

China vs. US space power

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The Chinese People's Liberation Army and Space Warfare Print Mail

Emerging United States-China Military Competition

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Space warfare will be an integrated part of battle planning by the Chinese People's Liberation Army (PLA) in any future conflict. One of the major proponents of integrated space power for the PLA, Major General Cai Fengzhen, believes that "control of portions of outer space is a natural extension of other forms of territorial control," such as sea or air control.[1] More seriously, because of American superiority in space, China's military theorists treat the United States as the most likely opponent in that domain of war. The head of the U.S. Army Space and Missile Defense Command, Lieutenant General Kevin Campbell, thinks it is possible that "within three years we can be challenged at a near-peer level" by China.[2] This means that China will be capable of "taking out a number of communications capabilities over a theater of war." [3]

The Genesis of China's Space Warfare Doctrine

We should not be surprised that the Chinese military is developing doctrine for warfare in space. Military theory evolves in response to changes in technology. It is a normal activity for strategists and war planners in any military to consider how advances in weapons and technology affect warfare and to explore how to adapt to these changes. The moves by the PLA are serious and bear watching, but American security policymakers should avoid an alarmist reaction to what is happening in China's military.

The PLA's development of space warfare doctrine is not some self-made phenomenon. Rather, the PLA has carefully absorbed and is reacting to what the U.S. military has published on space warfare and counter-space operations.[4] The PLA has also studied Soviet-era and contemporary Russian thinking on space operations, using these studies to guide its own evolving doctrine.[5]

China's neighbors are also developing the sort of space warfare capabilities that the United States and the Soviet Union considered decades ago. Former Indian Air Force Air

Chief Marshal S. P. Tyagi recently advocated establishing a jointly manned "aerospace command" for India to use the missile, satellite, and communications capabilities of the Indian armed forces effectively.[6]

U.S. security planners must monitor China's efforts carefully, however, because the United States is singled out in much of the literature as the most likely adversary for the PLA. The PLA has also made surprisingly rapid advances in this area.

The most senior and widely published author in the Chinese military on space warfare and aerospace doctrine, Cai Fengzhen, borrows most of his terminology and concepts from U.S. military doctrine. Indeed, Cai credits U.S. Lieutenant General Daniel O. Graham and his book *High Frontier* with developing the original concept.[7] Cai traces the concept of expanding one's borders directly into space to Graham and his "high frontier" theory.[8] Cai opines that space control is a natural extension of other forms of territorial control, such as sea control or the control of a nation's airspace. This is a concept that Cai explored in an earlier work on aerospace operations and the PLA Air Force.[9]

Other Chinese security literature reflects the interpretation that the intent of American missile defense in space is to extend national airspace control. An article on weapons in space by Huang Zhicheng of the Beijing Systems Engineering College says that "the United States is trying to build a 'strategic external border' in space" with its ballistic missile defense plans.[10] Huang quotes President John F. Kennedy as saying "whoever controls space [the universe] can control the earth" (shei neng kongzhi yuzhou, shei jiu neng kongzhi diqiu), reflecting China's deep uneasiness about U.S. intentions.[11] This is a popular quote in the PLA. It is probably taught in its military schools. In a China Military Science article, Major General Liu Jixian of the PLA Academy of Military Science paraphrases Kennedy this way: "Whoever controls the universe controls our world; whoever controls space controls initiative in war." [12]

Ultimately, these Chinese authors fail to acknowledge American intent in developing space doctrine. Nowhere in Cai's work, or in other Chinese examinations of the *High Frontier* concept, do the authors capture Graham's statement of intent, which was to break away from the strategic nuclear calculus of mutually assured destruction (MAD) in which the United States and the Soviet Union were once locked.[13] Graham advocated replacing "the dangerous doctrine of MAD with a strategy of assured survival" for the United States and its allies.[14] Cai focuses instead on Graham's concepts of high-performance space planes and directed energy weapons.

The PLA has reacted to what its officers observed in military operations in the Balkans, the first Gulf War, Afghanistan, and Iraq, where joint operations and command were so effective because of U.S. space assets.[15] It also has studied U.S. military literature about space operations. The PLA, like the U.S. Air Force, fully expects any future conflict to include forms of war in space integrated with other military operations. One should note that it does not take espionage to survey the PLA's collection of American doctrine.[16] Moreover, the PLA's terminology often flows from what its officers read in

U.S. doctrine. What is impressive--and bears close watching--is how rapidly the PLA has developed advanced capabilities to engage in warfare in space.

Space Warfare and Other Forms of Military Operations

Space operations and warfare in space are components of what the PLA calls "informationalized," or information age, warfare.[17] In general, PLA strategists are convinced that space will be one of the natural domains of war and that war in space will be an integral part of other military operations.[18] Moreover, PLA authors are convinced that "future enemy military forces will depend heavily on information systems in military operations." Therefore, they believe, China needs to break through the technological barriers and develop information system countermeasures in space.[19] Two authors writing in *China Military Science*, the PLA's premier military theory journal, believe that "it is in space that information age warfare will come to its more intensive points. Future war must combine information, firepower, and mobility." [20] They believe that future latent military threats will primarily come in aerospace.

Like these authors, other military theorists are convinced that "the atmosphere and space will become the primary battlefields [in high technology war], and the dividing line between them will be blurred." [21] Some are convinced that in future wars, space will be used to "carry out war between space platforms and to attack strategic surface and air targets." [22] In order to conduct warfare in space, attack targets in space, or conduct surface or air attacks from space, theorists in the PLA and other Chinese research institutes advocate research into forms of laser weapons, particle beam weapons, and other forms of directed energy and electromagnetic systems.[23] And not all of this research is limited to military theory. There are also PLA organizations conducting basic and applied research into space-to-ground kinetic weapons systems.[24]

Senior Colonel Zhang Zhiwei and Lieutenant Colonel Feng Zhuanjiang, both of the Nanjing Army Command Academy, argue that "space supremacy" must be an integral part of other forms of supremacy over the battlefield.[25] They see this as a necessary and logical extension of other forms of military conflict. The bottom line is that the PLA sees war in space as an integrated part of military operations and that offensive and defensive operations are blending.[26]

Legal Considerations in China

Justifying China's actions in international law and establishing positions in domestic law are increasingly important for the PLA as its strategists and planners think about space warfare. Some officers in the PLA's General Political Department are setting out positions that China could use to justify attacks on "space bodies" such as satellites and other installations, while other scholars and military thinkers deal with the nuances, and limits, of national sovereignty. This section explores some of these debates. The Communist Party's senior leadership sees achieving a leading position in space as key to becoming a military and economic power with global impact. China's 2006 White Paper on Space Activities sets out China's space power priorities. In PLA doctrinal books,

however, senior PLA officers make it clear that they see the ability to control space during any conflict as "controlling the 'high ground' of future warfare." [27]

Preparation for War and "Legal Warfare." While students of warfare are thinking through Beijing's military doctrine in space, other Chinese strategists and legal scholars are engaged in an internal debate on how traditional ideas of sovereignty and the laws of war apply in space. It is critical for those who follow China's military development to consider these internal debates because they imply that before using military force in space, China will telegraph its intentions or justify its planned operations through political or legal action.

One authoritative volume on the military legal system, *Xin Junshi Geming yu Junshi Fazhi Jianshe* (The New Revolution in Military Affairs and Building a Military Legal System), explored the importance of ensuring that the PLA sets out legal justifications for military actions in advance of any conflict. [28] These studies imply that even now, as these debates take place in China, the General Political Department is developing ways to justify its potential military actions in domestic law. Such activities and actions in domestic law are intended to have a future impact on international law and international opinion. Beijing did this in the 1992 Maritime Law adopted by the National People's Congress, which extended sovereign claims over some three million square miles of the East and South China Seas, marking it as Chinese territory on its maps. [29] The 2005 Anti-Secession Law is another example of how domestic law is used by Beijing to justify potential military action in the future--in this case against Taiwan.

In today's international system, PLA officers explain, setting forth clear legal arguments for military action is necessary if a nation is to get international support for military action. They call the process of justifying military conflict "legal warfare." [30] In authoritative PLA doctrine texts, the legal preparation for a military campaign is part of the "psychological operations" that complement the use of military force. [31] The major PLA text explaining how this legal warfare process would work was validated at a critique session attended by senior legal representatives of the Central Military Commission, all the general departments of the PLA, and the Academy of Military Science. [32]

In fact, since the establishment of the People's Republic of China (PRC), the Communist Party leadership has been careful to establish a *casus belli* before taking military action. Such justification has been in legal or political terms. Prior to the entry of PLA troops into the Korean War, the PRC telegraphed its actions publicly through the Indian government and with a declaration from Mao Zedong. [33] In the case of the 1962 Sino-Indian War, Chinese diplomats and military leaders carefully staked out their legal positions as early as three years before the conflict. [34] They did the same in 1969 with the Soviet Union and in 1979 prior to the "self-defensive counterattack" on Vietnam. Thus, this concept of legal warfare has roots in China's diplomatic practice that have been reinforced by the observation of modern war.

Zhang Shanxin and Pan Jiangang, two officers from the PLA's Xian Political Affairs College, believe that prior to any conflict, a nation must "muster public opinion in its favor," conducting propaganda, psychological, and legal campaigns to ensure support for military action.[35] They also suggest developing domestic law that justifies military action in international legal terms. These authors see this as a means of developing "comprehensive national power." They argue that the United States demonstrated the importance of such actions in the period before the 2003 attack on Iraq.

Lu Hucheng and Zhang Yucheng of the General Staff Department Political Department classify legal warfare as a "special form of military operations" to be undertaken in preparation for a conflict.[36] Lu and Zhang define these legal actions as "political preparation of the battlefield." They consider legal arguments, propaganda, and international agreements negotiated in advance to justify any necessary military action.

Why is this concept of legal warfare important? In the recent past, Chinese scholars have set out their views on national sovereignty, sovereignty in space, and the need for "space control" in modern war. These actions are consistent with this concept of legal warfare and, should any conflict come about in space, they will provide the outlines of any PLA justification for military action. Monitoring the outlines of the PLA's legal warfare arguments is important. It is also critical that American military theorists interact with Chinese scholars and diplomats whenever possible to limit their ability to define the justifications for conflict and evolving international law on their own terms.

The PLA is also aware of the deep political schisms in the United States over renewed nuclear testing and the placement of even defensive weapons systems in space. Debate on these issues rages in the U.S. Congress, the scientific community, academia, and the policy community. It is likely that the concept of legal warfare will be applied to these disputes. We can expect Chinese scholars and military officers to exploit legal objections to any U.S. space-based defense initiative.

By way of example, I was invited in 2002 to an international conference in England run by a group of British pacifists to debate issues related to arms control and space. The English group's partner from China was the Chinese Association for Peace and Disarmament. When I met the members of the Chinese delegation, however, four of them were either PLA officers or Ministry of State security officers I had met in China at other arms control events. In England, they operated under cover and identified themselves as disarmament researchers.

Anti-Access Strategies and "Sovereignty Control." China's nineteenth-century history of foreign invasion and extraterritorial zones is the basis for China's sensitivity to and strong national security concerns about questions of sovereignty.[37] As noted earlier, PLA military and legal thinkers see the control of outer space as a natural extension of a nation's control of its territory. PLA officers believe that "space control today is the way to guarantee the control of airspace . . . and is an absolute necessity for conducting modern 'informationalized' warfare." [38] When satellite images of China's new Jin-class submarine appeared on Google Earth on July 5, 2007,[39] the revelation in the

international press sent shock waves through portions of the PLA. But the military had already been thinking about the implications of the open availability of space imaging before this happened.[40] One commentator, Mao Yuan, suggests in a Second Artillery journal that "China's traditional 'security vaults' are evolving and remote areas of the country are less secure." [41] He also suggests passive, defensive responses to these threats: "The PLA needs better camouflage and concealment to counter imaging from space, and better computer network security to keep secrets." Other Chinese researchers have suggested decoys, space-based alarms to warn of imaging, and multi-spectrum stealth camouflage systems to mask China's activities.[42] Thus, there is a range of defensive measures under consideration in China to respond to space-based imaging and intelligence collection.[43]

Nonetheless, some PLA officers have sought to improve security by suggesting active, offensive measures and not the passive, defensive counterintelligence programs suggested by Mao Yuan. There is a debate in China focused on concerns about the freedom of other nations to undertake military activities in--or over--sovereign Chinese territory.[44] In addition, elements of this debate broaden the interpretation of sovereignty from that normally accepted in international law and practice. To respond, some researchers at PLA academies argue that modern technology is driving the main battlefield for future "informationalized" warfare into outer space. To meet that challenge, they believe that the Chinese military must rapidly build up its military space power.[45]

Military thinkers in China are also debating how sovereignty affects warfare in space. Legal scholar Ren Xiaofeng summarizes Beijing's sensitivity to reconnaissance and military activities in its exclusive economic zone (EEZ) and its adjacent airspace this way: "Freedom of navigation and overflight does not include the freedom to conduct military and reconnaissance activities. These things [military reconnaissance activities] amount to forms of military deterrence and intelligence gathering as battlefield preparation." [46] These activities in the EEZ, according to Ren, connote preparation to use force against the coastal state. When Ren refers to the "adjacent airspace," he includes outer space and space reconnaissance. Not all PLA authors, however, set out the same broad claims for sovereignty in space. There is ambiguity--even disagreement--among thinkers in the PLA over the extent to which a nation may extend its sovereignty into outer space. Two scholars from the Wuhan Military Engineering College believe that "one advantage of warfare in space is that once in space a nation is free from the restrictions imposed on military operations by international borders; therefore, there are no restrictions on operations because of territorial airspace." [47]

The official position of the United States on this matter is set forth in the National Space Policy.[48] In the policy, "the United States rejects any claims to sovereignty by any nation over outer space or celestial bodies, or any portion thereof, and rejects any limitations on the fundamental right of the United States to operate in and acquire data from outer space."

That position was not always set out so clearly. A legal note published after the Soviet Union downed a U.S. U-2 reconnaissance aircraft in 1960 discussed the concept of national sovereignty as applied to outer space.[49] The note acknowledged that "airspace sovereignty implies a sovereign air zone limited to a vertical projection from the underlying national territory." [50] In fact, in 1958, the legal advisor to the U.S. Department of State suggested, "American sovereignty may extend upward for ten thousand miles, while some Soviet commentators claimed that Soviet airspace "extends to infinity." [51]

Formally, however, both the Soviet Union and the United States refused to define the upward extent of airspace or otherwise differentiate airspace from outer space.[52] Although some commentators on the subject have suggested that the end of the atmosphere--about 100 kilometers or 62 miles up, a zone known as the Kármán line--ought to be the ceiling of sovereignty, there is none.[53]

The dominant argument in China seems to be that even though outer space is undivided and "the common domain of all mankind, space security is a necessary part of a nation's security and it is necessary to develop defensive mechanisms" over one's territory.[54] Indeed, Cai Fengzhen and his coauthors make the argument in the most detail:

The area above ground, airspace and outer space are inseparable and integrated. They are the strategic commanding height of modern informationalized warfare. . . . The airspace over territorial waters and territorial land are protected, but there is no clear standard in international law as to the altitude to which territorial airspace extends.[55]

Cai acknowledges a debate and discusses various interpretations of whether sovereignty extends only to the Kármán line or whether a nation can defend its sovereign airspace overhead up to an altitude of thousands of miles.[56] His bottom line, however, is that a nation can defend itself and seek to control space as far (or more correctly, as high) as its weapons can reach.[57] These views from China stand in direct contrast to the legal positions set forth in U.S. policy and practice.

There are also strong differences in the positions set forth by Chinese and American strategists and legal scholars on the conduct of reconnaissance. Since 1958, "the United States maintains that 'peaceful' in relation to outer space activities was interpreted . . . to mean 'non-aggressive' rather than non-military." [58]

For some time, the Soviet Union and the United States mutually recognized that the ability to conduct reconnaissance from space provided strategic stability in the cold war. The 1972 Anti-Ballistic Missile Treaty agreed by the two nations provided that "each Party undertakes not to interfere with the national technical means of verification of the other Party operating in" a manner consistent with generally recognized principles of international law.[59]

In Chinese texts, for the most part, questions of sovereignty in space are treated as analogous to the extension of national sovereignty into the EEZ and are viewed as an

inherent right of a nation, like the control of its airspace. Nevertheless, the advocates for "sovereignty control" recognize that they cannot continuously control the passage of space bodies through what they see as their territory. They seek a more limited and temporal ability to control space.[60] In their writing on integrated aerospace operations, Cai Fengzhen and Tian Anping give perhaps the most complete explanation of how space control relates to the PLA's military theory on outer space operations:

Space control is the capability of one belligerent in a state of war, in a specified period of time, in a defined area of space, to carry out its own operations with freedom while hindering or preventing an enemy from carrying out its own operations or using space.[61]

The most senior PLA Air Force officer who has written authoritatively on the matter of space and China's national security interests is General Zheng Shenxia, commandant of the PLA Academy of Military Science. Writing with his political commissar, Lieutenant General Liu Yuan, Zheng accuses the United States of maintaining a "policy of containment" (Meiguo dui Hua 'E- zhi' Zhanlue).[62] Zheng and Liu's recommendation to meet this challenge is that, to preserve China's own national interests, Beijing must be capable of controlling the electromagnetic spectrum as well as traditional sovereignty control, including the land territory, the maritime domain, airspace, and space.[63]

Based on the preponderance of policy positions advocated by senior PLA officers, it is likely that Beijing will develop capabilities to control or act in space up to the limits of its technical capabilities. The succinct suggestion by Cai and Tian above that such control be exercised only in a defined area and period of time, however, will probably prevail. Beijing will likely exercise sovereignty control in space only in times of serious crisis or war.

The Laws of War Apply. Cai and Tian also examine the "legal environment" surrounding the application of the laws of war in space. They believe that many of the concepts surrounding the conduct of war on the "common seas" apply in space, just as they do in airspace above the common seas.[64] They note that just as belligerents have the right to conduct warfare at sea beyond their territorial waters, they should have the right to attack the space bodies of belligerents.[65]

In their 2004 text on space and the PLA Air Force, Cai and Tian establish that they see no restrictions on defending one's nation in space or protecting the space bodies of allies.[66] They note in the 2006 text that, on common seas, acts of war by belligerents should not interfere with normal commerce for noncombatants, but that a belligerent can make war on commercial ships supporting the war effort.[67] Therefore, they reason, similar rules should apply in outer space. Two other Chinese scholars argue that because they are so vital for the conduct of war, in times of conflict the space installations and spacecraft of a belligerent nation are valid targets for attack anywhere in the common skies, just as ships of a belligerent can be attacked on the common seas.[68] One scholar has argued that in the event of a conflict, the satellites of third parties can be attacked if they are carrying the military data streams of a belligerent nation.[69]

The Chinese interpretation of the laws of war as they may apply in space is generally consistent with American and Western legal views.[70] Still, as legal scholar He Qishi pointed out in a 1993 article, "[t]he question of transit flights of foreign space objects through 'national airspace' and other matters" still need to be defined in law.[71]

He leaves open the question of what constitutes national airspace. Should Beijing decide to attack commercial spacecraft because they are carrying military data streams, it would severely affect international commerce as well as China's own use of space.

Reconnaissance or "Battlefield Preparation?" As noted earlier, there is deep disagreement between China and the United States about the nature of--and intent behind--the conduct of reconnaissance and surveillance.[72] Objections to aerial and maritime reconnaissance in common seas and airspace by Chinese military leaders are not new. During the years I was a military attaché in Beijing (1988-1990 and 1995-1997), I took part in a number of meetings at which senior Chinese navy and defense officials complained to U.S. commanders or defense officials about peacetime reconnaissance by the United States inside China's EEZ. Indeed, the 2001 collision between a U.S. EP-3 reconnaissance aircraft and a pursuing Chinese F-8 fighter--in which the fighter crashed, killing its pilot--raised new objections from Beijing over military reconnaissance in the EEZ. Recent legal articles that equate reconnaissance with battlefield preparation puts the EP-3 incident into perspective. Chinese commentators are extending this thinking into considerations about space reconnaissance.

In an international law journal, one Chinese writer acknowledged the disagreement between the United States and China on the matter, noting that the U.S. position on outer space takes "peaceful use" to mean "non-aggressive," whereas the Chinese interpretation is that to be peaceful use, it must be "non-military." [73] One author in a collection of essays on information age warfare in China for popular reading notes that "battlefield situational awareness is the core of information age warfare . . . which means that one must be able to destroy or jam the systems that are fundamental to that situational awareness." [74] Other PLA authors believe that the "intelligence war" (Qingbao Zhan) has to be fought before the start of armed conflict, which includes various means of reconnaissance and information-gathering. [75]

These differences between the United States and other countries on the nature of surveillance, especially from space, are not new. The Soviet Union's students of space theory and law generally interpreted "peaceful" to mean "non-military." Soviet and Chinese scholars have also argued that the use of surveillance satellites constitutes an aggressive use of outer space, while the U.S. position maintains that such surveillance is a "non-aggressive use" of outer space. [76] Thus, we can expect that any future dialogue between the United States and China on these strategic issues will spend a great deal of time on the question of the nature of reconnaissance activities. Also, now that China has a number of military reconnaissance satellites in continuous orbit--even if Beijing does not acknowledge them as military--China's positions on this matter may evolve. [77] There is

fertile ground for bilateral discussions in academic, quasi-governmental, and private "Track II" (that is, government) dialogue.

The PLA Considers Tools of Space Warfare

The PLA is exploring a variety of space weapons through theoretical, basic, and applied research.[78] These include:[79]

- satellite jamming technology
- collisions between space bodies
- kinetic energy weapons
- space-to-ground attack weapons
- space planes that can transit and fight "up or down" in the upper atmosphere or space
- high-power laser weapons
- high-power microwave weapon systems
- particle beam weapons
- electromagnetic pulse

PLA authors credit the United States with having the most advanced capabilities in the areas of kinetic energy weapons, particle beam weapons, and directed energy in general. However, the PLA does well at various forms of jamming and has done a lot of work on the concept of colliding space bodies.

The dilemma here for the military theorists and planners in the United States is that this is really space science and rocket science. Although Chinese military theory and basic and applied research into these areas are transparent, the weapons systems that may emerge as formal programs are not. It is not clear to theorists and policymakers whether current science will support many of these space war systems. Therefore, the United States must apply resources toward engaging people with scientific, mathematical, and engineering backgrounds in intelligence research and analysis on China. The PLA is serious about space warfare. Moreover, the destruction of its own weather satellite and the blinding of a U.S. satellite mean it is achieving some success.

In general, PLA theorists think internal lines of communication and support are most favorable for successful military operations, whether offensive, defensive, or logistical.[80] They see internal lines as superior to external ones.[81] Thus, they see their regional position in Asia as superior to that of the United States because the latter has to fight, communicate, and resupply along extended external lines, while China enjoys internal lines of communication within the range of its aircraft, missiles, and submarine fleet. This means that in a conflict, they would probably use their jamming and anti-satellite systems to disrupt American lines of communication, command and control, situational awareness, and efforts at military coordination.

One of the most disruptive things the PLA could do would be to neutralize the U.S. ability to use tracking and data relay satellites, which provide global, real-time sensor and communications capabilities for networked operations. The PLA believes that the United States is heavily dependent on its satellite systems--at least, more dependent than the

PLA is on its own. But that is changing. As the PLA modernizes its own command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) systems, it is becoming as dependent on space and information systems as the United States already is. Therefore, its policies of space control and space deterrence for military purposes are no longer forms of asymmetric warfare. Rather, the contest will be over which force can most effectively disrupt the other's military operations. Space warfare may well become an integral part of traditional conflict.

The Implications of Attacks on Reconnaissance Satellites

One question that begs an answer is whether the PLA is considering the implications of exercising the capabilities it is developing--that is, when researchers consider a form of space warfare, or develop capabilities to be applied in space weapons, are there also PLA officers in the policy or planning spheres thinking through the implications of employing that capability? If not, an incident could quickly escalate and get out of control, leading to an exchange of fire or a deeper crisis.

For example, four officers from the PLA's Second Artillery Command College have published an analysis of how to jam or destroy the space-based ballistic missile advanced warning systems of the United States.[82] In their article, the officers note, "a space-borne missile early warning system will play a pivotal role in future space wars." [83] They set out the capabilities and parameters of the U.S. Defense Support Program (DSP) early-warning satellites, including the geosynchronous orbits of the satellite sets, their axis of look, the infrared bands they cover, and their shortcomings. The authors discuss how to destroy the DSP satellites with other satellites, ground-based lasers, or direct ascent weapons.[84] They also discuss how to jam the satellites and their satellite-to-ground transmissions and how to camouflage the infrared radiation emitted by a missile to make it more difficult for the warning satellite to detect an attack.[85]

In their conclusion, the authors find that maintaining a strategic ballistic missile capability is a powerful deterrent to prevent the United States from launching a large-scale military attack or intervention aimed at China's own military operations on its southeast coast (say, to intervene in potential Chinese military operations against Taiwan).[86] Their view is that "destroying and jamming space-borne missile early warning systems not only can paralyze such anti-missile systems, but also will help [the PRC] win the war in space." [87]

The problem in this reasoning is that there is no consideration of a likely American reaction to the disruption of its missile early warning systems. One possible reaction by the United States is that it might well think it is coming under immediate attack and launch its own strike against China's strategic missile forces. Another reasonable--and perhaps equally escalatory--reaction by U.S. forces might be to strike the source of the Chinese attack, particularly if it came from a ground-based laser or direct ascent launch. Thus, even if such a reaction by the United States would use conventional weapons, the PLA may find it had created a deeper crisis leading to an American strike on Chinese

soil. These four PLA authors do not seem to have considered the ramifications of their own research.

Space Deterrence

Space power theorists like Cai Fengzhen advocate the ability to control parts of space for limited periods. Huang Zhicheng, in reaction to the U.S. Air Force Space Command manual section AFM 2-2.1 on space warfare and countermeasures, develops the concept further, advocating a regime of "space deterrence" to counter American "space superiority." [88] For Huang, this shift toward "space deterrence" mirrors a trend in U.S. space theory. [89] Huang defines this as "the use of strong aerospace power to create or demonstrate a threat to an opponent's space power to deter that opponent in a practical way." [90] The goal of this deterrence is to increase the PLA's power in weapons systems, information gathering, and command and control to improve national warning systems in China, create fear in an adversary, and degrade the adversary's power. [91]

The key to achieving this level of deterrence, according to Huang, is to concentrate one's own economic, military, and science and technology power to "ruin an opponent's economy and ability to function in space." [92] The intention behind the December 2006 blinding of a U.S. satellite by a Chinese laser and the January 11, 2007, destruction of a Chinese weather satellite by the PLA's own direct ascent vehicle is clear when interpreted as "space deterrence." [93] For a deterrent to be credible, one must demonstrate the capability to carry it out. It is also important to note that Huang's vision of effective space deterrence includes crippling attacks on information networks and C4ISR systems.

In the future, we may see other examples of "space deterrence" intended to let the United States and other countries know that they do not have free reign in space or over China. We may see the PLA demonstrate various forms of jamming. In doing so, the PLA would conduct operational tests of the work being done on jamming synthetic aperture radar satellites. Much of the work in Chinese journals discusses maneuvering space bodies to intersect in orbit. This type of maneuvering lends itself to "accidental" collisions between space bodies. China could then deny the hostile intent of such accidents, but they would still have a "space deterrent" capability.

Conclusions

In the event of conflict with China, we can expect to see military operations carried out across all the domains of war: land, sea, air, space, and the electromagnetic spectrum (that is, information warfare and cyber-warfare). Any military operations in space will be part of a more coordinated attack on an enemy's knowledge and command systems. There will probably be a strategic warning, even if there is operational or tactical surprise--that is, the PLA and the Chinese Central Military Commission will likely justify any of its actions in advance by conducting what it calls "legal warfare." The PLA will seek to exercise "space control" in a limited area of conflict, and it will probably observe the internationally accepted definitions of "commons" in space (above the Kármán line) in peacetime and during periods of tension. If conflict breaks out, however, altitude limits

on space control will be off, and any systems carrying adversaries' military traffic or signals will probably be fair game for the PLA. The PRC's foreign ministry, security services, Communist Party liaison department, and the PLA will likely exploit political divisions in the United States over nuclear testing and space-based weapon systems by applying the concept of "legal warfare."

U.S. Secretary of the Navy Donald Winter, on a visit to Australia in August, said that the United States still wants to "understand what the Chinese intention is" in its military modernization.[94] This concern over how China will engage in military operations in space is really about intentions. Many of China's activities and policy positions make it hard to interpret Beijing's intent. Among these are:

China's expansive territorial claims, combined with periodic incidents of the use of force to reinforce these claims[95]

the justification for extending the territorial claims of China into the reaches of outer space, as outlined in this paper

the shaping of the "space battlefield" with legal arguments that would justify China's actions to prevent space observation over its territory

The United States has taken a course with China far different from the isolationist and confrontational approach it took with the Soviet Union. The United States is heavily involved in trade and economic and political engagement with China. Nonetheless, each country is wary of the potential for conflict with the other, and they have some fundamental differences of national interest.

Whether one is a proponent of arms control agreements or not, the dialogue between the United States and the Soviet Union over arms control and treaties produced a body of mutual understanding that holds up today. Both countries seemed to realize that it is potentially destabilizing to define the upper limits of sovereignty. Thus, neither country interfered with the other's free passage in space. Both countries also agreed that the ability to conduct strategic verification from space stabilized the nuclear balance.

No such dialogue has taken place with China. Indeed, the PLA has either ignored or rebuffed American efforts at such a dialogue. Often, senior military or Communist Party leaders have told Americans that to engage in such a dialogue is an example of a "cold war mentality." [96] I believe that discussions on these issues will help clarify the rationale for U.S. space policy and help reduce the threat of space warfare.

Although we do not know China's intentions, we can infer them from Beijing's actions--the attack on a U.S. satellite with a laser and the destruction of its own weather satellite as a demonstration of capability. We can also infer Beijing's intentions from a judicious review of its military literature. By observing the military capabilities China is acquiring and reading its literature, we know that China's leaders are preparing as though they might have to fight the United States. Furthermore, the PLA is busily preparing the "space battlefield" in advance with legal arguments, just as called for in its doctrine. There are thus sound reasons to prepare to defend American interests in space, to engage in mutual threat reduction measures, and to pursue programs that will ensure that the U.S.

military will have access to space--and space-based logistical support--in any future conflict.

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This paper analyses the influence of different combinations of work and study on academic achievement among university students of Yaroslavl region in Russia. The data was collected during the first wave of longitudinal research on the educational and occupational trajectories of graduates of schools and universities conducted by the Institute of Education, Higher School of Economics, Moscow in 2009. CBSE Sample Paper, Worksheets, Syllabus, Notes, Assignment, last year papers, NCERT Solutions, NCERT Books. Free study material prepared by teachers of the best schools in India available for free download. All material has been prepared for students for quick and easy learning of important topics to get best scores in class test and examinations. Download pdf of latest NCERT books, MCQs, Value Based Questions, NCERT Exemplar Solutions and Unseen passages for English and Hindi for all classes. NCERT Solutions. The right to food guidelines: information papers and case studies. not increased across the board, the World Food Programme has increased the share of emergency assistance drastically, from 34 percent of its budget on emergencies in 1990 to 87 percent in 2001. Figure 2 below provides a breakdown of deliveries of food aid in metric tons from 1990 to the present.