

# An Authoritative Source on China's Military Space Strategy

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## Introduction

Questions about how China plans to use space for military purposes, and whether it plans to attack U.S. satellites in the event of hostilities, are the subject of lively debate and dogmatic assertions in the United States. This question is of great interest to U.S. decision makers because the U.S. military relies on satellites for communication, surveillance, navigation, and other support activities.

U.S. debates about China's space activity focus on intent. Unfortunately, U.S. analysts inside and outside of government often base their interpretations of Chinese intent on non-authoritative, poorly chosen, or poorly translated Chinese-language sources. This includes analysts who produce reports for U.S. intelligence agencies. This happens, in part, because of insufficient Chinese language skills and a lack of familiarity with Chinese sources, but also because credible, authoritative information on China's space programs, especially its military space programs, is difficult to find.

This article presents a careful examination of China's view of the military uses of space as discussed in a Chinese-language source that is both credible and authoritative. That source is a military textbook published by the General Command of the Chinese People's Liberation Army (PLA) in 2003 titled *The Science of Second Artillery Operations* (Yu 2004). The 406-page book is a product of more than 30 years of research and thinking by the PLA on the strategic value of its missile forces and how those forces should be used in the types of military conflicts the Chinese leadership fears may occur in the future. As a result, it is written both to reflect past experience and to be forward-looking.

As part of that discussion, *The Science of Second Artillery Operations* describes China's view of the military uses of space. The view it presents is very different than that typically discussed by U.S. analysts. Its contents suggest the United States may need to reassess its basic assumptions about the objectives of China's military space programs.

Unlike most sources cited in U.S. analyses of Chinese military space policy, this textbook was not intended for foreign or even general domestic Chinese audiences. It was classified as *jimi* (机密)—the third highest classification level among the four types of circulation restrictions placed on Chinese military publications. Its purpose is to educate the officers and soldiers of the Second Artillery—the branch of the Chinese military that operates China's nuclear and conventional missile forces—on the nature, purpose, and importance of the missions they must conduct to prepare for and fight in a possible future conflict.

Although no specific adversaries are named, there are many places in the text where the descriptions of China's imagined enemy leave little doubt it is talking about the United States. For this reason the textbook, although not specifically focused on any particular nation, provides a credible perspective on how China is training the officers and soldiers of the Second Artillery to use its national space capabilities in a conflict with the United States.

China is just now deploying the kinds of space-based military-support capabilities the United States has used for decades, including satellites and supporting ground systems for reconnaissance, communication, navigation, and weather monitoring. The discussion of outer space in the Second Artillery text demonstrates that the PLA, like the U.S. military, places a high priority on maintaining the normal functioning of these core military space capabilities in a time of conflict.

What is particularly striking in this classified publication on the operations of China's missile forces is that it contains no discussion of missile attacks against satellites. Given the purpose and the audience of this textbook, the lack of such discussion is strong evidence that missile strikes against U.S. satellites were not a focus of China's military space operations as of 2003 when the book was written, and suggest they may not be today, either.

This fact is potentially very important. At the time this book was written most U.S. assessments of Chinese military thinking assumed that attacking U.S. satellites was a key part of an "asymmetric" military strategy a weaker China intended to use to defeat a stronger United States in a high-tech regional war, given the U.S. military's reliance on satellites. The analysis of the space-related material in *The Science of Second Artillery Operations*, however, demonstrates that China was not pursuing an asymmetric strategy in space. Instead, China appears to be modeling its acquisitions of space technologies and implementation of military space applications on those used by the United States.

Today many U.S. observers believe anti-satellite missile attacks are central to Chinese military strategy. It is important to recognize, however, that this conviction took root in the late 1990s and early 2000s in an environment shaped by beliefs, assumptions, and information that the classified 2003 book shows were incorrect. When the text was published in 2003, Chinese missile forces were not, according to the text, anticipating or preparing for operations that involved attacking U.S. satellites.

### **"Space Pearl Harbor"**

The assumption that a central part of Chinese military planning is a preemptive attack on U.S. satellites—sometimes referred to as a "space Pearl Harbor"—was circulating among U.S. analysts and defense officials as early as 1999. It gained greater currency after being highlighted in the report of the commission headed by Donald Rumsfeld (Report of the Commission to Assess United States National Security Space Management and Organization 2001), who left the Commis-

sion to become Secretary of Defense under President George W. Bush.

It appears this popular and alarming characterization of China's military space strategy was based on questionable interpretations of non-authoritative Chinese publications. One publication repeatedly cited as evidence is a newspaper article written by a junior military officer named Wang Hucheng (Wang 2000). Ashley Tellis and other respected U.S. analysts claimed the article is evidence of aggressive Chinese intent (Tellis 2007a). But they failed to accurately describe and evaluate the author and the content of his article. It is not an authoritative statement of Chinese military space strategy or doctrine. It is a piece of military propaganda intended to belittle the U.S. military. And it contains only a single passing reference to the vulnerability of U.S. satellites.

The article opens with a demeaning cartoon making fun of a tragic U.S. Apache helicopter crash that occurred during the Kosovo campaign. The presence of the cartoon should have alerted U.S. analysts to the propagandistic nature and questionable credibility of Wang's article. But more importantly, analyzing the article shows that it is largely a summary of U.S. military assessments of its own shortcomings, which Wang simply collected and copied from open source U.S. military publications. These include the Quadrennial Defense Reviews of 1997 and 2001, an unnamed 1998 U.S. Air Force report, and the 1998 Space Command Long-Term Plan. Wang's article is not a description or analysis of Chinese views on space and warfare.

Nevertheless, the Rumsfeld Commission Report characterized this Chinese graduate student's musings as an official announcement from the Chinese government, and proof that "China's military is developing methods and strategies for defeating the U.S. in a high-tech and space-based future war." The only specific methods or strategies mentioned in Wang's article were a reference to India and Pakistan's ability to hide nuclear test preparations from U.S. satellite observation, and a reference to the Iraqi army's use of hand-held GPS jammers. Other official U.S. assessments of China's military space activities produced in the wake of the Rumsfeld Commission report were just as questionable. Official Pentagon reports on Chi-

nese military power published in 2003 and 2004 contained claims that China was developing a “parasitic microsatellite” that could secretly attach itself to an enemy satellite and destroy or disable it at an opportune moment. An analysis of the source of the Pentagon claim, however, showed that it was based on unsubstantiated commentary from the personal website of a self-described Chinese “military enthusiast” and that this commentary was not credible (Kulacki and Wright 2004). In 2005 the U.S. National Air and Space Intelligence Center (NASIC) published a study quoting a Chinese military officer as stating that China was “actively developing” anti-satellite weapons. But the NASIC quote was an erroneous translation of the final sentence of an academic essay in which the author made no such statement (Kulacki and Wright 2005).

Similar problems—translation errors, failures to assess the credibility and authority of the Chinese authors, and misinterpretations of the contents of the sources being examined—are found in many of the reports and analyses written about China’s space policy. These problems call into question the reliability of assertions made by U.S. intelligence and defense analysts regarding Chinese intent, especially the claim that the Chinese military is preparing a preemptive strike against U.S. satellites and that this is a central part of Chinese military strategy.

### **No Mention of ASAT Operations**

If missile strikes against satellites were an important concept in China’s military planning, one would expect to see some indication in a comprehensive textbook on the operations of China’s missile forces. On the contrary, the absence of any sign of preparations or training for missile strikes against satellites in this classified textbook used by the Chinese military to train its missile forces strongly suggests they were not part of military plans as of 2003 when the book was published. This was well after U.S. assessments based on less credible sources began discussing a Chinese “space Pearl Harbor.” It is possible that Chinese thinking and planning may have changed after the book was published, but absent alternative explanations it ap-

pears early U.S. assessments of aggressive Chinese intentions in space were wrong. We will discuss below the issue of what this book might imply for Chinese ASAT plans after 2003, but first look at what it tells us about the accuracy of U.S. assessments before 2003.

One might ask whether it is possible that ASAT attacks and space warfare are not discussed in *The Science of Second Artillery Operations* because these attacks were the responsibility of another branch of the Chinese military, such as the People’s Liberation Army Air Force (PLAAF). The Second Artillery textbook, however, includes extensive discussion of joint operations and coordination with other branches of the Chinese military, including the PLAAF, but makes no mention of ASAT operations.

Moreover, the textbook also indicates the Second Artillery is responsible for many of the space support functions that would be needed to plan, conduct and assess an anti-satellite missile strike that might be launched by another branch of the PLA. Yet there is no discussion of Second Artillery support for an ASAT strike by another branch of the Chinese military in the textbook. This implies that no other branch of the Chinese military trained or planned to conduct ASAT operations at the time this textbook was written.

One telling final consideration is that any Chinese ASAT attacks, regardless of which branch of the Chinese military conducted them, would be highly relevant to Second Artillery operations because they would affect the capability of foreign satellites to monitor or interfere with the activities of the Second Artillery. There is ample discussion of the potential impacts of foreign space assets on Second Artillery operations in the textbook, but there is no mention of planning for or training to conduct those operations under contingencies that anticipate Chinese ASAT attacks against those satellites.<sup>1</sup>

### **China Values Its Own Satellites**

U.S. defense and intelligence analysts often claim Chinese military planners do not show much concern for the vulnerability of their own satellites (Saunders et al. 2002). They also claim China views the heavy U.S. use of satellites in recent military engagements as

a weakness the PLA could exploit in a future conflict with the United States. The implication of these two U.S. claims is that China intends to attack U.S. satellites in a crisis, but does not depend on its own satellites and therefore is not vulnerable to an anti-satellite attack or counter-attack (Tellis 2007b).

The discussion of the role of satellites in *The Science of Second Artillery Operations* calls these U.S. claims into question. The authors of the PLA text describe the U.S. use of satellites in recent military engagements as a military advantage, not an Achilles heel. It may seem reasonable that China would conclude it needs ASAT capabilities to remove that advantage, but there is no evidence in the text that the authors believe such attacks could be successful on a scale needed to cripple the U.S. military. This issue is discussed further below.

Instead the authors of *The Science of Second Artillery Operations* draw a different conclusion: They tell the officers and soldiers of the Second Artillery that the coordinated U.S. use of different types of satellite constellations in recent regional wars constitutes an essential set of space capabilities China must acquire and learn to employ effectively in its future military operations.

China's recent investments in the rapid development of new communication, observation, weather, positioning, and data relay satellites demonstrates China is working energetically to acquire the same military space capabilities as the United States. The Second Artillery textbook indicates that China is pursuing those capabilities not because it plans to launch a preemptive attack against U.S. satellites, but because the U.S. experience demonstrates how important space capabilities are to modern military operations.

The classified textbook emphasizes how the steadily increasing quantity and quality of the satellites China has launched in recent years are becoming vital to the operation of China's missile forces and how those satellites will play an increasingly important role in any future conflict. This is remarkably similar to the U.S. military's assessment of the value of U.S. satellites, which is not surprising since the PLA General Command's views on outer space and modern warfare evolved from Chinese observations of U.S. military investments and activities over the past several dec-

ades. The authors of the text repeatedly refer to the U.S. use of satellites in contemporary U.S. military operations such as Iraq and Kosovo.

This is part of a larger pattern of interest in U.S. space capabilities that appears in Chinese military publications since the 1970s (Kulacki 2009). *The Science of Second Artillery Operations*, an educational textbook that reflects decades of Chinese thinking about the most effective use of China's missile forces, makes clear to the officers and soldiers it instructs that China's acquisition of comprehensive military space capabilities is now considered essential to Second Artillery operations.

The most explicit description of the Second Artillery's perspective on outer space and the operations of China's missile forces is articulated in the third chapter, where the authors of the textbook emphasize that "the Second Artillery's reliance on military space systems will necessarily increase, not decrease." The chapter notes that space offers unique capabilities that are increasingly important for Second Artillery operations:

"...owing to the fact that missiles are extremely complicated weapons systems whose use in warfare cannot be separated from intelligence, communication, surveying, weather, damage assessment and similar types of support. Moreover, for all of these, simply relying on ground equipment is already useless, and reliance on the support of military space systems such as intelligence satellites, communication satellites, surveying satellites, and weather satellites is necessary" (Yu 2004, p. 75).

The textbook stresses the importance of maintaining a real-time awareness of all the factors in the space domain that might influence the flight of Chinese missiles to their target, including environmental factors such as solar radiation and space debris. The responsibility for maintaining this awareness rests with what are described in the textbook as support units within the Second Artillery.

The key point to take away from this discussion is that the role of China's emerging space capabilities, as they are discussed in the textbook, is to support the use

and increase the effectiveness of China's missile forces, rather than to serve as a means of attack themselves. The word "anti-satellite" does not even appear in the textbook, and there is no discussion of Second Artillery operations that involve the use of Chinese missile forces to attack satellites.

## Avoiding Enemy Satellites

In addition to discussing the role of space capabilities to support the use of China's missiles, *The Science of Second Artillery Operations* makes a second major point related to the role of space in the operations of China's missile forces. It discusses the need to keep those operations from being detected and observed by foreign satellites. From a strictly quantitative point of view, the authors focus considerably more of their discussion of satellites on this second operational objective.

Because they are considered strategic assets, protecting Chinese missile forces from detection is a high priority. The PLA General Command views both its nuclear and conventional missile forces as "strategic" assets. This Chinese use of the word "strategic" in reference to its missile forces is important to note. In the United States, "strategic" typically refers to nuclear-armed long-range missiles. For the PLA "strategic" serves as a synonym for "critical"—something essential to the eventual outcome of a conflict.

Indeed, the authors emphasize, "All of the operations of the Second Artillery, regardless of the scale of activity, have strategic significance." The textbook explains that any use of China's missile forces is intended to "effect the overall strategic situation" and "directly affect the course and final outcome of the greater success or failure of the national political, military, and diplomatic struggle holding together the safety and fate of the nation." This is not intended as empty rhetoric. This is a textbook, not a piece of political propaganda. The language is intended to convey to the officers and soldiers of the Second Artillery the Chinese military leadership's view of the critical importance of missile force operations to China's security.

The authors repeatedly remind the officers and soldiers they are training that China's missile forces "will be the first target of attack during a future conflict" (Yu 2004, p. 85) Moreover, those forces are described throughout the text as "limited in number," "easily identified," "complicated to operate," and "difficult to coordinate and control." These attributes present what the textbook describes as a "serious threat to survivability."

Because of this, the reconnaissance capabilities of U.S. satellites are especially troubling to the authors of the text:

"At present, the military satellites of Western nations in the space above our nation are not only of a wide variety, their observation activity is very frequent. These satellites, in different earth orbits, constitute an all-directional, all-time, high functionality, multipurpose space observation system that also has a very high resolution. Under such tight surveillance, our missile forces, dependent on positional warfare, presenting large targets, spread over a broad area, are extremely easy for the enemy to discover" (Yu 2004, p. 97).

The textbook goes on to note that when combined with "the use of long-range high-precision weapons in large numbers," these satellite observation capabilities "naturally present a very serious challenge to the security of our battlefield installations."

A reader might assume this concern about the role of satellite observation would lead Chinese military leaders to propose anti-satellite attacks to destroy or interfere with U.S. Earth-monitoring satellites. However, there is no evidence in the book that the authors believe such attacks can circumvent this problem. Although many U.S. analysts see the comparatively larger U.S. investment in space as a vulnerability, the authors of the textbook may recognize that greater capacity affords the United States a greater ability to compensate for attacks on its satellites. As a result, in thinking about a potential conflict with the United States, China may recognize that anti-satellite attacks could signifi-

cantly escalate a crisis situation and still not solve the surveillance problem.

Moreover, attacking satellites could only address the problem of enemy satellite observations during a time of war, since an ASAT attack would almost certainly lead to war. ASAT attacks would therefore not address China's need for protection from satellite observation during normal peacetime operations, which is arguably a more important concern for the Second Artillery.

These two considerations may explain why attacks on satellites are not discussed in *The Science of Second Artillery Operations*.

Instead the textbook focuses on a more effective and less aggressive method of reducing foreign satellite observation of its missile forces: hiding from them. In the United States, these kinds of operations are known as “camouflage, concealment, and deception.” One of the operational techniques developed by the Second Artillery that is mentioned in the textbook is to counter foreign satellite surveillance by exploiting the “dead angles” and “gaps” in satellite coverage that can be discovered by “mastering the functions and special characteristics of every kind of observation and surveillance equipment” (Yu 2004, p. 381). These types of operations are also referred to as “anti-satellite” operations in many other Chinese military texts (Kulacki 2009).

It is these types of “weaknesses” in U.S. satellite capabilities—vulnerability to being fooled, not vulnerability to physical attack—that were discussed in the Chinese newspaper article by Wang Hucheng noted above, and that Wang called the “soft underbelly” of U.S. military space capabilities. He pointed to successful Indian and Pakistani efforts to hide preparations for their respective nuclear weapons tests from U.S. satellite surveillance as an example of this “soft underbelly.” The Rumsfeld Commission mistakenly cited Wang's paper as evidence that China was planning a “space Pearl Harbor.”

One aspect of fooling satellites requires determining their orbits in order to know when they will pass overhead. Monitoring satellites and keeping track of their locations is one of the space support functions performed by the Second Artillery.

The authors of *The Science of Second Artillery Operations* present the Chinese missile launches into the Taiwan Strait in 1995 as a successful demonstration of actual operational procedures that can be used by the Second Artillery to “exploit the weak points of enemy high-tech weapons” to “avoid satellite surveillance” and “confuse the enemy” (Yu 2004, p. 377). It is a real world example of the “anti-satellite” operations used by the Second Artillery to fool U.S. satellites.

“In the Shenjian-95 action, missile force movement was selected to begin four days before the launch, using nighttime loading and nighttime transport with the whole force implementing the missile launch two days after arriving. Even though implemented under the constant satellite surveillance of the strong enemy, because the time of movement and organizational methods were appropriate, the enemy was unable to figure out the intention of our activity and the combat area, and in this way we effectively achieved the goal of the intention to conceal movement” (Yu 2004, p. 378).

Other methods for exploiting the weaknesses of enemy satellite reconnaissance mentioned in the textbook include hiding actual forces by concealing their locations and movement in a vast network of connected underground facilities, while simultaneously exposing “virtual” or “false” forces that “pander to enemy psychology” with the aim of “influencing enemy thinking and decisions.” This sort of deception includes intentionally distributing false information and leaking false intelligence reports. U.S. analysts and lawmakers concerned about the extensive network of Chinese tunnels discussed in recent U.S. articles should note that the use of that tunnel network is another of the “anti-satellite” tactics employed by China's Second Artillery (Hui 2012).

## Analytical Challenges

China's pronounced reliance on deception requires a lack of transparency about its military capabilities that

makes it very difficult for U.S. analysts to assess how China intends to use space for military purposes. This lack of information has led U.S. analysts frequently to rely on speculation—much of it based on sources that are not credible or authoritative, and some of which may be intentionally misleading.

A majority of U.S. analysts seem to have concluded that China is using deception and opacity to conceal Chinese strengths. This is reflected in U.S. defense community reports of supposed Chinese plans to launch a surprise attack in space or “space Pearl Harbor.” But the discussion of space in *The Science of Second Artillery Operations* suggests that the PLA uses deception and opacity not to conceal strengths but to hide or compensate for perceived relative weaknesses.

The text demonstrates that the Second Artillery has become dependent on China’s relatively new space capabilities to provide the information it needs to use its missile forces effectively in a crisis. The Second Artillery also intends to use its increased knowledge of the various capabilities of U.S. satellites to protect its missile forces from U.S. detection and attack. The protective measures taught to Chinese missileers are confined to confusing the United States about where Chinese missile forces are located, when they might be used, and how they might be used.

The difference between the U.S. analytical community’s focus on a surprise Chinese ASAT attack and the Second Artillery’s focus on Chinese dependence on its own satellites, along with protecting China’s missile forces from detection by U.S. satellites, is reflected in the different meanings of two similar-sounding Chinese words that are frequently confused by U.S. analysts.

U.S. analyses of Chinese military writings often include the term “assassin’s mace” or *shashoujian* (殺手鐮). U.S. analysts frequently describe the “assassin’s mace” as a type of weapon China intends to use to target a supposed U.S. weakness and thereby gain an advantage in a conflict. In the Chinese language, the term is generally used to describe lethal actions committed in secret by an individual or small group to obtain a nefarious purpose. Not surprisingly, the term

*shashoujian* has a strong negative connotation in Chinese.

Some Chinese military authors use *shashoujian* when referring to potential Chinese conflicts with the United States, but in most cases these authors are writing for general audiences using sensational language in open source publications of variable quality.

Chinese military authors writing for official military purposes, like the authors of *The Science of Second Artillery Operations*, would not use a word that compared what they see as the grave and highly moral responsibilities of the professional soldier to the underhanded deeds of an assassin. Instead, they use a similar sounding term with a subtle but significantly different meaning and a vastly different connotation: *sashoujian* (撒手鐮).

*Sashoujian* is a Chinese figure of speech whose closest English language equivalent would be “trump card.” While it is sometimes referred to as a high-tech weapon in Chinese military publications, it also has a broader meaning and can also be thought of more as a skill or tactic. For example, the legendary “sky hook” of Kareem Abdul-Jabar, who scored more points than any other player in the history of the U.S. National Basketball Association, would be his *sashoujian*. In a military context, it refers to a decisive thrust at just the right moment in just the right place that a technologically or materially outmatched opponent can use to prevail over a stronger adversary. It connotes an ability to prevail in a difficult situation by using skill or strategy over superior armaments or technology. It is an attribute, not a particular weapon.

This emphasis on the importance of strategy over armaments is repeated throughout *The Science of Second Artillery Operations*, which refers to China’s conventional missile forces as the PLA’s *sashoujian*. Of crucial importance to the authors is how and when these weapons are used. Prevailing through superior strategy evokes a feeling in the professional Chinese military that is comparable to the admiration and respect many Americans hold for Confederate General Robert E. Lee. That is a quite different and more honorable image than one based on the schemes of an assassin.

The difference between these two concepts is important to recognize, and it plays a role in the way U.S. analysts approach the difficult task of trying to interpret Chinese intentions. U.S. analysts who write about Chinese “assassin’s mace” weapons are more likely to argue China is contemplating a disabling preemptive strike against U.S. satellites. But throughout *The Science of Second Artillery Operations* the strategic purpose of the use of China’s conventional missile forces—the PLA’s *sashoujian*—is consistently described as ending a conflict, not starting one.

Although there is no publicly declared policy regarding the use of China’s conventional missile forces, like there is for its nuclear forces, the textbook explains that the PLA principle of “active defense” dictates China’s conventional missile forces will be used after China is attacked first, not preemptively. Moreover, the text discusses many possible uses of Chinese conventional missiles as a *sashoujian*—*a conflict ending event*—including strikes against aircraft carrier groups, military bases in countries allied with Chinese enemies, and long-range conventional precision strikes against the continental United States (Yu 2004, p. 402).

It is also important to recognize that some of these capabilities had not been developed, tested, or deployed when *The Science of Second Artillery Operations* was written, which indicates that the authors were thinking about future as well as current military capabilities. Given this future-oriented focus, and the fact that Chinese missile strikes against U.S. satellites are not included in this list of *sashoujian* attacks, U.S. analysts should use caution when assessing how developments after the book was published, particularly the 2007 ASAT test, fit into PLA thinking about the military use of outer space.

### **Implications for Post-2003 Chinese Policy**

Given the absence of any discussion of ASAT operations or space warfare in *The Science of Second Artillery Operations*, attacking satellites was not a military operation the Chinese military was preparing to conduct when the book was being written or when it was distributed to officers and soldiers in the field in 2003. U.S. assessments issued prior to 2003 claiming China

was planning attacks against U.S. satellites and that these attacks were central to Chinese military strategy appear to have been wrong.

It is possible China’s views about anti-satellite technologies changed after *The Science of Second Artillery Operations* was published. Comparatively recent U.S. press reports suggest China is experimenting with a variety of anti-satellite capabilities:

- In 2006, reports suggested China fired lasers at U.S. satellites (Axe 2006).
- In 2007, China destroyed one of its own satellites with an interceptor launched on a ballistic missile. The same hit-to-kill interceptor was tested again in 2010 and 2013, but the targets were missiles, not satellites (Weeden 2013).
- In 2010, China allegedly conducted unusual maneuvers with experimental satellites that were compared to former Soviet co-orbital ASAT tests (Weeden 2010).
- In 2013, China launched what it reported as a space-weather experiment that some reports interpreted as a test of an ASAT interceptor intended to strike satellites in medium or high earth orbits (Schanz 2013).

The 2007 test, which actually destroyed a Chinese satellite, is the least ambiguous indication that attacks on satellites may at least be a part of contemporary Chinese military thinking or contingency planning, if not a central part of Chinese strategy. But assessments of the intent behind the 2007 test deserve careful scrutiny.

### **A CLOSER LOOK AT CHINA'S 2007 TEST**

In the January 2007 test China reportedly used a medium-range mobile missile to lift a kinetic energy interceptor into space. It struck an aging Chinese weather satellite circling the Earth at an altitude of approximately 860 kilometers. The collision of the interceptor and the satellite in such a high orbit created a huge field of long-lived debris that will pose a hazard to other spacecraft for many decades. A surprised and outraged international community condemned the test. Some prominent U.S. analysts concluded China anticipated and was willing to suffer this criticism in order

to send a warning to the United States that the PLA war plans now include the use of missiles strikes against satellites (Broad and Sanger 2007).

The history of the development of the interceptor and of the decision to carry out the test calls these conclusions into question (Kulacki and Lewis 2008). Chinese efforts to develop the technologies used in the hit-to-kill interceptor began in the mid-1980s. China enjoyed a positive military relationship with the United States, which supplied the Chinese military with substantial military and technological assistance at that time. Both the United States and the former Soviet Union were conducting high profile testing of ASAT technologies during that period. In 1985, the United States carried out a test very similar to China's test (except for altitude), destroying one of its own orbiting satellites.<sup>2</sup>

As in so many other areas of China's technological development, China used the United States as a model. The United States was developing an ASAT weapon at that time using interceptor technology that could be used for other purposes, such as intercepting missiles. As noted above, following the 2007 destruction of a satellite, China conducted two subsequent tests of the same interceptor in 2010 and 2013 that used missiles as targets.

The Chinese hit-to-kill interceptor program progressed slowly under low levels of funding from the mid-1980s until the early 2000s, when increased investments in advanced military technology ordered in the wake of the 1999 U.S. bombing of the Chinese Embassy in Belgrade led to an acceleration in the development of the hit-to-kill interceptor program. Those developing the system argued that a decision to conduct tests of the technology (there were three tests over an 18-month period, with the third being the one that struck the satellite in January 2007) was simply a logical next step in this decades-long development process.

The Chinese political leadership did not carefully consider the potential implications of carrying out the tests, which were presented to them by the developers of the interceptor as "space experiments" (Kulacki and Lewis 2008). Some of the PLA estimates of the amount of space debris that would be created by the

collision of the interceptor and the target satellite were vastly too low, and when the PLA briefed China's political leaders they downplayed the significance of the debris that might be created. As a result, Chinese decision makers apparently did not anticipate the international consequences or practical implications of the test. They seemed surprised and flustered in its wake, and took several days to release an official statement, which still referred to the test as a "space experiment."

The history of China's hit-to-kill technology, which has other uses than as an ASAT weapon, and its slow pace of development spanning decades, suggests China's motivation was to explore technologies similar to those the United States and Soviet Union were developing, but without a plan or urgent desire to make it part of its military tactics.

One additional consideration is that testing the hit-to-kill interceptor against an object that was already in space—a defunct satellite—is far cheaper and more controlled than testing against a missile, or another target launched into space simultaneously. Given the greater cost, the greater risk of failure, and the underestimation of the impact of the debris, using the satellite as a target may have seemed like a better option. And there was the precedent of the similar U.S. test in 1985 against a satellite, although at a lower altitude.

Finally, before the 2007 ASAT test China launched two other interceptors toward the same target satellite. These launches were either preliminary flybys or missed intercepts. Chinese decision-makers knew the United States was capable of detecting and tracking those launches with its early warning satellites. The United States did not complain about either of them. U.S. silence may have reinforced the Chinese leadership's assessment there was no reason for China not to proceed with the third test.

The history of the interceptor program and the circumstances surrounding the test make plausible the assumption that China developed and tested hit-to-kill technology without the specific intent to use it against the United States as an ASAT weapon. Both the United States and the former Soviet Union developed and tested anti-satellite weapons at similar stages in the development of their respective military space pro-

grams, but never deployed them. China could be following in their footsteps.

### **THE 2007 ASAT TEST AND THE 2003 TEXTBOOK**

What might it mean that the 2007 ASAT test took place even though the 2003 textbook does not discuss planning or training for using ASAT weapons?

It is unlikely that *The Science of Second Artillery Operations* does not mention Chinese missile strikes against enemy satellites simply because it was published four years before the 2007 test and the authors did not know this capability was being developed.

First, some of the missions and future scenarios that are discussed in the textbook, such as long-range conventional strikes against carrier groups and the continental United States, also require weapon systems and technical capabilities China has not demonstrated or tested. Yet, the implications of these untested weapons for the operations of the Second Artillery are discussed in the textbook. Thinking about future capabilities and their potential roles in Second Artillery operations is consistent with the instructional purpose of *The Science of Second Artillery Operations*.

Second, because the discussion of ASAT weapons in Chinese military literature dates back to the late-1970s, the authors of the Second Artillery text would certainly have been familiar with the concept, history, and potential utility of anti-satellite weapons, especially given their concern with foreign satellite surveillance of Chinese missile forces. Even if missile strikes against U.S. satellites were only a hypothetical capability in 2003, if such strikes were seen as a potentially important component of future PLA plans for the military use of outer space, they should have been discussed in the textbook, just as long-range convention strikes against the continental United States were.

A more likely explanation is that the textbook authors understood the history of ASAT programs and may have known about the long-standing technology development program that China was conducting on hit-to-kill technology, but that ASAT attacks were not part of China's military strategy. As discussed above, there are strong reasons to believe that the Second Artillery would be involved in conducting or assisting

with ASAT attacks, and those operations would be reflected in this textbook. The fact that they are not suggests that as of 2003, ASAT attacks were not part of China's military plans.

### **OTHER POST-PUBLICATION REPORTS OF CHINESE ASAT ACTIVITY**

The other three post-2003 reports of potentially ASAT-related Chinese space activity are more ambiguous.

There is not enough information to determine whether the 2006 reports that China intentionally illuminated U.S. satellites with lasers from the ground were intended as tests of a non-destructive ASAT capability. They could be part of normal non-military space activities. China uses laser-ranging techniques in its space science programs, and may also be using the technology as part of its effort to develop space-tracking capabilities. Bouncing a weak laser beam off a satellite is very unlikely to interfere with the satellite, but would allow China to determine the satellite's orbit well enough to accurately calculate when it will be overhead. The United States operates an extensive space surveillance system that does the same thing using ground-based radars.

Knowing a satellite's orbit does not necessarily imply intent to attack it; collecting information to know when satellites are overhead is consistent, for example, with China's strategy of hiding activities from spy satellites, a strategy that, unlike anti-satellite attacks, is discussed in *The Science of Second Artillery Operations*.

The unusual orbital maneuvers of Chinese experimental satellites in 2010 are not definitive evidence of an interest in developing co-orbital ASAT capabilities. Maneuvering satellites into close proximity has many other non-military applications that have been demonstrated by the United States, such as observation of satellite damage, and potential autonomous repair and refueling missions.

The May 2013 high-altitude launch may have been a legitimate space weather experiment, as claimed by the Chinese Academy of Science. On-going U.S. studies of the event may reveal more information in the future, but the assumption that it was an ASAT test is

based on U.S. presumptions of Chinese intent rather than the technical parameters of the mission itself. These presumptions are based on widely held U.S. interpretations of Chinese military publications that contain statements about space warfare; interpretations that were demonstrably wrong for the period before the publication of *The Science of Second Artillery Operations* in 2003.

## Conclusions

The classified 2003 book *The Science of Second Artillery Operations* strongly implies that:

- China understands and values the role that satellites that can play, and is working to develop the same space capabilities that the United States has demonstrated.
- China puts significant emphasis on protecting its missile forces from satellite surveillance, but its focus has been on camouflage, concealment, and deception rather than attacking satellites.
- As of 2003, attacking satellites was not part of China's military plan, despite the widespread view of U.S. analysts.

The space-related commentary in one PLA textbook, no matter how credible or authoritative it may be, cannot be interpreted as a definitive indication China is not contemplating the use of anti-satellite attacks against the United States. On the other hand, because it is a highly credible and authoritative source, published at the request of the General Command of the PLA and written by military professionals for the officers and soldiers of China's missile forces, the space-related commentary in *The Science of Second Artillery Operations* should also not be ignored. Although it was published in 2003, it presents Chinese thinking on the military use of outer space that reflects decades of Chinese research on how the PLA intends to operate its most valued strategic asset—its missile forces—in military conflicts it fears may occur in the future.

China sees its missile force as key to its strategic operations and its defense. It sees its own satellites and

the capabilities they provide as crucial to the effective operation of that force. China also sees the U.S. military use of satellites as an instructive example it is using to model the development of its own military space capabilities. Like their counterparts in the United States, Chinese leaders view their satellites as valuable military assets. They are investing aggressively in expanding their space capabilities as rapidly as they can. To the extent it is possible, Chinese investments in space technology and its military applications are designed to narrow the gap between China and the United States. China does not seem to be working to exploit asymmetry in space, but is working to end it.

As in the United States, there are military authors in China who believe anti-satellite attacks have military utility, despite the experience of the United States and the Soviet Union, which both decided against developing and deploying the anti-satellite weapons they tested decades ago at a similar stage in the history of their military space programs. There is very little evidence to suggest the publications of the Chinese authors who discuss ASAT attacks reflect or influence Chinese military strategy or planning. The authors of *The Science of Second Artillery Operations* decisively emphasized the importance of its space systems and missile forces, and of operating in ways that protect its missile forces by fooling foreign satellites, rather than attacking them. Foregoing such attacks models U.S. actions, and appears logical for a military that values and increasingly depends upon its newly acquired space capabilities.

The textbook was published in 2003, so the Chinese military perspective on space articulated in its pages is dated. But that does not necessarily mean it is out of date. No more recently published Chinese text of equal credibility contradicts it. And China's behavior, especially its accelerating investments in a new GPS constellation, data relay satellites, improved communication and Earth observation satellites, and all the ground systems and personnel that support these space systems, indicates the views articulated in *The Science of Second Artillery Operations* still guide China's approach to the military use of outer space.

In the light of the commentary on outer space in *The Science of Second Artillery Operations*, U.S. ana-

lysts should reassess their views on China's approach to military space operations. While by no means definitive, the textbook provides ample reason to question the conventional U.S. wisdom on Chinese intentions, particularly the "space Pearl Harbor" hypothesis positing an "asymmetric" Chinese strategy using preemptive attacks on U.S. satellites, and that such attacks are central to Chinese military planning.

#### [ENDNOTES]

<sup>1</sup> We note that missile attacks against satellites are not the only possible type of ASAT operation. For example, systems could be developed to deliver so-called "soft" or "reversible" attacks, such as laser dazzling of optical sensors and various forms of jamming that can interfere or disrupt the normal functioning of satellites without completely destroying them. Such attacks are

being considered by the United States as part of its National Security Space Strategy, and it would be logical to assume the PLA is considering them as well. However, even these ASAT methods are not mentioned as possible means to attack U.S. satellites in *The Science of Second Artillery Operations*. If ASAT attacks were critical to Chinese war plans, one would expect ASAT operations employing these techniques would be discussed in some detail given the support activities the Second Artillery would be expected to provide as well as the Second Artillery's concerns about U.S. satellite observation capabilities and the vulnerability of its missile forces.

<sup>2</sup> In October 1985 the U.S. tested the ALMV (Air Launched Miniature Vehicle) that was launched from an F-15 and destroyed an aging Solwind satellite at an altitude of 555 km. The last piece of tracked debris from this test finally fell out of orbit in 2002.

## [REFERENCES]

- Axe, D. 2006. Chinese laser vs. U.S. sats? *Defensetech*. September 25. Online at <http://defensetech.org/2006/09/25/chinese-laser-vs-u-s-sats/>.
- Broad, W.J., and D. Sanger. 2007. China tests anti-satellite weapon, unnerving U.S. *New York Times*. January 18. Online at [http://www.nytimes.com/2007/01/18/world/asia/18cnd-china.html?\\_r=0](http://www.nytimes.com/2007/01/18/world/asia/18cnd-china.html?_r=0).
- Hui, Z. 2012. The defensive nature of China's "underground great wall." *Bulletin of the Atomic Scientists*. January 16. Online at <http://thebulletin.org/web-edition/features/the-defensive-nature-of-chinas-underground-great-wall>
- Kaufman, M. and D. Linzer. 2007. China criticized for anti-satellite missile test. *Washington Post*. January 19. Online at <http://www.washingtonpost.com/wp-dyn/content/article/2007/01/18/AR2007011801029.html>
- Kulacki, G. 2009. *Anti-satellite (ASAT) technology in Chinese Open-Source Publications*. Cambridge, MA: Union of Concerned Scientists. July 10. Online at <http://www.ucsusa.org/assets/documents/nwgs/Kulacki-Chinese-ASAT-Literature-6-10-09.pdf>.
- Kulacki, G. and J. Lewis. 2008. Understanding China's antisatellite test. *Nonproliferation Review*. Vol. 15, No. 2. Monterey, CA: Center for Nonproliferation Studies. pp. 335-347.
- Kulacki, G. and D. Wright 2004. *A military intelligence failure? The case of the parasite satellite*. Cambridge, MA: Union of Concerned Scientists. August 16. Online at [http://www.ucsusa.org/global\\_security/china/page.cfm?pageID-1479](http://www.ucsusa.org/global_security/china/page.cfm?pageID-1479)
- Kulacki, G. and D. Wright. *New questions about U.S. intelligence on China*. 2005. Cambridge, MA: Union of Concerned Scientists. September 15. Online at [http://www.ucsusa.org/jump.jsp?path=/assets/documents/global\\_security/NASIC-analysis-final-9-15-05.pdf](http://www.ucsusa.org/jump.jsp?path=/assets/documents/global_security/NASIC-analysis-final-9-15-05.pdf)
- Report of the Commission to Assess U.S. National Security Space Management and Organization, 2001. Washington, DC: U.S. Government Printing Office. January 11. p. xiv and p. 22. Online at <http://www.dod.gov/pubs/space20010111.html>
- Schanz, M.V. 2013. Chinese anti-satellite test?" *Air Force Magazine*. May 16. Online at <http://www.airforcemag.com/DRArchive/Pages/2013/May%202013/May%2016%202013/Chinese-Anti-Satellite-Test.aspx>.
- Saunders, P., et al. 2002. China's space capabilities and the strategic logic of anti-satellite weapons. Monterey, CA: Center for Nonproliferation Studies. July 22. Online at <http://cns.miis.edu/stories/020722.htm>.
- Tellis, A. 2007. *Punching the U.S. military's "soft ribs": China's antisatellite weapon test in strategic perspective*. Washington, DC: Carnegie Endowment for International Peace. Online at [http://carnegieendowment.org/files/pb\\_51\\_tellis\\_final.pdf](http://carnegieendowment.org/files/pb_51_tellis_final.pdf)
- Tellis, A.J. 2007. China's Military Space Strategy. *Survival*. Vol. 49, No. 3.
- Wang, H. 2000. Meiguo de Junshi 'Ruan Lei' yu Zhanluë Rudian" (The soft ribs and strategic weaknesses of the American military). *Liaowang*. Vol. 27, July 3. pp. 32-34. (The FBIS translation reference number is FBIS, CPP20000705000081.)
- Weeden, B. 2010. Dancing in the dark: The orbital rendezvous of SJ-12 and SJ-06F. *The Space Review*. August 30. Online at <http://thespacereview.com/article/1689/1>
- Weeden, B. 2013. *Anti-Satellite Tests in Space—The Case of China*. Online at [http://swfound.org/media/115643/China\\_ASAT\\_Testing\\_Fact\\_Sheet\\_Aug2013.pdf](http://swfound.org/media/115643/China_ASAT_Testing_Fact_Sheet_Aug2013.pdf)
- Yu, J., ed. 2004. *Dier paobing zhanyixue (The science of Second Artillery operations)*. (Beijing: People's Liberation Army Press.