

Punching the U.S. Military’s “Soft Ribs”: China’s Antisatellite Weapon Test in Strategic Perspective

By **Ashley J. Tellis**

Senior Associate, Carnegie Endowment for International Peace

In the predawn darkness of January 11, 2007, a Chinese medium-range ballistic missile lifted off from a launch site at the Xichang space facility in Sichuan Province. Several minutes later, the missile’s kinetic kill vehicle slammed into an aging Chinese weather satellite deployed in a low Earth orbit at an altitude of 864 kilometers. This nearly head-on collision occurred at such extreme velocity that hundreds of fragments were ejected at speeds of up to 2,253 kilometers per hour.

This stunning demonstration was remarkable for several technical reasons. To begin with, there is no evidence that Chinese space managers manipulated the flight parameters of the target satellite before the mission to make it easier to hit; rather, the attack was executed on a spacecraft that was flying as fast—7.42 kilometers a second—as an intercontinental ballistic missile would be when entering the earth’s atmosphere. Further, the satellite was destroyed by a unitary hit-to-kill payload—a bullet hitting a bullet. China has, therefore, surpassed the erstwhile Soviet Union, which in its heyday could do little beyond attempting to kill space targets by spraying them with shrapnel from a conventional fragmenting warhead. Finally, the in-

terceptor missile was still rising when it hit the target, a technically more difficult task than destroying it on its descent.

Neither China nor the international media immediately announced the dramatic technological advances revealed through this test. But the United States was fully aware of what had happened—and of its significance. Almost two weeks later, after first repeatedly refusing to confirm or deny that a direct-ascent antisatellite (ASAT) weapon had been demonstrated, the Chinese Foreign Ministry wilyly acknowledged the event, claiming that it “was not directed at any country and does not constitute a threat.” Most American analysts disagreed with this assertion. Some argued, however, that it was a predictable response to assertive U.S. space policies: Because the United States had declined to negotiate an arms-control regime, Beijing may have felt that an ASAT test was the only way to get Washington’s attention.

Concerns about arms races in space should be taken seriously, but there is no arms-control solution. China is pursuing counterspace programs not in protest against the George W. Bush administration’s space policies but as part of a considered strategy designed to counter the *overall* military capability of the

We are pleased to present a new look for Carnegie Endowment Policy Briefs inspired by the launch of our New Vision in February 2007. Learn more about Carnegie and its international operations at www.CarnegieEndowment.org.

Summary

Although it is often argued that China’s recent antisatellite weapon test was a protest against U.S. space policies, Beijing’s counterspace programs are actually part of a considered strategy designed to counter the overall military capability of the United States. In preparing to cope with America’s overwhelming conventional might, China has taken aim at its Achilles heel: its space-based capabilities and their related ground installations. Thus, China will continue to invest in space-denial technology rather than be a party to any space-control agreement that eliminates its best chance of asymmetrically defeating U.S. military power. With its dominance of space now at risk, the United States must run and win this offense/defense space race if it is to uphold its security obligations and deter increased Chinese counterspace efforts.



Ashley J. Tellis is a senior associate at the Carnegie Endowment for International Peace, specializing in international security, defense, and Asian strategic issues. He was recently on assignment to the U.S. Department of State as senior adviser to the undersecretary of state for political affairs, during which time he was intimately involved in negotiating the civil nuclear agreement with India.

Previously he was commissioned into the Foreign Service and served as senior adviser to the Ambassador at the U.S. Embassy in New Delhi. He also served on the National Security Council staff as special assistant to the President and senior director for strategic planning and southwest Asia.

Prior to his government service, Tellis was senior policy analyst at the RAND Corporation and professor of policy analysis at the RAND Graduate School.

He is the author of *India's Emerging Nuclear Posture* (2001), and co-author of *Interpreting China's Grand Strategy: Past, Present, and Future* (2000). He is the Research Director of the Strategic Asia program at NBR and, most recently, co-editor of *Strategic Asia 2006–07: Trade, Interdependence and Security*. In addition to numerous Carnegie and RAND reports, his academic publications have appeared in many edited volumes and journals. He is frequently called to testify before Congress.

The author thanks Gregory Jones, Bert Keidel, Jessica Mathews, George Perkovich, Anirudh Suri, Michael Swaine, and Larry Wortzel for their most helpful comments on this Policy Brief.

United States. The weapons that China seeks to blunt are not space based; they are instead U.S. naval and air forces that operate in China's vicinity. What is in space are the sensory organs, which find and fix targets for these forces, and the nervous system, which connects all the combatant elements and permits them to operate cohesively. There is simply no feasible way to ban or control the use of space for such purposes. Beijing's diplomats, who repeatedly call for negotiations to assure the peaceful use of space, clearly understand this. And the Chinese military appreciates better than most that its best chance of countering the massive conventional superiority of the United States lies in being able to attack the relatively vulnerable eyes, ears, and voice of American power. Consequently, Beijing will continue to systematically pursue a variety of space-denial programs, even as it persists in issuing clarion calls for the demilitarization of space.

The Strategic Logic of Chinese Counterspace Efforts

Many arms-control specialists believe that China's counterspace programs are driven primarily by its desire to accumulate bargaining chips that could be traded for an eventual ban on space weapons. In reality, however, Beijing's investments in space denial technology are driven by strategic concerns that have little to do with arms-limitation agreements of any kind. In the near term, China is heavily focused on developing all possible means of defeating the superior U.S. conventional forces it expects to encounter in any war over Taiwan. And over the longer term, China is seeking to prepare for a prospective geopolitical rivalry with the United States. To achieve these goals, China must be able to exercise sufficient control over its land and sea borders to prevent U.S. forces from mounting attacks on the Chinese heartland from them. It must also be able to protect its nuclear deterrent from being neutralized by U.S. theater and national missile defenses. And it must be able to construct a sufficiently secure regional system

within which it can shape the political choices of its major neighbors and prevent any local adversaries from challenging it under the cover of American protection.

The near-term objective of preventing what Beijing would call Taiwanese secession from the mainland—and defeating any U.S. expeditionary forces that may be committed in support—remains the dominant consideration for China's military modernization. The resulting capabilities would then become the nucleus for servicing more ambitious geostrategic aims as the country's economic strength increases over time. For the moment, both objectives converge admirably in that they require Beijing to develop all the capabilities required to prevent superior U.S. forces from being able to enter the relevant theater of operations and, if that goal should prove unsuccessful, deny them the freedom to operate. Whether the theater of action is the limited geographic area around Taiwan or a wider expanse like the western Pacific, the tasks facing the Peoples' Liberation Army (PLA) therefore remain the same in the short to medium terms: It must be able to successfully prosecute antiaccess and battle-space-denial operations against all threatening American military forces.

Because China is confronted by America's formidable military dominance, any effort to defeat the United States through an orthodox force-on-force encounter would be doomed to a sorry ending. Consequently, ever since the dramatic demonstration of American prowess in Operation Desert Storm, Chinese strategists have struggled to find ways of overcoming the conventional might of the United States. Drawing on both China's indigenous military traditions—which emphasize stealth, deception, and indirect approaches to warfare—and the opportunities offered by emerging technologies—which permit effective asymmetric strategies focused on attacking an adversary's weaknesses rather than its strengths—the PLA has concentrated on developing those material and nonmaterial capabilities that would make possible “defeating the superior with the inferior.”

In this connection, Chinese analyses of U.S. military operations in the Persian Gulf, Kosovo, and Afghanistan have yielded one crucial insight: The advanced military might of the United States depends inordinately on a complex, exposed network of command, control, communications, and computer-based systems that provide intelligence, surveillance, and reconnaissance; and these systems operate synergistically in and through the medium of space. These space-based capabilities enable American forces to detect and identify different kinds of targets, exchange vast and diverse militarily relevant information and data streams, and contribute to the success of combat operations by providing everything from meteorological assessment to navigation and guidance to different platforms and weapon systems to early warning and situational awareness. Yet the very key to America's unrivalled military strength is also its greatest vulnerability. Accordingly, Chinese strategists quickly concluded that any effort to defeat the formidable military power fielded by the United States should aim not at its capacity to deliver overwhelming conventional firepower from long distances but at its Achilles heel: its space-based capabilities and their related ground installations.

China will, therefore, continue to develop the technology necessary to attack U.S. space systems comprehensively. As one PLA analyst, Wang Hucheng, succinctly articulated this rationale, the enduring American dependence on space constitutes "the U.S. military's 'soft ribs' and strategic weaknesses"; consequently, "for countries that can never win a war with the United States by using the method of tanks and planes, attacking the U.S. space system may be an irresistible and most tempting choice. Part of the reason is that the Pentagon is greatly dependent on space for [the success of] its military action."

The implications of this logic devastate the hopes of arms-control theorists who believe that Chinese counterspace investments are primarily bargaining chips aimed at creating a

peaceful space regime. In fact, they are just the opposite; they represent China's best hope for prevailing against the superior conventional military power deployed by the United States. For China to give up its emerging counterspace capabilities—whether through unilateral abnegation or a negotiated arrangement—would be to condemn its armed forces to inevitable defeat in any encounter with American power. This would mean, among other things, to risk the "loss" of Taiwan with all its attendant consequences for the unity of China and the survival of its Communist leadership. It would be equally unthinkable for Chinese leaders to abandon their efforts to stave off American forward-operating forces in the western Pacific or to allow the Chinese nuclear deterrent to be neutralized by emerging U.S.

China understands that its best chance of successfully countering U.S. military power lies in being able to attack America's relatively vulnerable eyes, ears, and voice.

strategic defenses. Because these goals—which are relatively conservative from Beijing's point of view—are so critical to China as a rising power, it cannot be expected to trade away its counterspace capabilities for any arms-control regime that would have the effect of further accentuating the military advantages enjoyed by its competitors.

This is why arms-control advocates are wrong even when they are right. Any "weaponization" of space will indeed be costly and especially dangerous for the United States, which relies most heavily on space for its military superiority, economic growth, and strategic stability. Space arms-control advocates are right when they emphasize that the advanced powers stand to gain disproportionately from any universal regime capable of protecting their space assets. Yet they are wrong in their belief that such a regime is attainable and, therefore,

ought to be pursued now. Weaker but significant challengers, like China, simply cannot permit the creation of such a space sanctuary. Even though a treaty protecting space assets would be beneficial both collectively and to Washington, its specific costs for China would be high. Not surprisingly, then, Beijing has authorized counterspace programs on a scale that demonstrates that these capabilities are vital for the realization of its geopolitical aims.

China's Emerging Counterspace Programs

Since at least the late 1980s, China has invested in a diverse portfolio of space-denial technologies. It is useful to look at each one.

Space-object surveillance and identification systems. A detailed knowledge of the location, orbits, and missions of various U.S. space platforms is a precondition for successful counterspace operations. Chinese military planners, accordingly, have emphasized the need for a comprehensive catalog of all relevant space

China cannot be expected to trade away its counterspace capabilities for any arms-control regime that would further accentuate its competitors' military advantages.

objects. Although these efforts have quite some ways to go, they have been aided by the vast amount of open information on U.S. space systems available through astronomy societies, international organizations, and universities—in addition to covert intelligence-gathering mechanisms. China therefore continues to invest in everything from specialized optical telescopes and theodolites to laser-tracking devices and large phased-array radar installations to detect and track orbital bodies passing over its mainland.

Direct-attack weapons. Although the January 11 test should lay to rest any doubts about the seriousness of China's ASAT program, such

weapons represent only one facet of its current counterspace effort. Direct-ascent weapons are particularly effective against satellites flying in low Earth orbits, where most of America's remote-sensing, meteorological, and imaging (electro-optical, infrared, and radar) intelligence satellites, and their associated relays, currently operate. They can also threaten spacecraft in medium and geosynchronous orbits, however, provided the attacker has a sufficiently powerful booster. This is where U.S. navigation and guidance satellites, military communications platforms, and early-warning and nuclear-detonation-detection systems now operate. There are several Chinese space launch vehicles and ballistic missiles like the DF-31 that could easily carry an ASAT payload to geosynchronous orbit, and it is not unreasonable to expect such dedicated systems in the future. One reputed analyst, Geoffrey Forden at the Massachusetts Institute of Technology, has already concluded that the payload used to intercept the weather satellite "could be used to destroy geostationary satellites in a direct ascent mode."

Despite possessing such nascent capabilities, China has embarked on another program of developing co-orbital ASAT interceptors using different kinds of agile micro- and nano-satellites, which could be difficult to detect both at launch and in orbit. Finally, U.S. military planners continue to remain concerned about nondirectional attacks involving nuclear explosions in space. China could easily mount such attacks, but given these weapons' indiscriminate effects, it probably would choose not to do so, except in extreme conditions.

Directed-energy weapons. As part of the effort to develop "new concept weapons," China has devoted substantial resources to directed-energy systems, particularly ground-based high- and low-power lasers, for counterspace purposes. Other technologies being discussed in China include high-power microwave weapons, electromagnetic railguns, and particle beam systems. Lasers are particularly attractive counterspace weapons because they

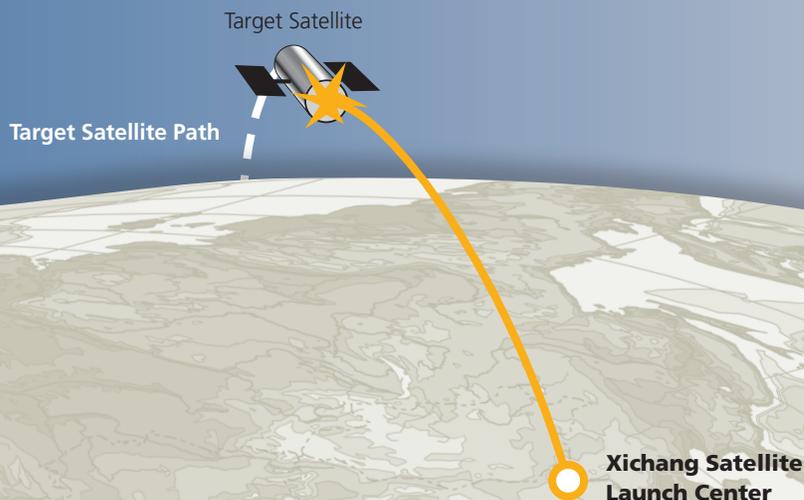
permit an attacker to cause varying levels of satellite damage depending on necessity. A low-power laser, for example, could be used to temporarily blind an electro-optical intelligence collector by oversaturating its receptors. A high-power laser could be used to actually inflict structural damage on a spacecraft. Satellites in any orbit can be attacked by ground-based lasers; assuming that beam quality, jitter and control, and propagation problems have been satisfactorily resolved, the vulnerability of high-altitude satellites would depend mainly on the power output of the laser. China is already known to have lased U.S. reconnaissance satellites, and its capability to inflict more consequential damage will only grow over the next decade.

Electronic attack. Because all the counterspace technologies discussed so far currently work best against spacecraft in low earth orbits, Chinese military planners have concentrated on electronic attack to stymie those critical U.S. space assets located in medium, geosynchronous, and highly elliptical orbits. The most important of these are the military tactical communications platforms and the global

positioning system constellation, which provides precision navigation and timing data to military users and permits the accurate targeting of various weapon systems. Because of the greater distances of such orbits from Earth, Chinese tacticians have focused on electronic rather than physical means of attack. Where tactical communications and navigation and positioning systems are concerned—both of which dominate the UHF band, providing the backbone for military operations—Beijing has focused on sophisticated jamming technologies that would permit it to enforce information blackouts at critical moments in a war. Success here would compel the U.S. military to rely even more than usual on commercial services, which are disproportionately vulnerable. Electronic attack is a transitory, yet potent, form of “mission kill” that Chinese tacticians seem determined to exploit when “hard kill” in space appears beyond reach.

Ground attack. Perhaps the easiest form of counterspace operations consists not of exotic attacks on space systems but of mundane physical assaults on the ground segments associated with telemetry, tracking and control,

“Illustrative trajectory of the Interceptor”



data reception, analysis, distribution, and assembly and launch facilities. Because these nodes are usually fixed, identified, and vulnerable to everything from computer network penetration to physical attack, it would be surprising if Chinese military planners did not emphasize ground attacks as the leading edge of their space-denial operations. And given that many of the ground elements indispensable to the military use of space are located outside the United States, they are particularly inviting targets for China's highly accurate late-generation conventional ballistic and cruise missiles. Missile attacks on space-related sites in the Indian Ocean and East Asian regions and electronic attacks on facilities worldwide would not carry the same risks of provoking American escalation as strikes on the U.S. heartland and, consequently, must be anticipated in any future Sino-American conflict.

This brief survey of Chinese counterspace activities is not intended to suggest that Beijing is *certain* to wrest control of space during a future war with the United States. These programs are at varying stages of maturity and will not all end up being equally successful. Moreover, the United States still has immense counter-counterspace capabilities, and thus many of these emerging threats will be countered, albeit at significant cost. The critical point, however, is that China's counterspace efforts are diverse, comprehensive, rapidly improving, and deadly serious—exceeding even those of the Soviet Union at its peak. Taken together, Beijing's space denial programs leave no doubt that it is determined to negate the operational advantages accruing to Washington's space-enabled conventional military dominance.

Three Implications of China's Counterspace Programs

Although the strategic implications of China's emerging counterspace capabilities will only be fully appreciated over time—as current programs succeed or fail in war-fighting terms—three important policy repercussions stand out now.

First, because Chinese counterspace investments are deeply rooted in strategic necessity and not capricious state choices, the suggestion that President Bush ought to move urgently to guarantee the protection of American space assets by initiating an international agreement to ban the development, testing, and deployment of space weapons ought to be approached cautiously by his administration. Although well intentioned, such recommendations are illusory because China—its rhetoric notwithstanding—will not conclude any space-control agreement that eliminates the best chance it may have of asymmetrically defeating U.S. military power and thereby protecting its interests.

Beijing's attitude toward space arms control will change only when one or more of the following conditions are met:

- China acquires the capacity to defeat the United States despite America's privileged access to space.
- The investments in Chinese counterspace programs begin to yield diminishing returns because the United States consistently nullifies these capabilities through superior technology and operational practices.
- China's own strategic and economic dependence on space intensifies to the point where the threats posed by any American offensive counterspace programs exceed the benefits accruing to Beijing's own comparable efforts.

Because these conditions will not be realized any time soon, Washington should certainly discuss space security with Beijing but should not expect that its negotiating investments will yield any effective space-control agreements in the near-term.

Second, the successful Chinese ASAT test ought to serve as a stark reminder that the United States' dominance of space—which is often taken for granted and which underwrites both its civilian and military advantages—is at risk. This is so because the wide-ranging U.S. dependence on space is more intense than ever and because Chinese space-denial programs

today exceed those pursued by the Soviet Union at the height of the Cold War in their diversity, depth, and prospects of success.

These unnerving realities have led some observers to conclude that the solution to redressing emerging American space vulnerabilities lies in developing offensive counterspace capabilities. Though such elements will be required, what is more important in the near term is to accelerate investments in the mitigating solutions. The United States must improve its ability to comprehensively identify and assess all orbiting objects as well as to better anticipate the sources and capacity for counterspace attacks. A program to enhance the survivability of American space platforms through hardening, increased maneuverability, and possibly onboard active defenses is long overdue. And finally, the United States must increase its capacity to recover from space attacks by investing in reserve satellites either on-orbit or on the ground; in rapid space-launch capabilities; and in redundant, preferably mobile, control stations capable of seamlessly managing space operations in case of damage to primary control centers.

Third, the growing Chinese capability for space warfare implies that a major conflict in the Taiwan Strait would entail serious deterrence and crisis instabilities. If such a clash were to compel Beijing to attack U.S. space systems—primarily intelligence, surveillance and reconnaissance, military communications, navigation and guidance, and meteorology assets—right at the beginning of a war to increase China's chances of achieving its objectives, the very prospect of such a "Space Pearl Harbor" could, in turn, provoke the United States to contemplate preemptive attacks or horizontal escalation on the Chinese mainland, particularly if such a conflict were to occur before Washington had the opportunity to fully invest in survivable space capabilities. Already, U.S. Strategic Command officials have publicly signaled that conventionally-armed Trident submarine-launched ballistic missiles would be appropriate weapons for executing

the prompt strikes that might be necessary in such a contingency. These types of attacks on space launch sites, sensor nodes, and command-and-control installations on the Chinese mainland could well be perceived as precursors to an all-out war. This indicates how difficult it would be for all sides to limit the intensification of such a conflict, even if one discounts the complications of accidents and misperception.

All in all, the emergence of potent Chinese counterspace capabilities makes U.S. military operations in Asia more perilous. These threats have arisen because China's requirement that it be able to defeat the United States in a future regional conflict—despite its inferiority in conventional military power—compels it to exploit every asymmetric battle-space-denial technology prospectively available. In such a situation, the United States has no

Washington should not now invest its time, energy, and resources in negotiating space-control arrangements that are doomed to failure

choice but to run and win this offense/defense space race if it is to both uphold its security obligations in East Asia and elsewhere and deter increased Chinese investments in counterspace operations. ■

The Carnegie Endowment normally does not take institutional positions on public policy issues; the views presented here do not necessarily reflect the views of the Endowment, its officers, staff, or trustees.

© 2007 Carnegie Endowment for International Peace. All rights reserved.

Related Resources

Visit www.CarnegieEndowment.org/pubs for these and other publications.

Reframing China Policy Debate 3: Is China's Military Modernization Program a Growing Threat to the United States and Asia? (debate transcript, February 6, 2007) available at www.carnegieendowment.org/files/debate_3%20final%20transcript.pdf.

Assessing the Meaning of the Chinese ASAT Test, Michael D. Swaine (Web Commentary, February 7, 2007), available at www.carnegieendowment.org/publications/index.cfm?fa=view&id=19006&prog=zch.

Ballistic Missiles and Missile Defense in Asia, Michael D. Swaine with Loren H. Runyon (NBR Analysis 13, no. 3, June 2002), available at www.carnegieendowment.org/files/swainenbr.pdf.

Interpreting China's Grand Strategy: Past, Present, and Future, Michael D. Swaine and Ashley J. Tellis (RAND Corporation, 2000), available at www.rand.org/pubs/monograph_reports/MR1121/index.html.

Managing Sino-American Crises: Case Studies and Analysis, Michael D. Swaine, Zhang Tuosheng, and Danielle Cohen (Carnegie Endowment for International Peace, 2006).

Military Modernization in Asia, Ashley J. Tellis, in *Strategic Asia 2005–06: Military Modernization in an Era of Uncertainty*, edited by Ashley J. Tellis and Michael Wills (National Bureau of Asian Research, 2005), available at www.nbr.org/publications/strategic_asia/pdf/sa05_1overview.pdf.

The Impact of Missile Defense in Asia, Ashley J. Tellis, Strategic Comments (International Institute for Strategic Studies, 2004), available at www.informaworld.com/smpp/section?content=a768140030&fulltext=713240928.

Strategic Asia 2005–06: Military Modernization in an Era of Uncertainty, edited by Ashley J. Tellis and Michael Wills (National Bureau of Asian Research, 2005), available at www.carnegieendowment.org/publications/index.cfm?fa=view&id=17533&prog=zch,zgp&proj=zsa,zusr.

www.CarnegieEndowment.org

The Carnegie Endowment for International Peace is a private, nonprofit organization dedicated to advancing cooperation between nations and promoting active international engagement by the United States. Founded in 1910, Carnegie is nonpartisan and dedicated to achieving practical results. Building on the successful establishment of the Carnegie Moscow Center, the Endowment has added operations in Beijing, Beirut, and Brussels to its existing offices in Washington and Moscow. The Carnegie Endowment publishes *Foreign Policy*, one of the world's leading magazines of international politics and economics, which reaches readers in more than 120 countries and several languages.

www.CarnegieEndowment.org

1779 Massachusetts Avenue, NW
Washington, DC 20036

FOR INTERNATIONAL PEACE

CARNEGIE ENDOWMENT