

Dean Cheng
The Heritage Foundation
Research Fellow, Asian Studies Center

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I would like to express my thanks to the US China Economic and Security Review Commission for the opportunity to present this testimony.

In the last several years, China has been steadily expanding its space efforts. This has included the third manned *Shenzhou* mission, which included a space-walk; expansion of the indigenous Chinese Compass satellite navigation system; and deployment of a range of new remote sensing satellites, such as the *Yaogan* series.

At the same time, there has been growing concern about the likelihood that China is pursuing a policy of space dominance, including programs specifically oriented towards counter-space operations. The most well-known example is the 2007 anti-satellite (ASAT) test, which generated enormous debris. Since then, though, the Chinese have engaged in further tests with potential anti-satellite implications. In January 2010, they undertook a test in which “two geographically separated missile launch events with an exo-atmospheric collision.”¹ Between June and August 2010, two Chinese satellites, SJ-06F and SJ-12, engaged in orbital rendezvous maneuvers that appear to have included “bumping” into each other.² None of these tests involved prior notification or announcement, heightening concerns and underscoring the opaque nature of China's space program.

¹ “China Did Not Notify US Before Anti-Missile Test,” AFP (January 12, 2010).

<http://www.google.com/hostednews/afp/article/ALeqM5gIyJwTWQjzwLtHke9NhVHNS7qiHQ>

² Brian Weeden, “Dancing in the Dark: The Orbital Rendezvous of SJ-12 and SJ-06F,” *The Space Review* (August 30, 2010). <http://www.thespacereview.com/article/1689/1>

It is important to recognize, however, that these Chinese efforts are not simply the actions of the People's Liberation Army (PLA), nor efforts at political signaling to obtain a space arms control treaty, as some have posited. Rather, these actions occur within a particular strategic and military context.

The first contextual element is the broadening view of the responsibilities of the People's Liberation Army. One of the first and foremost responsibilities of the PLA is the preservation of the rule of the Chinese Communist Party. As the PRC's economic and national interests have expanded beyond its borders, however, what is deemed essential for preserving the power of the Party has also expanded. To this end, Hu Jintao and his predecessor Jiang Zemin set forth what are now termed the "Historic Missions" of the PLA. Not only do these historic missions sustain the longstanding task of providing support to the CCP, but now the PLA is responsible for helping safeguard China's national development, its expanding national interests, and furthering the objective of maintaining global stability and peace.

It is in this strategic, national light, and especially given the PLA's roles in safeguarding national development and national interests, that China's space capabilities have been expanding. If the PLA is to fulfill these historic missions, it will have to be able to exploit space at times and places of its own choosing, and, as important, be able to deny an opponent the same freedom of action.

We also find increasing mention in PLA writings of the need for a deterrence capacity. Thus, to these historic missions must be added the additional task of constraining conflicts, both by preventing their outbreak, and limiting their extent should they nonetheless occur. Both of these tasks fall under the rubric of "deterrence."

What is striking, however, is that, whereas Western writings on deterrence generally focus on *dissuading* an opponent from performing actions that the deterring power would prefer they not undertake, Chinese writings also talk about *compellence*. That is, if the

PLA is to be successful in deterring an opponent, not only should it be able to dissuade, but it must also be able to coerce an opponent into undertaking actions that the deterred power would prefer not to. In this regard, Chinese discussions about deterrence note roles not only for conventional and nuclear forces, but also highlight the importance of space deterrence as well.

Finally, by way of context, the PLA continues to improve its ability to undertake joint operations. This interest in joint operations was already evident a decade ago, when the PLA promulgated a variety of *gangyao* that would help guide future military planning, training, and operations. The capstone of these *gangyao* was devoted to joint military operations.

The ability to conduct joint operations is portrayed as a hallmark of Local Wars Under High-Tech Conditions, because they allow synergies among services, pit one's strengths against opponent's strengths, and shield one's weaknesses. As the 2010 edition of *China's National Defense* notes, "The PLA takes the building of joint operation systems as the focal point of its modernization and preparations for military struggle."³

As PLA analyses have emphasized over the past decade, however, joint operations are founded upon the ability to gather, transmit, and exploit information. Indeed, the very description of future wars has shifted from Local Wars under High-Tech Conditions, to Local Wars under Informationalized Conditions; the most important high-technologies are those related to information technology. Similarly, the 2010 Chinese defense white paper goes on to note that the PLA "strives to enhance its fighting capabilities based on information systems."⁴

Widely dispersed units must be able to establish a common situational awareness framework. They must be able to coordinate their activities, timing their operations to

³ State Council Information Office, "National Defence Policy," *China's National Defence in 2010* (Beijing, PRC: Information Office of the State Council, 2011).

⁴ State Council Information Office, "National Defence Policy," *China's National Defence in 2010* (Beijing, PRC: Information Office of the State Council, 2011).

maximize effects. And, if future wars will be marked by the “three non’s” of non-contact, non-linear, and non-symmetrical operations, then information will be the *sine qua non* of successfully conducting these future wars.

In order to effect joint operations, according to PLA analyses, a military must be able to exploit space. Only from the high ground of space can one gather information, transmit it rapidly, securely, and reliably, and exploit it promptly. Space is described in PLA writings as essential for reconnaissance and surveillance, for communications, for navigation, for weather forecasting, and for battle damage assessment. And a military that is capable of undertaking effective joint operations is one that can also deter an opponent. Thus, space capabilities help strengthen conventional deterrence, as well as deterring in its own right.

So, the PLA has an interest in being able to achieve space dominance, in order to fulfill its historic tasks, in order to deter future conflicts if possible, and to fight and win Local Wars Under Informationalized Conditions if necessary.

With this context in mind, it suggests that there is a particular method to China’s development of an expanding array of space capabilities, including not only an ever-growing range of satellites, but a new heavy-lift space launcher and a fourth launch site, one that is much nearer the equator.

These are reflected in certain space missions, which PLA writings suggest are of particular importance.

Most obviously, the PLA expects improved space information support. With each passing year, China’s satellite constellations will provide better information to military users. Chinese systems today provide not only basic earth observation capabilities, but also:

- an autonomous navigation system, which, unlike the European Galileo system, is already operational;

- data relay capacity;
- weather forecasting
- earth observation, including maritime surveillance

In addition, China's improving space capabilities, coupled with its steadily advancing conventional capabilities, will provide it with better ability to seek space superiority or space dominance (*zhitian quan*), through a combination of space offensive and defensive operations.

In discussing Chinese space offensive and defensive operations, it is important to note that, while many of the tasks associated with these efforts align with what American military planners consider "counter-space" activities, the Chinese themselves do not employ such a term. Moreover, Chinese writings on offensive and defensive space operations are not limited to, or even primarily focused on, attacking systems in orbit. Instead, they discuss a range of efforts aimed at affecting the range of space-related capabilities, from orbiting satellites, through space-related terrestrial facilities, to the data, communications, and telemetry links that tie all these systems together. Thus, the improvements in the PLA's broader conventional portfolio are also important, because they, too, may be employed to debilitate portions of the overall American space infrastructure.

For example, space offensive operations include not only applying hard-kill capabilities against satellites, but also attacking launch bases and tracking, telemetry, and control facilities. They also discuss the use of soft-kill techniques, such as jamming and dazzling, against satellites, in order to minimize the generation of debris, and the attendant physical and diplomatic consequences. And they also will likely involve the application of cyberwarfare methods against the various data and communications links that transfer information and allow satellites to maintain their orbits.

Similarly, space defensive operations incorporate a range of measures of information denial. These include passive measures such as camouflage and deception, so that the

information an opponent derives from *their* space-based systems are inaccurate. But, in addition, it also includes efforts to prevent an opponent from attacking Chinese space-related systems, meaning efforts to neutralize and suppress the enemy's space infrastructure. This includes both kinetic as well as electronic means, directed at space-based systems, terrestrial facilities, and, again, the data and communications links between and among them.

This is all consistent with what may be a guiding concept for space operations, unified operations, key point is space dominance. Unified operations refers to applying all types of capabilities, terrestrial and space-based, active- and passive-measures, hard-kill and soft-kill, focused on assuring that the PLA can derive and exploit space at times and places of its choosing, while preventing an opponent from doing so.

Finally, as I indicated earlier, the PLA also views space capabilities as essential for deterring an opponent. Given the importance of this issue both in shaping peacetime space postures and crisis management, it merits further discussion.

Chinese Views on Space Deterrent Forces

In the view of PLA authors, the information that enables local wars under modern, informationalized conditions flows through space assets. Space systems are essential for the gathering, transmission, and exploitation of information, which allows non-contact, non-linear, non-symmetrical warfare, and which allows disparate forces, operating across a vast expanse, to coordinate their movements and their activities. In this context, then, space systems are essential for deterrence.

Several characteristics of space systems make their deterrent capacity especially powerful.⁵ In the first place, space systems are seen as more credible than nuclear ones; they are more usable, and indeed, have been employed in many recent wars.

⁵ This section is drawn from Xu Wei and Chang Xianqi, "Discussing Space Deterrence," *Journal of the Academy of Command Equipment and Technology* (XIII, #1, February 2002)

Consequently, in the context of the three pre-requisites for deterrence, they are not only real combat capabilities, but leaders are likely to have the will to employ them, unlike nuclear weapons.

At the same time, PLA space writers suggest that space systems offer the potential capacity to neutralize an opponent's nuclear deterrent, while expanding one's own integrated deterrent capability. Space defenses can intercept an opponent's nuclear forces while they are still en route, minimizing damage to oneself. As one PLA article suggests, by pairing space defense with nuclear forces, one can attack or defend at will, retaining the initiative while confronting an opponent with an unpalatable set of choices.⁶

Space systems also are seen as a vital partner for conventional deterrence. In the first place, space systems allow for the detection and location of enemy forces. This alone may be sufficient to deter, since it potentially removes the prospect of surprise. Moreover, as noted previously, space systems are essential for coordinating terrestrial forces, allowing them to communicate with each other and to synchronize their activities. This makes conventional forces able to operate jointly, making them much more powerful than when they were only able to operate in combined arms fashion.

Finally, by enhancing conventional forces' lethality and range, space systems enable them to engage in "non-contact warfare," striking the enemy with great accuracy yet limited expenditure of weapons. This combination will make an opponent less likely to be willing to engage in conventional warfare at all.

In addition to complementing nuclear and conventional deterrence, PLA writings suggest that space systems may deter an opponent on their own. A space force effects deterrence in a number of ways.

In the first place, it is hardly a secret that space systems are very expensive and fairly fragile. Furthermore, they are in predictable orbits. This makes them extremely

⁶ Hong Bin and Liang Xiaoqiu, "The Basics of Space Strategic Theory" *China Military Science* (#1, 2002).

vulnerable. In essence, because of the combination of expense, fragility, and vulnerability, one can hold an opponent's space infrastructure hostage. Much like nuclear deterrence, space deterrence, in this regard, becomes a question of cost-benefit analysis: is the focus of deterrence, say, Taiwan, worth the likely cost of repairing or replacing a badly damaged or even destroyed space infrastructure?⁷

Moreover, because space systems affect not only military but economic, political, and diplomatic spheres, damage to space systems will have wide-ranging second-order repercussions.⁸ Damaging an opponent's space infrastructure will impose economic and diplomatic costs, beyond simply that of replacing satellite systems. The combination of first- and second-order effects may be sufficient to persuade an opponent that they cannot attain victory at an acceptable price. "Then, they may not be willing to undertake hostile activities."⁹

EFFECTING SPACE DETERRENCE

In light of the potential import of space deterrence, how do PLA authors envision the actual implementation of space deterrence? It appears that there is a concept of an "escalation ladder" of PLA measures that one might employ to effect space deterrence. These involve testing space weapons, exercising space forces, reinforcing space capabilities, and actually employing space forces.

Testing space weapons. Several Chinese articles suggest that testing space weapons, especially in peacetime, can influence an opponent's psychological perceptions. Thus, even if the tests fail, they nonetheless reflect a certain level of capability and interest.¹⁰ An opponent must presume that the deterring nation is engaging in R&D of space weapons and that their own assets are likely to be vulnerable, or at least jeopardized.

⁷ Xu Wei and Chang Xianqi, "Discussing Space Deterrence," *Journal of the Academy of Command Equipment and Technology* (XIII, #1, February 2002).

⁸ Li Jingjun and Dan Yuquan, "The Strategy of Space Deterrence," *China Military Science* (#1, 2002).

⁹ Xu and Chang, "Discussing Space Deterrence."

¹⁰ Xu and Chang, "Discussing Space Deterrence."

To this end, maximum publicity is seen as enhancing the deterrent effect of such tests. Any potential opponent is therefore effectively notified that their space assets are likely to be placed in jeopardy in event of crisis. Not only might this dissuade an opponent from pursuing aggression, but it might also undercut their political and diplomatic standing. Conversely, by undertaking such tests, one's own overall national level of science and technology are made clear, reinforcing concepts of comprehensive national power, and feeding political and technological deterrent capacities.¹¹

Exercising space forces. The next level of deterrence involves exercising one's space forces. These exercises can include such elements as space offense and defense operations, anti-missile exercises, space strategic strike rehearsals, and displays of joint military operations involving both space and non-space forces. Each such type of exercise has its own intended meaning. Space offense and defense operations, for example, indicate the ability to seize space dominance, whereas anti-missile exercises reflect one's strategic defensive capacity, even in the face of nuclear weapons. Space strike exercises implicitly threaten the entire strategic depth of an opponent, whereas joint exercises with other forces serve as a reminder that a full range of capabilities are potentially at play, and not simply space capabilities.¹²

Whereas tests of space weapons might be part of a peacetime routine, PLA authors suggest that exercises should be undertaken in the context of an ongoing crisis. By holding such exercises, according to one analysis, a nation is helping to mold other's perceptions. Exercises may be seen as an expression of will or commitment, signaling an opponent of the deterrer's readiness for war.¹³ Similarly, some PLA analysts suggest that such exercises should be held in sensitive space areas, in order to underscore the seriousness of one's resolve.¹⁴

¹¹ Li and Dan, "The Strategy of Space Deterrence."

¹² Xu and Chang, "Discussing Space Deterrence."

¹³ Xu and Chang, "Discussing Space Deterrence."

¹⁴ Chang Xianqi, *Military Astronautics*, 2nd ed., p. 303.

As an added benefit, such exercises not only display the space deterrent capabilities of the forces involved, but they also provide valuable unit training. This additional training, in and of itself, can also enhance deterrent effects. Well-trained forces are better able to implement operational plans. Thus, in the opinion of some PLA officers, US military space exercises have improved America's space deterrent capacity.

Deployment of additional space forces. In the event of an ongoing, escalating crisis, where space exercises may not have proven sufficient to constrain the crisis, the next step would be to reinforce available space forces. This includes both deploying additional systems, and maneuvering those already in orbit towards “sensitive areas of space (*mingan de kongjian quyū*; 敏感的空间区域),” so as to create a local advantage over an opponent.¹⁵

Not only does reinforcement of available space forces signal an opponent of one's resolve, but increased reconnaissance and surveillance assets will also complicate an opponent's efforts at maintaining secrecy. The likelihood of discovery, in turn, may dissuade an opponent from commencing hostilities, as the element of surprise is jeopardized. Moreover, should an opponent nonetheless not take steps to de-escalate, increased deployments will also provide greater redundancy in the event of war.¹⁶

Actual use of space forces. The actual use of space forces is seen as the ultimate form of deterrence. Different PLA analyses, however, seem to have different definitions of what this means. One article, for example, seem to suggest that *prior* use of space forces lends credibility for subsequent deterrent efforts. Thus, the employment of space forces in previous local wars provide an unmistakable statement of one's own capabilities, as well as one's willingness to take losses and inflict punishment. According to this view, the foundation of space deterrence rests upon actual capabilities that are displayed in real wars.

¹⁵ Xu and Chang “Discussing Space Deterrence.”

¹⁶ Chang Xianqi, *Military Astronautics*, 2nd ed., pp. 303-304.

Other analyses, however, suggest that the deterrence involved in actual attacks is not based on prior experience, but on the effective implementing of *actual attacks* in the course of 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).¹⁷ The aim is to undertake point strikes to effect “cow the enemy with small battles (*yixiaozhan er quren zhibing*; 以小战而屈人之兵).”¹⁸

One type of punishment strike would be to 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.¹⁹ By inflicting confusion and disruption on their space systems, an opponent may yet decide to cease hostilities. If they do not, then one’s own military activities will operate from a more advantageous position.

The other option is to undertake sudden, short-duration strikes against enemy space systems. In light of the previous option, this would imply that such strikes would involve kinetic means. The types of targets would reinforce this implication: space information systems, command and control centers, communications nodes, guided missile launch bases, energy storage sites and other strategic targets. Such strikes, it is suggested, will inflict a psychological impact upon the enemy, as well as likely produce cascading effects throughout their space system, due to their linked nature.²⁰

This sort of deterrence logic would seem to be rooted in the idea that the ability to inflict punishment is the greatest deterrent. Thus, as one Chinese author suggests, “the

¹⁷ Chang Xianqi, *Military Astronautics*, 2nd ed., p. 304.

¹⁸ Chang Xianqi, *Military Astronautics*, 2nd ed., p. 302.

¹⁹ Chang Xianqi, *Military Astronautics*, 2nd ed., p. 304.

²⁰ Xu and Chang, “Discussing Space Deterrence.”

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),” or war-fighting.²¹

PROBLEMATIC ASPECTS OF CHINESE VIEWS ON SPACE DETERRENCE

The divergence of views on how to emplace a policy of space deterrence 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 civilian leadership necessarily subscribes to the same view of deterrence as that laid out by Chinese military space analysts.

On the other hand, some PLA writers, including the author of a PLA textbook on military space operations, suggest that such tests should not be announced, precisely in order to foster uncertainty in an opponent. Given that the other Chinese tests appear to have involved no real advance warning, it suggests that this may be a matter of policy.

Which to believe?

Similarly, the description of reinforcing available space forces would seem to imply a very slowly developing crisis. It is open to question whether such measured steps would be possible, or whether they would be interpreted in the manner presented, in the event of a rapidly escalating situation. Again, the track record of Chinese crisis management, including the Belgrade embassy bombing and the EP-3 incident, as well as the more recent Senkakus/Diaoyutai fishing boat incident, hardly inspire confidence..

²¹ Chang Xianqi, *Military Astronautics*, 2nd ed., p. 302.