



214 Massachusetts Avenue, NE • Washington DC 20002 • (202) 546-4400 • [heritage.org](http://heritage.org)

*CONGRESSIONAL TESTIMONY*

---

**The PLA's Interest in Space  
Dominance**

**Testimony before**

**US-China Economic and Security Review  
Commission**

**February 18, 2015**

**Dean Cheng**

**Senior Research Fellow**

**The Heritage Foundation**

My name is Dean Cheng. I am the Senior Research Fellow for Chinese Political and Security Affairs at 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.

The Chinese People's Liberation Army (PLA) has been a close observer of other people's 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 Russian wars and counterinsurgencies along its periphery.<sup>1</sup> Chinese analysts have also examined earlier conflicts such as the 1973 Arab–Israeli War and the 1982 Falklands conflict.

From their analysis, the Chinese have concluded that the key to fighting and winning modern wars lies in the ability to establish “*zhi xinxi quan*; 制信息权” (information dominance). Because of the evolution in human society and economics towards the Information Age, Chinese analysts expect most future wars will be “*xinxihua tiaojian xia jubu zhanzheng*; 信息化条件下局部战争” (local wars under informationized conditions). Winning such wars depends upon the ability to better exploit information just as during the Industrial Age success in war depended upon the ability to better mobilize the full panoply of national economic resources and industry. The key is establishing “information dominance,” i.e., the ability to gather, transmit, manage, analyze, and exploit information, and preventing an opponent from doing the same.

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 played a growing role. More and more essential data, from meteorological information to weapons guidance and communications, is gathered from or transits through satellites. As one PLA assessment noted, in the course of the NATO intervention in Kosovo, the US military deployed some 50 satellites, and integrated them with unmanned aerial vehicles and aircraft to create a comprehensive surveillance system. Space systems are judged to have provided 70 percent of battlefield communications, 80 percent of battlefield surveillance and reconnaissance, and 100 percent of meteorological data, and did so through all weather conditions, 24 hours a day.

---

<sup>1</sup>For a fuller discussion of Chinese lessons learned from these various conflicts, see Andrew Scobell, David Lai, and Roy Kamphausen, *Chinese Lessons from Other People's Wars* (Carlisle, PA: Strategic Studies Institute, 2011).

Moreover, 98 percent of precision-guided weapons were guided with space-based information.<sup>2</sup> Consequently, establishing “*zhi tian quan*; 制天权” (space dominance) has become an essential element of achieving “information dominance.”

PLA analyses suggest that it views space in a very holistic fashion. Chinese writings note that the overall space system encompasses not only satellites in orbit, but also terrestrial launch, mission control, tracking, and telemetry and control (TT&C) facilities, as well as the data links that tie the space and earth-bound portions together. Consequently, efforts aimed at establishing space dominance must incorporate offensive and defensive measures covering this full range of targets (orbiting systems, ground-based systems, data).

### **Chinese Space Doctrine**

At this point in time, it is not yet clear whether the PLA has promulgated a formal doctrine for military space operations. As important, it is essential to recognize that, in PLA writings, there is no single concept that corresponds directly to that of “counter-space.” Rather, within the context of establishing “space dominance,” or “space control,” there are a range of tasks and missions that would correspond to aspects of counter-space activities. Thus, the ability to establish space dominance requires the ability to conduct space offensive operations, space defense operations, and space blockades.

More important to understanding PLA thinking about space than a specific counter-space term or concept is the “*zhidao sixiang*; 指导思想” (guiding thought) 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 appears to be “active defense, all-aspects unified, key point is dominating space.”<sup>3</sup> Each of these elements, in turn, has important significance.

**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

---

<sup>2</sup>Jiang Lianju, *Space Operations Teaching Materials* (Beijing: AMS Press, 2013), p. 65.

<sup>3</sup>*Ibid.*, p. 40.

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, while at the same time, 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.”<sup>4</sup>

**All Aspects Unified.** “All aspects unified” refers to the need to unify thinking about a number of different aspects of space operations. It requires 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, with operations in each domain contributing to, and requiring support from, the other domains. Similarly, it requires seeing all the various wartime 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, rather than as discrete phases, tasks, or methods.

Thus, proper conduct of space operations should involve the application of soft-kill methods, such as dazzling or jamming, in coordination with hard-kill methods, such as direct-ascent-kinetic kill vehicles. Space operations should be coordinated with terrestrial operations, not only for the provision of meteorological, positioning and navigation, or communications data from space systems, but also for air, land, and sea attacks on an enemy’s space launch and mission-support facilities. As with cross-domain operations, the various methods and activities should be seen holistically, all contributing to the goal of establishing space dominance while serving the larger, strategic ends of the overall campaign.

To this end, command and control of space operations plays a central role. Not only must the various space activities, including offensive and defensive operations, be closely controlled, but competing demands for reconnaissance and early warning, communications, navigation, and various other space information support assets must also be managed. This encompasses not only military space assets, but civilian and commercial systems as well. Space operations must also be integrated into larger, joint campaign plans to help achieve terrestrial objectives; command and

---

<sup>4</sup>Ibid.

control of space operations must therefore reconcile space-related requirements, timing, and structure with those of the overarching joint campaign.<sup>5</sup>

**Key Point Is Establishing Space Dominance.** “Key point is establishing space dominance” emphasizes the importance of securing space dominance, through the comprehensive application of various types of tactics and forces, in a variety of ways, including interference, obstruction, disruption, and destruction of enemy space-related systems (including terrestrial facilities and data links). The objective is both to prevent the enemy from operating their space systems for as much of the course of the conflict as possible, while also ensuring that one’s own space systems can operate effectively. To this latter end, establishing space dominance also encompasses the exploitation of space, whether in the provision of information support to terrestrial operations, undertaking space deterrence, or engaging in operations against remaining enemy space assets.<sup>6</sup>

### **Chinese Assessment of Required Space Capabilities for Space Dominance**

In order to meet the demands of the guiding thought for space operations, 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.

**The Ability to Enter Space.** This includes not only space launch capacity, but also the ability to monitor and maintain space vehicles after they have been launched. It therefore includes tracking, telemetry, and control (TT&C) capabilities. It also includes the establishment of overall space situational awareness (SSA), and maintaining it even in the face of enemy electronic countermeasures (ECM) and other interference.<sup>7</sup> In addition, satellite servicing capability and retrieval of certain types of space systems is also included in this task.

**The Ability to Exploit Space.** From the PLA’s perspective, this primarily involves the provision of information support to terrestrial operations, including reconnaissance and surveillance, ballistic missile early warning, communications, navigation and positioning, meteorological data, and geodesy information (i.e., information about the globe, essential for determining missile

---

<sup>5</sup>Ibid., p. 43.

<sup>6</sup>Ibid., p. 44.

<sup>7</sup>Ibid., p. 65.

trajectories). This support significantly enhances the effectiveness of land, sea, and air forces, and is what makes space a force multiplier in the Chinese perspective. Such information support is essential for successful joint operations.

**The Ability to Control Space.** This follows from the ability to launch systems into orbit and successfully exploit space. Fundamentally, it is the establishment of space dominance, the ability to dominate a certain area of space at given times and places of one's choosing, while denying an opponent the same ability.<sup>8</sup> Controlling space, in turn, requires fulfilling several distinct responsibilities. First, there must be the ability to preserve one's own space assets, including the ability to operate in the face of enemy interference or destructive attacks. Second, there must be the ability to interfere with, disrupt, or destroy other nations' space systems. Finally, there is the ability to conduct support to terrestrial operations, including the provision of space-to-ground attacks in the future.

To fulfill these tasks, a nation must field space forces that possess certain capabilities. These include:

- Space launch facilities;
- Space tracking, telemetry, and control facilities;
- Orbital space combat capabilities and units;
- Strategic missile forces;
- Ground-based space defense forces (which have the ability to establish SSA); and
- Space logistics and safeguarding capabilities and forces.

The PRC currently fields or is developing all of these forces. In the context of counter-space capabilities, of particular note is China's interest in orbital space combat capabilities and ground-based space defense forces.

### **Chinese Space Weapons Developments**

Since the 1990s, Chinese writings have increasingly emphasized the importance of space. In that time, that interest has also been reflected in a number of weapons tests and other activities that suggest an ongoing array of weapons development efforts. These include a number of different

---

<sup>8</sup>Chinese Military Encyclopedia Editorial Committee, *PLA Encyclopedia: Military Strategy* (Beijing: NDU Press, 2007), p. 211.

anti-satellite vehicles, as well as possible directed-energy weapons (e.g., lasers). Chinese cyber capabilities may also have anti-satellite functions (among others); similarly, Chinese conventional modernization may allow them to hold some of the terrestrial elements of the American (and allied) space infrastructure at risk.

**Ground-launched Anti-satellite Systems.** In January 2007, China tested a direct-ascent kinetic-kill vehicle against a defunct FY-1C weather satellite, resulting in one of the worst debris-generating events in space history. This test, according to Paula DeSutter, then–Assistant Secretary of State for Verification, Compliance, and Implementation, was not the first test, however, but followed two earlier non-destructive tests of the same system.<sup>9</sup> This ongoing development program does not appear to have ended, although there have not been any comparable tests since 2007.

Since then, however, China *has* conducted three tests of a ballistic missile defense system that might also have anti-satellite applications. In 2010, the Chinese “conducted a test on ground-based midcourse missile interception technology within its territory.”<sup>10</sup> As American defense officials noted, “We detected two geographically separated missile launch events with an exo-atmospheric collision also being observed by space-based sensors.”<sup>11</sup> The Chinese conducted another missile defense test in January 2013, and used almost the exact same language to describe it (i.e., a midcourse missile interception). In July 2014, the Chinese conducted another test, which it has termed a missile defense test, but which the United States characterized as a non-destructive anti-satellite test.<sup>12</sup> It should be noted that these tests resemble the American interception of the satellite US193 with an Aegis missile.

While these earlier tests were engaging targets in low-earth orbit (160–2000 kilometers altitude), in 2013, China has also tested a ground-launched anti-satellite system that would appear to be able

---

<sup>9</sup>Lon Rains and Colin Clark, “Profile: Keeping a Watch on U.S. Interests,” *Space News*, March 1, 2007, <http://spacenews.com/profile-keeping-watch-us-interests/> (accessed February 6, 2015).

<sup>10</sup>“China Reaffirms Its Missile Test Defensive,” *Xinhua*, January 12, 2010, [http://news.xinhuanet.com/english/2010-01/12/content\\_12797459.htm](http://news.xinhuanet.com/english/2010-01/12/content_12797459.htm) (accessed February 6, 2015).

<sup>11</sup>“China: Missile Defense System Test Successful,” *USAToday*, January 11, 2010, [http://usatoday30.usatoday.com/news/world/2010-01-11-china-missile-defense\\_N.htm](http://usatoday30.usatoday.com/news/world/2010-01-11-china-missile-defense_N.htm) (accessed February 6, 2015).

<sup>12</sup>Mike Gruss, “U.S. State Department: China Tested Anti-Satellite Weapon,” *Space News*, July 28, 2014, <http://spacenews.com/41413us-state-department-china-tested-anti-satellite-weapon/> (accessed February 6, 2015).

to threaten satellites in geosynchronous orbit (36000 kilometers altitude).<sup>13</sup> This constitutes a substantial expansion of the potential threat posed by Chinese anti-satellite capabilities. As important, it would hold at risk a range of key satellites, including communications and missile early warning systems.

**Co-orbital Anti-satellite Systems.** The ability of satellites to maneuver together has both peaceful and military potential. Docking maneuvers are integral to such actions as resupply of the International Space Station and were fundamental to the American Moon landings. At the same time, however, any satellite, if it has sufficient fuel and can be finely controlled while guided by a sufficiently discerning tracking system, can serve as a co-orbital anti-satellite system; in effect, it would be a space kamikaze. Recent Chinese developments in small satellites and space robots, as well as manned space missions, have demonstrated an ability to maneuver satellites together.

In 2010, two Chinese small satellites, SJ-06F and SJ-12, engaged in a series of maneuvers that suggest a controlled conjunction, in which the two satellites “bumped.”<sup>14</sup> The ability to undertake controlled approaches reflects a nascent ability to steer a satellite, and to bring it into contact with another space system. Similarly, China’s controlled docking maneuvers by the Shenzhou-VIII, Shenzhou-IX, and Shenzhou-X space capsules with the Tiangong space lab demonstrate China’s ability to closely monitor spacecraft operations, including approach and contact. That Shenzhou-VIII was remotely docked via ground control also reflects Chinese ability to bring spacecraft into carefully controlled contact with each other.

In August 2013, China again demonstrated an ability to maneuver satellites in close proximity, as several Chinese satellites apparently maneuvered in a manner that again suggests that they may have physically contacted each other. One of the satellites may have been equipped with a robotic arm, adding an additional capability for servicing satellites—or damaging them while in orbit.<sup>15</sup>

---

<sup>13</sup>Brian Weeden, “Through a Glass, Darkly,” Secure World Foundation, March 17, 2014, [http://swfound.org/media/167224/Through\\_a\\_Glass\\_Darkly\\_March2014.pdf](http://swfound.org/media/167224/Through_a_Glass_Darkly_March2014.pdf) (accessed February 6, 2015).

<sup>14</sup>Brian Weeden, “Dancing in the Dark: The Orbital Rendezvous of SJ-06F and SJ-12,” *The Space Review* (August 30, 2010), <http://www.thespacereview.com/article/1689/1> (accessed February 6, 2015).

<sup>15</sup>Kevin Pollpeter, “China’s Space Robotic Arms Programs,” Study of Innovation and Technology in China Project (October 2013), <http://igcc.ucsd.edu/assets/001/505021.pdf> (accessed February 6, 2015).



**Directed-Energy Weapons.** Chinese KKV tests have garnered significant commentary and discussion; less is known about Beijing's development of directed-energy weapons (DEW). In 2006, China apparently fired lasers at American satellites passing overhead. Contemporary reporting indicated that this was one of a series of events involving Chinese lasers and American military or intelligence satellites.<sup>16</sup> While the United States expressed concern over what was then described as an anti-satellite system, subsequent reporting suggested that it was not clear whether these were, in fact, weapons, or laser-ranging devices.<sup>17</sup> Other reports suggest an ongoing research effort into developing lasers for a variety of defense purposes, including anti-satellite functions.<sup>18</sup>

**Cyber Capabilities.** As noted earlier, the Chinese interest in counter-space is not limited to developing systems to attack orbiting satellites, but also extends to the ability to degrade or damage datalinks that connect satellites to ground stations. Space dominance can be achieved if a key satellite is shut down, its mission payload is pointed in the wrong direction, or it is unable to communicate at critical moments, as if it had been destroyed by an anti-satellite system. Indeed, this may be a preferable outcome, since attribution may be difficult and such approaches are unlikely to generate space debris (and attendant political and diplomatic criticism). Consequently, Chinese cyber capabilities should be considered an integral part of China's counter-space capabilities.

Several recent cyber incidents involving space systems have been attributed to the PRC, suggesting that they are actively exploring vulnerability in space information systems. Hacking incidents in 2007 and 2008 against the LANDSAT-7 and Terra AM-1 EOS (Earth Observation System) satellites reportedly allowed cyber-intruders to gain control over all functions of these satellites for several minutes.<sup>19</sup> The attacks have been attributed to the PRC. Other reports suggest that China

---

<sup>16</sup>Vago Muradian, "China Attempted to Blind U.S. Satellites with Laser," *Defense News*, September 25, 2006.

<sup>17</sup>"NRO Confirms Chinese Laser Test Illuminated US Spacecraft," *Space News*, October 3, 2006, <http://spacenews.com/nro-confirms-chinese-laser-test-illuminated-us-spacecraft/> (accessed February 6, 2015), and "China Jamming Test Sparks US Concern," *USAToday*, October 5, 2006, [http://usatoday30.usatoday.com/tech/news/2006-10-05-satellite-laser\\_x.htm](http://usatoday30.usatoday.com/tech/news/2006-10-05-satellite-laser_x.htm) (accessed February 6, 2015).

<sup>18</sup>Wendell Minnick, "China Pursues Systems to Keep US Forces at Bay," *Defense News*, September 17, 2013, <http://archive.defensenews.com/article/20130917/DEFREG03/309160021/China-Pursues-Systems-Keep-US-Forces-Bay> (accessed February 6, 2015).

<sup>19</sup>Tony Capaccio and Jeff Bliss, "Chinese Military Suspected in Hacker Attacks on U.S. Satellites," *Bloomberg News*, October 27, 2011, <http://www.bloomberg.com/news/2011-10-27/chinese-military-suspected-in-hacker-attacks-on-u-s-satellites.html> (accessed February 6, 2015).

is responsible for hacking into the National Oceanic and Atmospheric Administration's weather satellite system.<sup>20</sup>

### **Potential Future Development Trends in PLA Space Capabilities**

As the PLA continues its modernization program, it will likely continue to improve its ability to secure information dominance, including space dominance. At the same time, as technology improves, space operations themselves will shift from primarily oriented towards provision of information support towards combat capabilities to achieve space dominance.

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.<sup>21</sup> 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.<sup>22</sup>

**More Robust Space Situational Awareness.** An important likely focus in the coming years will be improving China's *kongjian taishi ganzhi*; 空间态势感知 (space situational awareness) 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

---

<sup>20</sup> Mary Pat Flaherty, Jason Samenow, and Lisa Rein, “Chinese Hack Weather Systems, Satellite Network,” *The Washington Post*, November 12, 2014, [http://www.washingtonpost.com/local/chinese-hack-us-weather-systems-satellite-network/2014/11/12/bef1206a-68e9-11e4-b053-65cea7903f2e\\_story.html](http://www.washingtonpost.com/local/chinese-hack-us-weather-systems-satellite-network/2014/11/12/bef1206a-68e9-11e4-b053-65cea7903f2e_story.html) (accessed February 6, 2015).

<sup>21</sup>Tan Rukun, *Operational Strength Construction Teaching Materials* (Beijing: AMS Publishing House, 2012), p. 157.

<sup>22</sup>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 February 6, 2015), 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 February 6, 2015).

environment.<sup>23</sup> 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 anti-satellite weapons can be detected and characterized earlier, allowing Chinese space operators more time to move their own assets.<sup>24</sup> 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 anti-satellite systems, including a demonstrated capacity for direct-ascent kinetic-kill vehicles, co-orbital anti-satellite systems, 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.<sup>25</sup>

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.<sup>26</sup>

\*\*\*\*\*

The Heritage Foundation is a public policy, research, and educational organization recognized as exempt under section 501(c)(3) of the Internal Revenue Code. It is privately supported and receives no funds from any government at any level, nor does it perform any government or other contract work.

---

<sup>23</sup>Tan, *Operational Strength Construction Teaching Materials*, pp. 158–159.

<sup>24</sup>Ibid., pp. 161–162.

<sup>25</sup>Ibid., p. 161.

<sup>26</sup>Ibid., p. 158.

The Heritage Foundation is the most broadly supported think tank in the United States. During 2013, it had nearly 600,000 individual, foundation, and corporate supporters representing every state in the U.S. Its 2013 income came from the following sources:

Individuals	80%
Foundations	17%
Corporations	3%

The top five corporate givers provided The Heritage Foundation with 2% of its 2013 income. The Heritage Foundation's books are audited annually by the national accounting firm of McGladrey, LLP.

Members of The Heritage Foundation staff testify as individuals discussing their own independent research. The views expressed are their own and do not reflect an institutional position for The Heritage Foundation or its board of trustees.