Sensing) satellites placed into orbit, some with optical sensors and others equipped with synthetic aperture radars (SAR), which allow imaging through clouds and at night. These have often been orbited in pairs, allowing for comprehensive coverage of any given target, under all weather conditions (Clark 2012; Cliff et al. 2011, p. 101). China has also deployed a number of Shijian (Practice) satellites, which may have a reconnaissance role. In addition, China has orbited the Huanjing (Environment) series of disaster-monitoring satellites. These mount visible light and multispectral cameras or synthetic aperture radars. While all of these are believed to have low resolution, they can provide additional information.

### 25.5.2 Planning and Organization and Control and Coordination

The commander, once acquainted with the situation, must undertake planning and organization (*jihua zuzhi*; 计划组织). This involves making assessments and issuing broad directives, which will be supplemented by guidelines formulated by his staff. These will inform the subordinate command staffs in their formulation of more specific plans, including those governing operational activities (*zuozhan xingdong*;

作战行动), various safeguarding activities (*baozhang xingdong*; 保障行动), and command activities (*zhihui xingdong*; 指挥行动) (Yuan 2008, p. 14). As multiple services will be participating in any joint operations, one key task for the joint campaign command headquarters is to reconcile the various services' plans, integrating them into a coherent whole.

Once the campaign has begun, the commander and his staff must engage in control and coordination (*kongzhi xietiao*; 控制协调), so that the engaged forces can respond to battlefield situations as they arise. Given that conflicts under informationized conditions are much more complex, involving more participating services, larger physical scale, and more varied operational styles (*zuozhan yangshi*; 作战协同), the tasks of coordination and control of participating forces will be much more difficult. Campaign commanders and staffs will require ready access to both information about friendly and enemy forces and reliable communications to adjust force dispositions and activities.

To support these tasks, China fields communications and data relay satellites, to allow commanders to receive updates and issue new orders.

*Communications Satellites*. China has access to a range of commercial communications satellites, including those owned by AsiaSat, a Hong Kong-based company. China itself has only a limited number of commercial satellites in orbit. In addition, it fields two military communications satellite systems. The Fenghuo (Signal Fire) system provides C-band and UHF communications, while the Shentong (Wide Ranging) satellites are reportedly China's first military Ku-band communications satellites (Cliff et al. 2011, p. 94). It is possible that the two satellites serve different communities; the Fenghuo may be intended for tactical communications, while the Shentong may support higher echelons.

In the wake of the 2008 Sichuan earthquake, Chinese officials relied upon their communications satellites to coordinate disaster relief efforts. In subsequent reviews, Chinese officials noted the role of the Beidou (Northern Dipper) navigation satellite system as a supplement to the Fenghuo and Shentong satellites (Lu 2008). While the geosynchronous Beidou satellites are intended primarily as a positioning, navigation, and timing (PNT) system, it also can transmit text messages of approximately 120 characters (China Satellite Navigation Office 2011). This capability was apparently heavily exploited in the aftermath of the earthquake.

*Data Relay Satellites*. Most of China's tracking, telemetry, and control (TT&C) network is located in the PRC itself. As a result, Chinese ground-based stations can only maintain communications with any given mission for approximately 12 % of an orbit. Beginning in 2008, the PRC began to deploy additional Tianlian (Sky Link) data relay satellites, to bolster this coverage. The three Tianlian satellites placed in orbit by 2012 had increased Chinese coverage to over half of each orbit (Clark 2011b). While these satellites were ostensibly placed in orbit to support China's Shenzhou and Tiangong manned space missions, they can obviously provide support for other space systems and tasks as well.

## 25.6 Space as a Tactical Factor

In the course of waging "Local Wars Under Informationized Conditions," PLA forces will seek to overcome the enemy through precision operations. Such missions, in turn, involve precision in several specific areas, including the selection of targets, the application of force, and the choice of tactics (Zhang 2006, pp. 89–92).

The *precise selection of targets* (*jingque xuanze daji mubiao*; 精确选择打击目标) involves determining the most vital enemy targets, so as to maximize the effect of attacks. Destruction of enemy military forces may not be as essential as key military, political, or economic targets. Timing and sequencing is also important.

Similarly, the campaign commander and his staff are expected to *precisely apply forces against key points* (*jingque zhongdian yongbing*; 精确重点用兵). Weapons must be carefully allocated against targets, to assure that the right weapons are matched against each target. It may be better to apply "soft-kill" capabilities, e.g., against orbiting satellites, so as to minimize collateral damage, especially to third parties. In other cases, such as launch and mission control facilities, the goal may be to maximize permanent destruction, with an emphasis on "hard-kill" capabilities.

Precision also applies to the choice of tactics and techniques (*jingque yunyong gezhong zuozhan fangfa he shouduan*; 精确运用各种作战方法和手段). This requires the campaign command to be familiar with one's own forces and enemy forces, with the ability to fight the close-in as well as distant battles. The campaign command must be able to flexibly and innovatively adjust one's actions, engaging in both simultaneous and sequential operations while responding to contingencies as they arise.

In undertaking precision operations, key targets would include:

- Command and control facilities and associated elements, in order to paralyze an opponent
- Logistics and reinforcement centers, as well as power infrastructure and other targets that help sustain the enemy's forces
- Key missile, air, and naval bases and combat information facilities, in order to blunt an opponent's ability to conduct offensive campaigns or seek to establish information, air, or naval dominance
- Transportation choke points, including railways, highways, vital bridges, and harbors, so as to disrupt an opponent's mobility and isolate their forces (Chang 2005, p. 314; Dong et al. 2003)

Space capabilities play an essential role in supporting such precision operations. The various reconnaissance and surveillance systems allow commanders to develop detailed understanding of the nature of fixed targets and also are central to locating enemy and friendly forces. The communications satellite network allows the coordination of participating forces drawn from all the services.

In addition, the PRC fields its own *PNT satellite network*. The original Beidou constellation first took shape in 2000 and is comprised of satellites in geosynchronous orbit, which provided regional geo-location with an active portable set and a fixed site in the PRC. The Compass portion of this PNT network adds a group of mid-Earth orbit (MEO) satellites that operates along the same lines as the American

GPS, Russian GLONASS, or European Galileo system, with the satellites providing regular signals to passive receivers. By operating its own satellite navigation system, the PLA is assured access to PNT data in event of conflict.

Beyond information support from space, Chinese forces are likely to engage in offensive and defensive operations specifically against an opponent's space forces. It is important to note that, in this context, the PLA would target not only an adversary's systems in orbit but also terrestrial installations such as launch sites, mission control centers, and TT&C facilities and the data links that combine them into a systemic whole. The objective would be to cause the enemy's overall *space system* (*kongjian tixi*; 空间体系) to fail, not simply individual satellites or even mission aspects. Attacking an opponent's mission control facilities would have powerful effects that would ripple through the system, much as attacking an opponent's command and control systems would cause widespread disruptions (Hong and Liang 2002). Attacks against launch sites, meanwhile, would affect an opponent's ability to reinforce or replace damaged or destroyed orbiting systems. As one analysis notes, striking at both space and terrestrial targets is necessary to establish local space superiority (Dong et al. 2003).

Attacks against terrestrial targets could be undertaken with a panoply of systems, ranging from special operations forces to guided missile attacks or long-range bombers, depending on the location of the target. Such attacks would need to be coordinated with other operations, however, and are recognized to have a high potential for strategic escalation (Chang 2005, p. 294).

In addition, the PLA is likely to mount attacks against assets in space. This might involve the physical interception of enemy satellites. In January 2007, China tested a kinetic kill vehicle (KKV), when it destroyed a defunct FY-1 weather satellite. Available information indicates that the test was conducted with a solid-rocket booster launched from Xichang Satellite Launch Center (Kan 2007). Chinese military writings, however, acknowledge that such attacks would likely generate debris (the 2007 test was one of the first debris-generating incidents in history), which would, in turn, pose a threat to friendly and neutral satellites (Chang 2005, pp. 290–291).

Consequently, in addition to physical attacks against terrestrial facilities and orbiting systems, the PLA is likely to conduct "soft-kill" attacks against an opponent. One essential element would be to attack the data links that tie the various elements of a space system together. For example, it is noted that attacks against satellite uplinks can affect a satellite's orbital orientation or turn on (or off) its sensors. Thus, electronic interference can cause a satellite to become operationally ineffective (Chang 2005, pp. 292, 296). Another possibility would be the use of lasers, microwaves, or particle beams against a satellite's instruments and sensors. Such an attack would not necessarily cause the satellite to disintegrate, but even a low-powered attack would likely disrupt instruments (Chang 2005, pp. 292–293).

At the same time, commanders should expect an opponent to undertake similar attacks against key space assets, both terrestrial and orbital, and therefore must prepare defenses. In particular, an opponent, upon discovering one's own side has organized and prepared space strike operations, may well seek to preempt.

Consequently, an essential part of any successful space defense effort is attacking the enemy's space system. As one PLA analysis observes

> Only by using space attack strength and long-range strike weapons (such as long-range bombers) of other [military] services and branches, at the appropriate time, and using actively offensive activities for concentrated attacks against enemy space launch bases, ballistic missile launch bases, space command and control centers, and aerospace production bases, destroying or reducing the enemy's offensive capacity, can one effectively block and disrupt the enemy's undertaking of space attacks against us (Chang 2005, p. 321).

Meanwhile, in addition to augmenting active defenses by deploying air and ground defenses around key space facilities and systems, it is essential to engage in passive defense as well. Chinese writings suggest that the provision of camouflage and other stealthing measures can help satellites survive, by concealing the nature of a satellite's functions and nature (Chang 2005, p. 316). In addition, they should be hardened or otherwise shielded from enemy efforts at dazzling and electronic interference.

Another option is dispersing satellite functions, by fielding groups of small satellites and microsatellites, rather than relying on individual platforms. This would increase resiliency, allowing a mission to continue despite the destruction or disruption of any individual satellite. Where one must rely on a single satellite, it should be capable of altering its orbit, so as to evade enemy attacks, and of functioning autonomously so that even if their ground links are severed, they would nonetheless be able to continue operations (Chang 2005, p. 320).

## 25.7 Conclusions

The Chinese see space as contributing to many different aspects of their national security, including not only the military but economic and diplomatic components. This is in part because they see space itself as a holistic entity, including not only the systems in orbit but also terrestrial facilities and the data links that bind the system together.

Within the military realm, space contributes to all the levels of conflict: strategic, operational, and tactical. The various systems within China's space program provide support for its military at each of these levels; as they acquire additional capabilities, the space program's contributions will only grow. Its importance, too, will also expand, since space is a key avenue for the acquisition, transmission, and exploitation of information, the cornerstone for successfully fighting future wars.

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