ASYMMETRIC WARFARE IN SPACE

Five Proposals from Chinese Strategic Thought

Jake Suss

Chinese thinkers like Sun Tzu offer universally-applicable strategic recommendations for national security, but the advancement of military space operations invites further analysis of Eastern thinking as it relates to space. Such strategic thinking applied to new challenges posed by the space domain in the development of broader space strategy expands perspectives and improves durability. Looking through the strategic lens of Chinese thought regarding exploiting local asymmetric advantages elucidates several recommendations for limiting adversaries' use of the domain and winning conflicts extending to space.

Despite more than two millennia passing since Sun Tzu wrote *The Art of War*, its tenets are still applicable today. Militaries across the world study Sun Tzu and apply strategic prescriptions derived from chariot warfare in the Warring States period (475–221 BCE) to modern military conflict.[1] Although his lessons have stood the test of time, advancements in modern technology and military strategy open new areas for contemplation through a Chinese strategic lens.

Space is a relatively recent addition to historical warfighting domains and is ripe for a deeper consideration in terms of Sun Tzu and later Chinese strategic thinking.[2] As the People's Republic of China (PRC) builds its military capabilities, including space-based assets, Chinese thought becomes increasingly more applicable to understanding Beijing's intentions and developing Western doctrine regarding space matters. In order to win in space and fill a theoretical gap in modern space strategy, planners must consider broadly applicable strategic guidance through the lens of historical and contemporary Chinese thought.

Space is a critical component of modern life and warfare. In the First Gulf War, China witnessed the American military's use of space to dominate Iraq's military—at

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1. Sun Tzu, *The Art of War: Bilingual Chinese and English Text*, trans. Lionel Giles and John Minford (North Clarendon, VT: Tuttle Publishing, 2016).

2. John W. Raymond, *Spacepower: Doctrine for Space Forces*, Space Capstone Publication (Washington DC: Headquarters US Space Force, June 2020).

the time, the fourth largest military in the world.[3] American military capabilities, including space-enabled navigation and communications, were decades ahead of China's post-Tiananmen military.

In the three decades since the First Gulf War, international space capabilities have proliferated and increased in sophistication. Global navigation satellite system constellations now power civilian smartphones in addition to military smart bombs. Space-based internet such as SpaceX's Starlink offers speeds 3,500 times faster than dial up, and high-resolution commercial satellite imagery now costs tens of dollars—thousands of dollars cheaper than a decade ago.[4]

Militarily, space is a key enabler for terrestrial forces. Control of the ultimate high ground is more contested than ever. The PRC, Russia, India, and the United States have tested antisatellite (ASAT) missiles capable of reaching low-Earth orbit (LEO).[5] Several countries are pursuing electronic warfare, directed energy, and cyber capabilities that could temporarily or permanently disable satellites or disrupt space-enabled services.[6] Although the First Gulf War is widely considered the first space-enabled conflict, no country has yet contested space in open conflict.[7] As a result, space combat strategy currently relies on theoretical underpinnings derived from other domains, models, and exercises, rather than concrete historical combat examples. While real-world space combat will certainly modify today's space strategy, the lack of historical models makes a thorough and sound theoretical background a crucial starting point for future space conflict.

The Art of War provides a basis for contemplating modern combat, but the nature of the space domain and recent developments in Chinese military thought invite an analysis of Eastern strategic thinking relevant to space. Many areas of Sun Tzu's work are applicable in all domains, yet space provides unique opportunities and challenges not considered by *The Art of War's* terrestrial-only environment.

This article examines historical and contemporary Chinese strategic writing to illuminate areas for consideration in broader space strategy. This includes the application

3. Dean Cheng, "Evolving Chinese Thinking about Deterrence: What the United States Must Understand about China and Space," Heritage Foundation, March 2018, https://www.heritage.org/.

4. Yarnaphat Shaengchart and Tanpat Kraiwanit, "Starlink Satellite Project Impact on the Internet Provider Service in Emerging Economies," *Research in Globalization* 6 (June 2023): 100132, https://doi.org/; Kim Ann Zimmermann and Jesse Emspak, "Internet History Timeline: ARPANET to the World Wide Web," LiveScience, April 8, 2022, https://www.livescience.com/; and Dexter Jagula, "Satellite Imagery for Everyone," IEEE Spectrum, November 22, 2022, https://spectrum.ieee.org/.

5. Victoria Samson and Brian Weeden, "Op-Ed: India's ASAT Test Is Wake-up Call for Norms of Behavior in Space," *SpaceNews*, January 23, 2023, https://spacenews.com/; and James Dickinson, *Hearing on National Defense Authorization Act for Fiscal Year 2023 and Oversight of Previously Authorized Programs, Before the Committee on Armed Services House of Representatives*, 117th Cong., 2nd session (2022) ("Priorities and Posture of United States Space Command," presentation by General James H. Dickinson, commander, US Space Command), https://www.armed-services.senate.gov/.

6. Dickinson.

7. Peter Anson and Dennis Cummings, "The First Space War: The Contribution of Satellites to the Gulf War," *RUSI Journal* 136, no. 4 (1991).

of historical writings like *Thirty-Six Stratagems*, Maoist "people's war" doctrine, and contemporary PRC writings on space strategy. While the proposed strategic recommendations are written through the lens of such Chinese sources, they are as universally applicable as those from *The Art of War*.

Asymmetric Warfare

To understand the basis for Beijing's thoughts on space, one must first understand the strategic context of historical and contemporary Chinese thought on strategy writ large. Finding asymmetric advantages underpins the strategic thought of military theorists spanning from ancient China to the modern PRC. Sun Tzu devoted an entire chapter to the discussion of weak and strong points and how to concentrate one's own strength at the enemy's weak points.[8] Wang Jingze expanded on this thought in his sixth-century *Thirty-Six Stratagems* by proclaiming one should avoid direct confrontation with a strong enemy and instead attack weaknesses elsewhere.[9]

More recently, in the twentieth century, Mao Zedong also emphasized the need to attack only when the local balance of power is advantageous and victory assured by pitting strength against weakness.[10] Contemporary Chinese strategists like Qiao Liang and Wang Xiangsui call for expanding these asymmetric attacks into domains like economic, cultural, and information domains.[11] PRC activities similarly demonstrate a willingness to use asymmetric tactics, like maritime militia vessels, against countries like the Philippines whose military capabilities lag far behind China's.[12]

Attacking a superior force with an inferior force is generally recognized as folly in Chinese strategic thought; however, such a strategy focuses more on local, relative asymmetries, unlike the contemporary Western thought of absolute asymmetries. After 2001, the United States devoted significant attention to doctrine focused on the rise of "nontraditional, asymmetrical, and insurgent-terrorist" threats, highlighting holistic, comparative strengths.[13] Both historical and contemporary Chinese strategists assess that asymmetries can provide local, sometimes temporary strengths that can achieve tactical advantages. These asymmetries can occur in tactical and operational levels, with "whole pitted against separate parts of a whole," so that a strategically weaker country can still

8. Sun Tzu, *Art of War*.

9. Wang Jingze, *Thirty-Six Stratagems, bilingual ed.* (Los Angeles, CA: Lionshare Chinese Classics, 2015), 6.

10. Mao Zedong, *Quotations from Chairman Mao Tse-Tung: The Little Red Book, bilingual ed.* (Beijing, China: Peking Foreign Language Press, 1996), Mao Tse-Tung Internet Archive, https://www.marxists.org/.

11. Qiao Liang and Wang Xiangsui, *Unrestricted Warfare* (Beijing: PLA Literature and Arts Publishing House Arts, 1999).

12. Andrew Erickson and Connor Kennedy, "China's Maritime Militia," Center for Naval Analyses, 2016, https://www.cna.org/.

13. Michael J. Mazarr, "The Folly of 'Asymmetric War,' " *Washington Quarterly* 31, no. 3 (2008): 33.

leverage asymmetries.[14] These tactical advantages compound to form strategic victory through self-preservation and destruction of the enemy.[15]

Modern People's Liberation Army (PLA) literature emphasizes the transient, limited nature of control derived from balancing relative strengths to achieve objectives.[16] Particularly in light of China's recent comparative military disadvantage since the First Opium War (1839–42) and the "century of humiliation," exploiting small, transient, or ideological asymmetries is crucial to maximizing capability against holistically more capable adversaries.[17] Additionally, although PRC combat power is advancing rapidly, with the ultimate goal of creating a globally powerful military force, many military leaders still envisage conflict from a position of holistic disadvantage, so the PRC must maximize local asymmetries to achieve strategic goals.[18] Consequently, the following recommendations derive and apply Chinese strategy and context to inform the broader development of space strategy.

Proposals for Space Strategy

The following sections offer five general proposals concerning the execution of space operations across the conflict continuum, which Chinese thinkers generally perceive as including ongoing competition.[19] These considerations are derived primarily from historical and modern Chinese theoretical views of asymmetric warfare, historical Chinese thought, and contemporary PLA writings, but they are applicable to conflict in the space domain. As with Sun Tzu's original writing, they are not intended to serve as imperatives or laws that cannot be violated, but as recommendations to consider. Contravening one of these proposals does not guarantee defeat, nor does following each one guarantee victory. Yet as strategic recommendations for space operations, abiding by these propositions could enhance one's prospects for victory.

Proposal 1. Space is an idea, not just a location. Space strategy should be separated from location in order to attack the enemy's weaknesses and optimize one's own strengths.

As mentioned, ancient and modern Chinese strategy generally emphasizes finding asymmetric ways to secure victory. The sum of historical strategists'—Sun Tzu, Wang Jingze, and Mao—thoughts on conflict, particularly with an enemy of equal or

14. Sun Tzu, *Art of War*, 382.

15. Mao, *Quotations*.

16. 记荣仁 and 王学进 [Ji Rongren and Wang Xuejin], "试析制交通权与制空权,制海权的关系 [Assessing the Relationships between Command of Communications, Command of the Air, and Command of the Sea]," 中国军事科学 [*China Military Sciences*] 15, no. 4 (2002).

17. Xinhua, "Full Text: Speech by Xi Jinping at a Ceremony Marking the Centenary of the CPC," *Global Times*, July 2017, https://www.globaltimes.cn/.

18. Xinhua.

19. Eric Kuznar and George Popp, "China's Perception of the Continuum of Conflict," NSI, October 2019, https://nsiteam.com/.

superior strength, is to find and exploit weaknesses. Moreover, the PRC's history of ideological conflict with capitalism and Mao's exhortations that "every Communist and revolutionary should take up this [ideological] weapon" further underscore its penchant to attack an adversary's ideas, not just physical capabilities.[20] In that light, space is as much an idea as it is a location.

Of course, there are physical laws and a distinct geography that define space, but the modern military use of space essentially distills to persistent or recurring overhead access. The ability to overfly countries at will is a significant benefit of space operations, but the mechanism of access may come just as easily from nontraditional persistent overhead capabilities such as unmanned aerial vehicles (UAV) or balloons as from orbital assets. Space operations must consider more than the physical geography of space, which enables targeting and overcoming the enemy's advantages while finding innovative ways to provide persistent overhead capabilities to one's own forces.

This theory of attacking space as an idea rather than as a physical location is particularly useful for countries with relative weaknesses in space. Considering the idea of space as persistent overhead access expands attack vectors beyond the physical geography of space and enables alternatives for countries without robust space capabilities. For example, the United States is heavily reliant on space-based capabilities, but the Democratic People's Republic of Korea (DPRK) has an extremely small space-based intelligence, surveillance, and reconnaissance (ISR) capability.[21] For the DPRK and other countries with limited space capabilities like Iran, even a high-altitude nuclear detonation that destroys most of the satellites in LEO would have little effect on their own minimal space capabilities.

Furthermore, nontraditional persistent overhead capabilities provide additional asymmetric advantages, particularly in times of conflict. In peacetime, satellites flying outside the atmosphere enjoy legal protections not afforded to objects like balloons, but the PRC has already demonstrated a willingness to flout sovereignty issues with high-altitude balloons.[22] Conflict reduces the import of some legal considerations, and although subject to considerations of international opinion and strategic escalation, using balloons or UAVs to provide persistent overhead coverage in conflict affords secondary benefits. The PRC demonstrated that even in peacetime, balloons may fly largely unhindered over 40 countries and five continents.[23] When unconstrained by peacetime rules, balloons could easily provide both theater coverage of a conflict in the Indo-Pacific as well as strategic overflight of the American homeland.

Nontraditional persistent overhead capabilities also provide targeting, command, and control complications to adversaries. While the United States shot down a Chinese

20. Mao, *Quotations,* 5891.

21. "Why Are North Korea's Satellite Launches Controversial?," Reuters, November 22, 2023, https://www..reuters.com/.

22. Edward Wong and Julian E. Barnes, "Chinese Balloon Had Tools to Collect Electronic Communications, U.S. Says," *New York Times*, February 9, 2023, https://www.nytimes.com/.

23. Wong and Barnes.

balloon in February 2023, it used a fifth-generation fighter and advanced heat-seeking missile to do so.[24] During a conflict, the widespread use of balloons or other aerial objects to augment or replace space services like ISR and communications would dramatically increase adversary targeting requirements, particularly when coupled with the use of dummies and decoys.

In a regional conflict around Taiwan or the South China Sea, the additional aircraft, missiles, and personnel required to defend the American homeland from balloons would be unavailable to participate in deployed operations. Conversely, balloons launched on a westward trajectory from India or the Middle East could complicate PRC air defense targeting solutions.

High-altitude balloons also split most countries' space, air defense, and territorial/homeland defense commands. In a 2023 congressional hearing, US Air Force General B. Chance Saltzman jokingly underscored this in answer to a question on "near space" balloons by referring to them as "far air."[25] PRC organizations are similarly divided: the PLA Strategic Support Force has space responsibilities, PLA Air Force has the responsibility for strategic air defenses, and the PLA maintains tactical air defenses.[26] As a result, the widespread use of alternative persistent overhead assets will complicate a country's targeting calculus, even if these balloons carry no offensive capabilities or countermeasures.

The use of high-altitude balloons or UAVs to provide traditionally space-based services offers several additional advantages for spacefaring and nonspacefaring nations alike. Because these assets are relatively closer to the Earth's surface, signal strength is significantly stronger in accordance with the inverse square law. Similarly, due to the increased proximity, electro-optical, infrared, or other imagery capabilities may be more detailed than space-based imagery or will require less substantial equipment. Thus, nontraditional overhead systems can provide advantages in communications and ISR services.

Additionally, the physical location of balloons or high-altitude UAVs may improve electronic attack capabilities. This is similarly true for communications jammers or other electronic warfare options. Finally, adding defensive missile countermeasures like flares and other electronic countermeasures will increase a balloon's or UAV's resilience and add further targeting complications for adversaries. This is particularly true when swarms of balloons or UAVs with intermixed ISR, communications, jamming, and dummy platforms clog a country's airspace during a conflict.

Balloons and UAVs are only two examples of the vulnerabilities and opportunities that arise when decoupling space strategy exclusively from its geographic location.

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24. Jim Garamone, "F-22 Safely Shoots Down Chinese Spy Balloon off South Carolina Coast," US Department of Defense (DoD), February 4, 2023, https://www.defense.gov/.

25. Sandra Erwin, "Space Force: We Expect to See 'Interfering, Blinding' of Satellites during Conflict," *SpaceNews*, March 15, 2023, https://spacenews.com/.

26. Anthony Cordesman and Joseph Kendall, "China Military Organization and Reform" (working draft, Center for Strategic and International Studies [CSIS], August 1, 2016), https://csis-website-prod.s3.amazonaws.com/.

Challenging the idea of traditionally space-based services offers significantly more prospects to array asymmetric strengths against adversary weaknesses, both offensively and for providing capabilities to terrestrial forces. Finally, although balloons and UAVs are tested options available today, there are likely novel capabilities not yet developed or fielded that may be even more effective.

Proposal 2. Space is the principal battlefield in space warfare, but space operations are inseparable from terrestrial operations and objectives. Space warfare comprises activities affecting and affected by the orbital, link, and ground segments, and should contribute to achieving strategic goals.

Space operations predominantly occur in or affect space. Chinese military dictionaries and strategic analyses consider space operations to be military actions occurring primarily in space with the intent to seize, hold, and use command of space.[27] American military doctrine defines the space area of responsibility as altitudes equal to or greater than 100 kilometers above mean sea level.[28] Both these definitions are helpful in understanding the principal area of space operations along the competition continuum, but additional nuance is required to assess the full range of actions that occur in, affect, and are affected by space.

Space operations are comprised of three principal segments: orbital, link, and ground. The orbital segment includes assets in space, the link segment covers the electromagnetic spectrum used to communicate with and between satellites, and the ground segment includes the terrestrial infrastructure used to control and communicate with satellites.[29] Degrading any of these segments can compromise space-based services and may achieve the tactical goal required for a specific operation.

Attacking different segments or combinations thereof may provide the most effective or accessible vector. Targeting the ground or link segments of an adversary's space system echoes Wang Jingze's dictum to "besiege Wei to rescue Zhao," by finding a more convenient target to attain the desired effect.[30] The logistical cost of denying an adversary space capability by destroying its ground infrastructure may be significantly lower than denying the same in space. Conversely, using nonkinetic space capabilities to set more advantageous political conditions in competition carries far lower risk than some terrestrial options. The skilled strategist must consider the full range of

27. Jiang Lianju and Wang Liwen, eds., *In Their Own Words: Lectures on the Science of Space Operations* (Maxwell AFB, AL: China Aerospace Studies Institute, Air University, April 2013), https://www.airuniversity.af.edu/.

28. Dickinson, *Hearing*; and *Space Operations*, Joint Publication 3-14 (Washington, DC: Chairman of the Joint Chiefs of Staff, April 10, 2018, incorporating change 1, October 26, 2020).

29. Brian Garino and Jane Gibson, "Chapter 21: Space System Threats," CSIS, September 2018, https://aerospace.csis.org/.

30. Wang, *Thirty-Six Strategems*, 5.

attack options in the objective military conditions, within which one directs the military "drama full of color, power and grandeur."[31]

While occurring predominantly in space, military space operations are inseparable from terrestrial operations and strategic goals. Space effects may intrinsically generate strategic outcomes, but more often, space is a tool that supports actions in other domains. Space-enabled capabilities such as ISR, precision navigation and timing (PNT), and communications affect forces' ability to conduct operations.[32]

Although one must field offensive and defense capabilities to ensure space access and control while denying the enemy the same, controlling space without providing space-enabled services does not significantly benefit terrestrial or strategic objectives. Just as air superiority is not the only requirement for strategic victory—which the United States learned in Vietnam and Afghanistan—control of space alone does not guarantee victory.[33] Unless and until the Earth is no longer the principal population center for humanity, space operations must support strategic terrestrial objectives.

Proposal 3. It does not matter if an attack is kinetic or nonkinetic, as long as it achieves the objective. Debris-generating kinetic kills have long-lasting consequences; they should be anticipated. Nonkinetic kills provide flexible escalatory options and can work in concert with kinetic kills to achieve desired effects. Nonkinetic attacks against the adversary's mind may achieve desired effects as efficiently as against electromagnetic targets.

Nonkinetic options that generate space effects are at least as important as kinetic capabilities. Because nonkinetic attacks generally do not create debris, their use threshold is far lower. Reversible nonkinetic attacks like jamming and dazzling lasers further lower the threshold for use. Strategists like Sun Tzu consider the conflict continuum quite fluidly, which resonates in modern PRC gray zone activities, so reversible effects both help to improve one's position in competition and leave an outlet for foes to escape and save face.[34]

Nonkinetic attacks may also facilitate kinetic attacks or deception operations. For example, blinding space domain awareness satellites while executing a co-orbital, kinetic antisatellite attack greatly increases the attack's chance of success. Similarly, a temporary cyberattack that interrupts a reconnaissance satellite's downlink may be more effective than blatantly destroying the satellite in allowing naval forces to enter a battlespace surreptitiously.

Traditional nonkinetic attacks span the electromagnetic spectrum, from radio frequency jammers to lasers, but attacking an adversary's mindset or partners can be just as effective. SpaceX's decision to limit Ukraine's use of its services for military

31. Mao, *Quotations,* 5053.

32. Jiang and Wang, *Lectures*.

33. Giulio Douhet, *The Command of the Air*, trans. Dino Ferrari (Maxwell AFB, AL: Air University Press [AUP], 2019).

34. Sun Tzu, *Art of War*, 529; and Kuznar and Popp, "China's Perception."

purposes during its conflict with Russia demonstrates the usefulness of this tenet.[35] SpaceX made this decision unilaterally, not under an adversary's influence, but it demonstrates the power a country may wield if it can influence a foreign commercial provider or ally to curtail services.

In fact, because proliferated constellations such as Starlink are more resilient than traditional architectures, generating effects against them through influence may be significantly more cost effective than generating the same effect with jammers or other offensive capabilities.[36] Generating nonkinetic effects by influencing an adversary's allies or commercial providers may be particularly effective for countries who rely on ground segment stations located abroad. This is a direct corollary to the *Thirty-Six Stratagems* advice on spies, to "undermine the enemy's ability to fight by secretly causing discord between him, his friends, [and] allies."[37]

Proposal 4. Space operations are strategic in nature and can have a strong deterrent effect. To deter effectively, the enemy must fear one's capabilities prior to a conflict. During a conflict, space should be used aggressively to retaliate and achieve a favorable operational situation.

Both the United States and the PRC emphasize deterring conflict as a key task for their militaries and as preferable to open warfare.[38] Space can act as a key contributor to deterrence, including deterring the tactical use of counterspace capabilities, as well as supporting nuclear strategic deterrence. PRC discussions underscore not only this use of space as a contributor to holistic strategic deterrence, but also the use of some space capabilities that require a lower threshold than nuclear deterrents, providing flexibility in deterrent options.[39] A comprehensive discussion of space's role in strategic deterrence and deterrence theory is beyond the scope of this article, but a brief overview of several key space deterrence themes is provided.

Deterrence requires the use of threats in one or multiple domains to dissuade a target from taking actions that change the status quo.[40] A key component of this understanding is that deterrence requires forcing an adversary to do (or refrain from doing) an action, not just influencing an adversary's thought. For example, many Imperial Japanese military leaders—including Admiral Isoroku Yamamoto—believed attacking the United States to be an unwinnable strategy, but this did not deter their actions

35. James FitzGerald, "Ukraine War: Elon Musk's SpaceX Firm Bars Kyiv from Using Starlink Tech for Drone Control," BBC News, February 9, 2023, https://www.bbc.com/.

36. Greg Hadley, "Proliferated Architecture Necessary for Future Satellite Communications," *Air & Space Forces Magazine*, January 7, 2022, https://www.airandspaceforces.com/.

37. Wang, *Thirty-Six Strategems*, 36.

38. Lloyd J. Austin III, *2022 National Defense Strategy* (Washington, DC: DoD, October 27, 2022), https://media.defense.gov/; and M. Taylor Fravel, *Active Defense: China's Military Strategy since 1949* (Princeton: Princeton University Press, 2019).

39. Jiang and Wang, *Lectures*.

40. Jon R. Lindsay and Erik Gartzke, *Cross-Domain Deterrence: Strategy in an Era of Complexity* (New York: Oxford University Press, 2019), 2.

in December 1941.[41] Consequently, effective deterrence requires that the adversary fear the capabilities and actions they would face in a conflict to the extent that they are unwilling to begin a war at all or at minimum refrain from undesired actions. This can help achieve Sun Tzu's dictum to "subdue the enemy's troops without fighting."[42]

A key component to managing adversaries' trepidation of friendly capabilities is ensuring that they both understand some threats arrayed before them and fear the still-unknown secret capabilities. Striking a balance between revealing one's capabilities to ensure an adversary knows of their existence while maintaining secrecy and preventing the development of countermeasures is crucial. An adversary cannot fear an unknown capability, but some weapons or tactics may only be effective for their first use. It is seldom advantageous to disclose capabilities for which the adversary can easily develop countermeasures, or whose value derives from its surprise.

Similarly, disclosing capabilities that adversaries can easily duplicate, particularly given the PRC's penchant for reengineering, is unwise. Conversely, weapons that the adversary already possesses, weapons for which there are no easy countermeasures, or a willingness to use attacks in other domains to counter space aggression are useful disclosures for deterrence.

Many space operations are inherently strategic in nature, and space capabilities can significantly contribute to strategic deterrence. While nuclear weapons are the ultimate strategic deterrent, space plays an essential enabling role. Satellites are a critical component of nuclear command, control, and communications, and the United States heavily leverages space-based ISR architectures to provide first warning of nuclear launches.[43] Nuclear-tipped ballistic missiles transit through space, and space-based threats to terrestrial targets such as space planes or fractional orbital bombardment systems can challenge traditional missile warning and defense architectures.[44]

Additionally, modern reliance in some countries on space-based capabilities such as communications and PNT services provides an opportunity for generating dramatic strategic effects across an adversary's entire population. PRC literature also discusses space's opportunity to restrain the outbreak of war or escalation thereof by "displaying necessary space strategic strengths that have deterrence as their goal."[45] Putting aside concerns for destabilization, consider the deterrent effect to a technologically advanced country preparing for an immediate military campaign if its entire country suffered even a 60-second simultaneous loss of PNT, access to nuclear command and control satellites, and a space-based ISR blackout. Even a brief interruption of some of these capabilities may force a country to reconsider offensive operations.

41. Ian W. Toll, *Pacific Crucible: War at Sea in the Pacific, 1941–1942* (New York: W.W. Norton, 2012).

42. Sun Tzu, *Art of War*, 170.

43. Marie Villareal Dean, "Space-Based Nuclear Command and Control: A Guide," CSIS, January 13, 2023, http://aerospace.csis.org/.

44. Dickinson, *Hearing*.

45. Jiang and Wang, *Lectures*, 58.

Space also provides opportunities to deter attacks against one's own space assets and targets for cross-domain deterrence. The threat of facing counterspace weapons may be enough to deter an adversary from using one, and immediate retribution in kind may deter further space attacks. Depending on the scale of the conflict, a country may also be able to deter counterspace weapons employment by threatening its terrestrial launch or command and control locations with cyberattacks or conventional munitions. PRC maritime militia gray zone activities demonstrate a parallel willingness to use this type of cross-domain deterrence strategy in other domains.[46]

Additionally, PRC thinking on integrated strategic deterrence stresses that some options are better deployed and coordinated across domains, either challenging the ground and link segments or by threatening retaliation in other domains entirely.[47] Finally, denying adversary space capabilities provides an option for flexible escalation and deterrence of further aggression. A country may be unwilling or unable to prosecute a war if faced with a denial of space services and capabilities.

Even during conflict, offensive and defensive space operations may still be limited in time or scope, but striving for space superiority maximizes one's own capabilities and limits an adversary's freedom to operate.[48] Used in concert with other capabilities, local space superiority, enough to control the right terrain for a few hours or minutes, may be sufficient to achieve strategic goals. While the Taiwan Strait is only 97 nautical miles wide, it takes days for the United States to move aircraft carriers into theater if not already forward deployed.[49] Consequently, if the PRC can deny American space-based ISR and communications for several hours, that may be enough to prevent easy American intervention in a Taiwan invasion. Conversely, if the United States can deceive China's ISR satellites for several hours, it may enable sufficient force redeployment from bases like Korea or Guam to cripple a PRC invasion fleet.

Just as nuclear powers may still fight conventional wars, the scope and scale of a conflict may still limit the use of kinetic weapons that generate debris and threaten the tenability of the environment. Yet a maximal use of nonkinetic options to generate reversible and nonreversible space effects during conflict is critical to mitigating an adversary's technological advantages while maximizing one's own. Finally, in the face of degraded technological weapons, a country's asymmetric advantage in this way may not be fighting under "informationized" conditions leveraging the totality of modern technology, but rather may be one's ability to employ analog weapons to achieve strategic objectives instead of focusing on restoring degraded technologies.[50]

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46. Erickson and Kennedy, "China's Maritime Militia."

47. Lindsay and Gartzke, *Cross-Domain Deterrence.*

48. Cheng, "Evolving Chinese Thinking."

49. Joseph W. Lisenby Jr., "Repelling a Chinese Invasion of Taiwan: A Space, Forces, Time Dilemma for United States Pacific Command" (research paper, US Naval War College, Newport, RI, 2001).

50. "China's National Defense in 2010," Ministry of National Defense, March 2011, http://eng.mod.gov.cn/.

Proposal 5. Space has its own key terrain that must be seized and held to achieve space dominance.

Although space is immense, there are key areas and points that are particularly advantageous for military use. As with terrestrial terrain features, occupying a key space location can convey advantages for the operator and simultaneously deny those to an adversary. These features include orbits like LEO, sun-synchronous orbit, and geosynchronous Earth orbit (GEO); Lagrange points; the Moon; and even terrestrial terrain that enables space operations.

LEO and GEO are increasingly crowded orbits with distinct uses. LEO is relatively close to Earth, enabling higher signal strengths, lower latency, better imaging resolution, and reduced lift costs. The lower altitude reduces launch costs, which makes proliferated architectures more cost efficient. Moreover, the proximity makes LEO optimal for ISR satellites and even some communications payloads. At 35,786 kilometers altitude above Earth's equator, GEO is significantly farther than LEO, but satellites in GEO match Earth's rotational period and essentially hover over the same position on Earth's surface. This distinct advantage provides benefits for communications satellites and some ISR satellites and confers a larger aperture than LEO satellites. Although a larger expanse than LEO, the relatively narrow GEO belt provides precious few locations for a growing quantity of satellites.

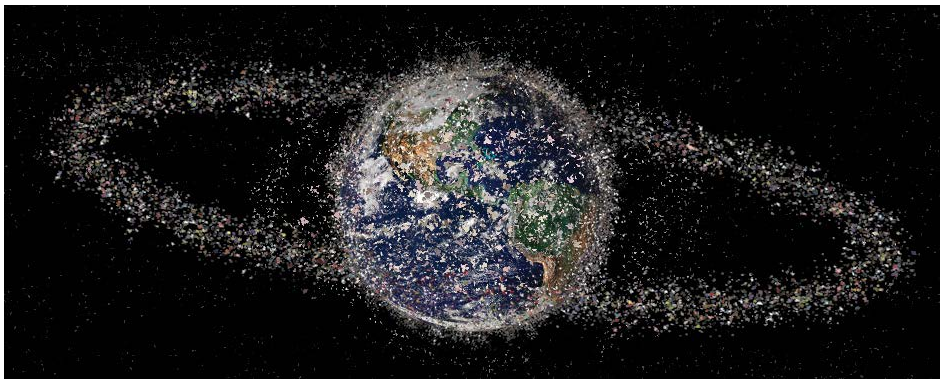

Figure 1. GEO congestion[51]

Both Chinese and American strategic space thought emphasize the need to seize space superiority, which includes maintaining freedom of action in critical orbits.[52] Maximizing one's own use of these orbits is beneficial, but denying adversary use when needed is equally important. Such denial may range from temporarily disabling satellite relay communications to creating widespread kinetic damage.

Because of the challenges associated with launching more satellites, particularly if an orbit is full of debris, space superiority may differ from superiority in other domains. Contemporary Chinese space strategists emphasize that space superiority

51. Image Credit: "Artist's Interpretation of Space Debris Orbiting Earth," Catherine Smith.
52. Jiang and Wang, *Lectures*; and Raymond, *Spacepower*.

includes the use of space and ability to deny adversaries the same, but it may be local or temporary in nature.[53] This differs somewhat from other domains, for in space, a country may achieve superiority simply by preventing others from using space with counterspace weapons employed from other domains, while maintaining only a small presence in the domain.

Lagrange points, which allow a spacecraft to remain relatively stationary due to gravitational effects, will become critical enablers for space operations as countries move into cislunar space, to the Moon, and beyond. The PRC has already used a relay satellite at Earth-Moon Lagrange 2, a point on the far side of the Moon, to facilitate a lunar probe landing.[54] Additionally, Earth-Moon Lagrange 1, a point between Earth and the Moon, has applications for space domain awareness looking back toward Earth's orbits.

Similar to the gravitational constraints of GEO, Lagrange points constitute a discrete, precise location whose control may greatly facilitate attaining space superiority. While not as proliferated as traditional Earth orbits, these points may acquire increased value for space operations and become a point of contention for military space competition. This is similarly true of the Moon, where the PRC and Russia agreed to develop a joint lunar base.[55] Beyond the Moon's economic and mineral implications, control of the Moon and supporting Lagrange points may be space's contested high ground in coming years.

Space operations also require key terrestrial terrain, which makes this geography a prime target to control. Spaceport locations can offer key advantages in orbit inclination, weather, and population proximity, so guaranteed launch access is an important component of attaining space superiority.[56] Similarly, ground segment control stations play a key role in space operations. Depending on the orbit and satellite's purpose, multiple ground stations or relays in both hemispheres may be critical for timely links, control latency, and domain awareness. If using balloons or high-altitude UAVs to provide persistent overhead capabilities, launch locations that can exploit jet streams, trade winds, and winds aloft are critical. Finally, all these terrestrial locations become potential attack locations that affect space operations without the need to attack the orbital segment.

Conclusion

Although space strategies may not heed each of these recommendations, sound military planning will consider their implications. Conflict in space is an emerging domain

53. Jiang and Wang.

54. Kristin Burke, "What Is China Doing at the Lunar Distant Retrograde Orbit?" (Maxwell AFB, AL: China Aerospace Studies Institute, Air University, March 2022), https://www.airuniversity.af.edu/.

55. Namrata Goswami, "The Strategic Implications of the China-Russia Lunar Base Cooperation Agreement," *Diplomat*, March 20, 2021, https://thediplomat.com/.

56. Thomas Roberts, *Spaceports of the World* (Washington, DC: CSIS, March 2019), https://www.researchgate.net/.

of military strategy, and first contact in space will rely heavily on innovative solutions to new dilemmas. Consequently, considering these perspectives from Chinese strategic thought in the construction of space strategy broadens perspectives and improves durability in case of conflict.

Conflict in, through, and from space will require militaries to challenge traditional concepts, attack enemy weak points to deny space benefits, and find new ways to provide services in a degraded environment. Space capabilities and the potential for space conflict are vital components of achieving national and terrestrial objectives. Space is the ultimate high ground, but it must be one of many tools used in concert to achieve strategic objectives.

Conflict in space will likely rely on temporary and local space superiority, but one only needs to achieve that superiority at the appropriate time and place to secure victory. Space combat may be temporary and reversible—for example, just enough to blind ISR satellites during an invasion of Taiwan—or it may be the ultimate deterrent to military operations. Regardless of the endeavor, success in space will require cunning and ingenuity to outthink and outmaneuver one's opponents.

This article provides only a brief, selected discussion of space within the context of historical and modern Chinese military strategy, but additional study is needed to continue developing a comprehensive space strategy. Additional research on cooperation with Allies and partners, secrecy and deception, and developing space human capital will benefit space strategists. Moreover, an analysis comparing this with Western strategic thinking and space doctrine based on Clausewitz's theories would be useful as well. The space domain's importance is growing, so the demand for space strategy and capabilities will only increase. *Æ*