Debates over the Military Value of Outer Space in the Past, Present and the Future: Drawing on Space Power Theory in the U.S.*

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Abstract

Throughout the Cold War era, U.S. debate over the military value of outer space focused on how space systems were able to contribute to nuclear deterrence and strategic stability between the U.S. and Soviet Union. Sanctuary school was the first prevailing view of the debate, and it recognized the value of outer space in the observation of regions within the boundaries of other sovereign nations. However, the views of this school were relativized following the inauguration of the Reagan Administration. As an alternative to the sanctuary school, there was another argument that made headway, which was that outer space should be positioned as the ultimate high ground and that ballistic missiles should be intercepted from outer space. Furthermore, following an increase in the military value of outer space, the idea that space control would become a prerequisite for the utilization of outer space began to draw interest. In the post-Cold War era, in contrast, the main point of contention has been about how space systems can contribute to wartime military engagements. The Gulf War saw a rise in the military value of space systems in terms of C4ISR, and since then the U.S. has maintained its policy of pursuing the C4ISR value of space systems in military operations. At the same time, as the perceived value of space systems increased, the view that space control should be established gained traction. However, when considering the future path of the debate, space control has a number of issues in terms of feasibility. Additionally, in the long term, the utilization of outer space as the high ground may become the point of contention. Nonetheless, technical challenges and other issues must be overcome before space-based BMD systems and other alternatives can be deployed.

Introduction

Outer space is a domain of human activity comparable to land, sea, air and cyberspace. It was in 1957 that outer space began to be used in earnest after the world's first successful launch of a satellite by the former Soviet Union. Since then, more than 7,000 satellites have been launched from locations throughout the world[1] and around 1,100 satellites are currently in operation.[2] While these satellites have been utilized for various purposes, the central utility has been military application. Compared to land, sea and air, outer space is used in greater proportion for military

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1 Japan Aerospace Exploration Agency, *Jinko Eisei nitsuiteno FAQ (Yokuaru Shitsumon to Kaito)* [Frequently Asked Questions (FAQ) Concerning Satellites] <http://www.jaxa.jp/pr/inquiries/qa/satellite.html>.

2 U.S. Department of Defense and Office of the Director of National Intelligence, *National Security Space Strategy,* Unclassified Summary, January 2011, p. 1.

purposes, and it is believed that between 75 and 80% of satellites launched during the Cold War were military satellites.[3] Since the 1980s, outer space has been increasingly used for commercial purposes in the field of communications and earth observation. However, this does not mean that the use of outer space for military purposes became less prevalent. As the strategic environment changes, new military uses and benefits of outer space have been discovered and have shaped today's use of outer space.

This paper examines the developments of the debate over the military value of outer space. More specifically, the paper highlights how the debate over the military value of outer space has developed in the U.S. as the military has changed the way it uses outer space over time by drawing on the U.S. Space Power Theory. Space Power Theory positions the use of outer space as the power employed for achieving certain objectives, just like Sea Power Theory, Air Power Theory and Cyber Power Theory.[4] Within the U.S., there has been much debate over space power, especially by military officials and researchers on strategic theory.[5] The debate over space power is not limited to military affairs, but just like sea power and air power theories, the focus of the debate has been from this perspective. Therefore, an analysis of the space power theories of each era will provide insight into the trends of the debate over the military value of outer space.

Compared to land, sea and air, the military value of outer space has not been thoroughly considered.[6] Indeed, there has never been warfare in outer space nor a power projection launched from outer space targeting land, sea or air space. Presently, the role of space systems remains ancillary; they are used to support land, sea and aerial military activities in terms of C4ISR.[7] However, the military use of outer space is expected to become increasingly prevalent globally, and in fact, some countries such as the U.S. are heavily dependent on outer space, to the point that execution of military operations is impossible without the use of space systems. Furthermore, as counterspace systems become common throughout the world, it is said that this will give rise

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3 Setsuko Aoki, *Nihon no Uchu Senryaku* [Space Strategy of Japan], Keio University Press, 2006, p. 11.

4 Major sea power and air power theories include *The Influence of Sea Power upon History* by Alfred T. Mahan and *The Command of the Air* by Giulio Douhet. Alfred T. Mahan, *The Influence of Sea Power upon History 1660-1783*, S. Low, Marston, 1889; Giulio Douhet, *The Command of the Air*, trans. Dino Ferrari, The University of Alabama Press, 2009. Information on cyber power can be found in the following reference: Joseph S. Nye, Jr., *Cyber Power*, Belfer Center for Science and International Affairs, Harvard Kennedy School, May 2010 <http://belfercenter.ksg.harvard.edu/files/cyber-power.pdf>.

5 U.S. space power theories are reflective of the backgrounds of theory presenters and have developed under the strong influence of policy trends. Refer to the following reference for more information. David E. Lupton, *On Space Warfare: A Space Power Doctrine,* Air University Press, 1988, p. 52.

6 A large amount of research has been conducted on the military value of land, sea and air as shown by the following: Yuichiro Nagao, Tomoyuki Ishizu, and Kyoichi Tachikawa, "*Sentokukan no Gaienteki Kakudai to Gunjiryoku no Hensen* [Expansion of Military Combat Space and Changes in Military Capacity]," Tomoyuki Ishizu, ed., *Senso no Honshitsu to Gunjiryoku no Shoso* [The Nature of War and Various Aspects of Military Capacity], Sairyusha, 2004, pp. 103-180; Tomoyuki Ishizu, Kyoichi Tachikawa, Narushige Michishita, and Katsuya Tsukamoto, eds., *Air Power*, Fuyo Shobo Shuppan, 2005; Tomoyuki Ishizu and Williamson Murray, eds., *Niju-isseiki no Air Power* [Air Power of the 21st Century], Fuyo Shobo Shuppan, 2006; Tomoyuki Ishizu, Kyoichi Tachikawa, Narushige Michishita, and Katsuya Tsukamoto, eds., *Sea Power*, Fuyo Shobo Shuppan, 2008.

7 C4ISR is an acronym for Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance. Satellites used for these purposes include communications satellites, reconnaissance satellites, early-warning satellites, positioning satellites and weather satellites.

to the possibility of warfare in outer space.[8] As illustrated, outer space is becoming a domain indispensable to the military activities of various countries requiring further study on the military value of outer space.

Drawing on U.S. Space Power Theory, Section One examines how the military value of outer space was debated in the context of the Cold War. This paper places particular focus on the development of the debate throughout the 1980s when there was a particularly active debate. Section Two looks at how the military value of outer space has been debated in the modern context of the post-Cold War era. Section Three then discusses where the debate is headed in light of the changing strategic environment.

Trends of the Cold War Era — The Rise and Relativization of the Sanctuary School

Until the 1980s, the U.S. debate over the military value of outer space was dependent on the state of the U.S.-Soviet Union Cold War. Notably, the focus of the debate was on how space systems were able to contribute to nuclear deterrence and strategic stability between the U.S. and Soviet Union.

Four Schools of Thought Relating to the Military Value of Outer Space

To gain insight into the development of the debate during the Cold War era, the paper makes reference to *On Space Warfare: A Space Power Doctrine* by David E. Lupton.[9] Lupton's *On Space Warfare* is an excellent reference on space power and is frequently cited even today, 20 years after its publication in 1988.[10]

Lupton's greatest achievement is his categorization of the debate over the military value of outer space into four schools: the sanctuary school; the survivability/vulnerability school; the high ground school; and the control school. The first of the four categories, the sanctuary school, is the school of thought that recognizes the military value of outer space in the observation of regions within the boundaries of other sovereign nations and asserts that outer space should remain off-limits to war in order to protect its value.[11] If a surveillance aircraft were to see within the boundaries of another country, it would be difficult for this to occur without a violation of air space. On the other hand, satellites are able to legally travel over the territories of foreign nations, making them suitable for the surveillance of other sovereign nations. For this school of thought, surveillance conducted from outer space is an inevitable part of the nuclear deterrent force, and is the most important role of space systems. In fact, the U.S. has used reconnaissance satellites

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8 In addition to ASAT weapons, which target satellites in orbit, counterspace systems also include systems that target ground stations and the links between satellites in orbit and earth stations. Refer to the following for information on the global proliferation of counterspace systems: Yasuhito Fukushima, "*Kenzaika suru Tai-uchu Shisutemu no Kyoi* [The Rising Threat of Counterspace Systems]," *Japan Association of Disarmament Studies (JADS) News Letter*, Vol. 12, November 2012, pp. 8-9 <http://www.disarmament.jp/pdf/NL12.pdf>.

9 Lupton, *On Space Warfare: A Space Power Doctrine*.

10 The following is an example of a publication that draws on Lupton's *On Space Warfare*: Burton Catledge, "Space Power Theory," Space Research Electives Seminars, Air Command and Staff College, Air University, U.S. Air Force, eds., *Space Primer*, AU-18, Air University Press, 2009, pp. 29-41. With no space power theories that are accepted by a majority, Colin S. Gray stated that the arguments of Lupton are worthy of an honorable mention. Colin S. Gray, "The Influence of Space Power upon History," *Comparative Strategy*, Vol. 15, No. 4, October-December 1996, footnote 23; Colin S. Gray, "Introduction," James Oberg, *Space Power Theory*, Government Publishing Office, 1999, p. xiii.

11 Lupton, chapter 4.

since the 1960s. The satellites played a central role in gaining insight into the military capabilities of the Soviet Union and in verifying compliance with arms-control treaties. Furthermore, early-warning satellites have the capability of detecting intercontinental ballistic missiles immediately after launch. In addition, they can provide global coverage, making them an effective means of detecting submarine-launched ballistic missiles. For this reason, early-warning satellites played an extremely important role in assuring the credibility of deterrence by punishment. In this vein the sanctuary school argues that outer space must remain off-limits to war in the interest of ensuring the stable utilization of these assets. Accordingly, this school supports the prohibition of the outer space deployment of nuclear weapons and ballistic missile defense (BMD) systems as well as of the deployment of anti-satellite (ASAT) weapons through the conclusion of arms control treaties. The sanctuary school is also against the use of outer space for providing direct support for the land, sea or aerial military engagements as it may incite attacks on space systems.

The second of the schools is the survivability/vulnerability school. It argues that compared to the assets of other domains (land, sea, air), space systems are more vulnerable and therefore the military value of outer space is limited to times of peace.[12] This school lists the following reasons to claim that space systems are more vulnerable: space systems may be destroyed by high altitude nuclear explosion; their orbits are predictable and maneuverability is limited; and since the systems are in principle unmanned, the threshold for the use of force against them could be lower than against terrestrial targets. This school claims that to protect space systems from these threats, it is necessary to deploy systems with similar capabilities on earth to decrease the value of space systems as targets of attack, and that deterrence by punishment needs to be implemented through the deployment of terrestrial ASAT weapons. At any rate, the survivability/vulnerability school regards space systems as inherently vulnerable and therefore questions the military value that outer space offers.

The third school, the high ground school, grants outer space the highest military value of the four schools.[13] Drawing on the saying that those who dominate the high ground also dominate the low ground, this school argues that whoever controls the ultimate "high ground," i.e., outer space, also controls the earth. More specifically, this school gives high regard to the value of space-based BMD systems. This is contrasting to the assumption of the sanctuary school, which argues that defense against nuclear attack is impossible and the only way to maintain strategic stability is through deterrence by punishment. The high ground school stands by the premise that technologically, BMD is possible, and the theory of U.S.-Soviet Union mutually assured destruction (MAD) should be denied.

The fourth school of thought, the control school, asserts that whatever the military value of outer space may be, the prerequisite is to establish space control.[14] This notion stems from analogous concepts of sea control and control of the air. Just as there are sea lines of communications across the vast ocean, there are also space lines of communications in outer space, and thus it is imperative that its stable utilization is secured. Moreover, this school recognizes the necessity of ASAT

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12 Ibid., chapter 5.

13 Ibid., chapter 6.

14 Ibid., chapter 7. Control has two components: the capacity to protect friendly forces; and the capacity to deny the enemy use of an environment. Ibid., pp. 41-42. Notably, denying others the use of an environment is a wartime task; during times of peace, focus is placed on maintaining this capacity. Ibid., p. 108.

weapons as a means of controlling outer space. On the other hand, this school does not give outer space utilization as much ultimate value as the high ground school does. The control school claims that space control is nothing more than preparatory, and ultimately ground military engagements will determine the outcomes of wars.

In summary, the school that places the most emphasis on the military value of outer space is the high ground school, and the vulnerability school is most skeptical of the military value of outer space, while the two other schools lie in the middle ground. The sanctuary school regards highly the military value of outer space; however, it argues that the role of space systems should be restricted to the surveillance of foreign nations, and therefore, unlike the high ground school, it does not ascribe to the theory that outer space can determine the outcomes of wars. The control school also views the military value of outer space as important, but it asserts that whatever value outer space may offer, it is important to gain control of outer space as a prerequisite of its utilization rather than seeking specific value through the utilization of outer space.

The Rise and Relativization of the Sanctuary School

Of the four schools, the sanctuary school was the most mainstream until the arrival of the Ronald W. Reagan Administration. This school had been the U.S.'s official doctrine since the Dwight D. Eisenhower Administration.[15] While Eisenhower was in power, the surveillance of Soviet Union's territories and nuclear arsenal was a high priory to prevent a surprise attack. However, due to the closed nature of the country, the information available was extremely limited. Surveillance by aircraft would violate territorial boundaries and if discovered would risk international criticism and the safety of the crew of the surveillance aircraft. In 1955, President Eisenhower presented his "Open Skies" plan, which would allow the U.S. and Soviet Union to conduct aerial surveillance over each other's territories. Nevertheless, the Soviet Union rejected the proposal. In 1954, President Eisenhower secretly granted approval for reconnaissance flights over the Soviet Union, which was followed by the deployment of U-2 high-altitude reconnaissance aircraft from 1956 onwards. However, the U-2 aircraft was shot down over the Soviet Union in 1960 and led to the end of surveillance flights over Soviet Union's territories.[16]

In light of this, the new reconnaissance satellites launched shortly after the incident were particularly valuable. In the month following the U-2 incident, the U.S. launched its first signals intelligence (SIGINT) satellite GRAB-1 to obtain information on Soviet air defense radars.[17] Furthermore, two months after the launch, the U.S. successfully recovered, for the first time, the images taken by the CORONA imagery intelligence (IMINT) satellite.[18] It is said that the negatives

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[15] Refer to the following reference for more information: Lupton, p. 51; R. Cargill Hall, "The Evolution of U.S. National Security Space Policy and its Legal Foundations in the 20th Century," *Journal of Space Law*, Vol. 33, No. 1, Summer 2007, pp. 1-103; M. Mowthorpe, "US Military Space Policy 1945-92," *Space Policy*, Vol. 18, Issue 1, February 2002, pp. 25-36.

[16] SR-71 reconnaissance aircraft were deployed in action in 1967. However, the aircraft did not conduct reconnaissance flights over Soviet Union's territories, and operations were limited to surveillance from near border locations. Thomas Graham Jr. and Keith A. Hansen, *Spy Satellites and Other Intelligence: Technologies that Changed History*, University of Washington Press, 2007, p. 36.

[17] National Reconnaissance Office, *NRO History and Heritage* <http://www.nro.gov/about/50thAnniv/50th-Flyer.pdf>.

[18] The first test launch of the Corona series was conducted in 1959. National Reconnaissance Office, *CORONA Fact Sheet* <http://www.nro.gov/history/csnr/corona/factsheet.html>.

recovered on this occasion contained a greater number of useful images than the numerous U-2 surveillance flights over Soviet Union's territories.[19] The data obtained through the IMINT satellites also proved that there was in fact no U.S.-Soviet Union missile gap.[20]

Consequently, the U.S. government following the Eisenhower Administration, which prioritized the development of an international consensus on the legality of satellites to travel above the territories of other nations, held back the development of space weapons. If it had been discovered that the U.S. was developing space weapons, it was highly likely that the Soviet Union would have opposed the passing of foreign satellites over their territories, even if they were passing through outer space. In fact, the Soviet Union was not only against the development of space weapons, it remained staunchly opposed to the operation of reconnaissance satellites until 1963.[21] In this way, the sanctuary school did not originate from idealism; rather it was developed due to the pressing need to spread internationally the principle of outer space freedom during the 1950s and 60s.[22]

This sanctuary school philosophy was challenged as the Reagan Administration took office in the 1980s.[23] In 1983, President Reagan announced the Strategic Defense Initiative (SDI), and in 1984, ordered the technology development and demonstration program for land- and space-based BMD systems.[24] These policies developed by the Reagan Administration had the potential to bring about a significant change to the nation's official doctrine, which had been in place since President Eisenhower's term in office. In tandem with these policy moves, the arguments of the high ground school, which highly value space-based BMD systems, came to prominence.

Additionally, the arguments of the control school also came to be heard broadly during the 1980s. The origin of the school can be traced back to the late 1950s and some believe that it was Thomas D. White, then the Chief of Staff of the United States Air Force, who founded this school of thought.[25] White argued that just as control of the air assures free activity across land and oceans, control of space assures free activity across the earth.[26] However, as the sanctuary school became more dominant, White's argument was seldom spoken of in the public sphere from the 1960s onwards.[27] As the philosophy of the sanctuary school was relativized by the Reagan Administration, the arguments of the control school resurfaced.[28]

It is believed that as the high ground school of thought became more prevalent, as discussed earlier, the debate over space control became more active. The high ground school asserts that outer space is able to determine the outcomes of wars fought on earth. Therefore, this school attaches significant value to the protection of space systems. At the same time, this school maintains a strong

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19 Graham and Hansen, p. 37.

20 Ibid., p. 35.

21 The Soviet Union launched its first reconnaissance satellite in 1962. Ibid., p. 38.

22 In 1967, the Outer Space Treaty, which included this principle, came into force.

23 Lupton, p. 51.

24 Hall, pp. 54-55, 97-98.

25 Lupton, chapter 7, footnote 9.

26 Thomas D. White, "Air and Space are Indivisible," *Air Force Magazine*, Vol. 41, No. 3, March 1958, pp. 40-41; Thomas D. White, "Space Control and National Security," *Air Force Magazine*, Vol. 41, No. 4, April 1958, pp. 80-83.

27 Lupton, p. 106.

28 Refer to the following reference for more information: Colin S. Gray, "Space is not a Sanctuary," *Survival*, Vol. 25, No. 5, September/October 1983, pp. 194-204. Lupton is also in support of the control school. Lupton, p. 125.

sense of vigilance toward opponents seeking to establish similar systems. For these reasons, gaining control of space becomes crucial as a prerequisite for determining the outcomes of wars from outer space. Furthermore, it is notable that the space-based BMD systems supported by the high ground school were believed to have been technologically capable of targeting space launch vehicles and satellites in orbit in addition to taking down ballistic missiles.[29] However, while the high ground school would inevitably be in support of space control, the control school does not necessarily support the arguments of the high ground school. As did Lupton, the control school would sometimes argue that the high ground school overestimates the military value of outer space.

Another factor contributing to the increasing attention given to the debate over space control was the strengthening of U.S. and Soviet Union's initiatives to provide direct support for land, sea and aerial military engagements from space. Toward the end of 1976, the U.S. launched KH-11, the first electro-optical imaging satellite capable of transmitting data in near real-time via a data relay satellite.[30] Following the implementation of this space system, the National Space Policy (NSP) developed by the James E. Carter Administration in 1978 stated that the country would provide support for front-line troops through the use of reconnaissance satellites.[31] The Soviet Union had also operated radar ocean reconnaissance satellites (RORSATs) and electronic ocean reconnaissance satellites (EORSATs), which had posed a significant challenge to U.S. vessels.[32] Against this backdrop, the value of space systems as an attack target had been increasing. In fact, the U.S. and Soviet Union advanced their development and deployment of ASAT weapons throughout the 1980s. Between 1984 and 1986, the U.S. completed five air-launched ASAT weapon tests, with one satellite in orbit successfully shot down in 1985.[33] It is believed that the Soviet Union deployed ground-based ASAT weapons in the 1980s.[34] In light of this, the arguments by the control school began to gain momentum.

In this way, in the 1980s the arguments of the sanctuary school, which had overwhelming influence as the U.S. government's official doctrine, were relativized. Gaining prominence at this time was an argument based on the recognition that outer space was not a sanctuary off-limits to war, but was actually a domain with potential for military engagement in the same way as land, sea or air. More specifically, it was argued that outer space should be positioned as the ultimate high ground and that ballistic missiles should be intercepted from outer space. Furthermore, as the military value of outer space increased, the idea that space control would become a prerequisite for the utilization of outer space began to gain traction.

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29 Lupton, p. 41; Hall, p. 98.

30 National Reconnaissance Office, *NRO History and Heritage*.

31 White House, *National Space Policy*, Presidential Directive/NSC-37, May 11, 1978; Hall, pp. 33, 36, 95-96.

32 U.S. Department of Defense, *The Soviet Space Challenge*, p. 7; The Aspen Strategy Group, *Anti-Satellite Weapons and U.S. Military Space Policy*, University Press of America, 1986.

33 The ASAT weapon used in this test was designed to target Low Earth Orbit (LEO) satellites and the missile launched from the F-15 fighter jet physically destroyed the target when the missile made a direct hit. Clayton Chun, "The U.S.AF Strikes into Space: Anti-Satellite Capability and Space Control," Dik Alan Daso, ed., *U.S. Air Force: A Complete History*, Hugh Lauter Levin Associates, Inc., 2006, p. 527. However, system development was cancelled in 1988.

34 The main target of this weapon was LEO satellites. When launched into orbit, the weapon approaches the satellite and releases pellets to physically destroy the target. U.S. Department of Defense, *The Soviet Space Challenge*, p. 11.

Post Cold War Trend – Increased Value in Terms of C4ISR and the Growth of the Control School

Following the end of the Cold War, the debate over the military value of outer space within the U.S. took on new meaning. The main point of contention of the debate following the Cold War became how space systems can contribute to wartime military engagements.

Increased Value in Terms of C4ISR

"The Influence of Space Power upon History" by Colin S. Gray (1996) provides insight into the post-Cold War debate.[35] Gray argues a space power theory that is reflective of developments since the Gulf War, which is also known as the First Space War. According to Gray, the Gulf War and subsequent wars can be defined as space age information warfare, where information plays a central role in war. Gray believes that space systems are the main provider of that information.

It is deemed that during the 1991 Gulf War, approximately 60 military satellites were utilized to provide C4ISR support for the coalition forces' Operation Desert Storm.[36] The majority of inter-theater communications were made via satellite. Within the theater, satellites were also utilized to conduct non-line of sight communications. In addition, in desert zones in Kuwait and Iraq where landmarks were few, GPS provided locational information to ground troops and air units.[37] Reconnaissance satellites were also used to keep track of the movements of Iraqi troops and to identify the results of aerial bombings by coalition forces. Early-warning satellites were originally developed to detect the launch of Soviet Union's intercontinental ballistic missiles; however, during the Gulf War the satellites were used to detect the launch of Iraqi theater ballistic missiles. Additionally, satellites provided weather information, which was crucial for determining military operations. In this way, the Gulf War proved that space systems had high value in terms of C4ISR.

The U.S. maintained its policy of pursing the C4ISR value of space systems in military operations following the Gulf War, including the 1999 Operation Allied Force, Operation Enduring Freedom (2001 onwards) and Operation Iraqi Freedom (2003-2010). During Operation Allied Force, a device called JDAM, which enables accurate guidance via GPS by mounting the device on aircraft-carried bombs, was deployed in action for the first time. It is said that the combined use of the device together with the B-2 Stealth Bomber, which was also deployed in combat for the first time, triggered a revolution in air warfare.[38] During Operation Iraqi Freedom, the Combined Forces Air Component Commander of the U.S. Central Command was given direct responsibility and ultimate authority of space operations for the first time, fully incorporating outer space into war.[39]

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35 Gray, "The Influence of Space Power upon History," pp. 293-308. Gray was born in the UK but has dual UK-U.S. citizenship. Gray, under the political appointee system, served as a committee member of the General Advisory Committee on Arms Control and Disarmament during the Reagan Administration. Strategic Studies Institute, U.S. Army War College, *Dr. Colin S. Gray* <http://www.strategicstudiesinstitute.army.mil/pubs/people.cfm?authorID=44>.

36 Sir Peter Anson and Dennis Cummings, "The First Space War: The Contribution of Satellites to the Gulf War," Alan D. Campen, ed., *The First Information War: The Story of Communications, Computers and Intelligence Systems in the Persian Gulf War*, AFCEA International Press, 1992, p. 121.

37 It should be noted that due to the incomplete GPS satellite constellation during the Gulf War, the period in which two and three dimensional positioning could be conducted along the Gulf Region was limited to 22 and 16 hours respectively each day. Ibid., pp. 126-127.

38 U.S. Air Force, *Fact Sheet: Joint Direct Attack Munition GBU-31/32/38* <http://www.af.mil/information/factsheets/factsheet_print.asp?fsID=108&page=1>.

39 James W. Canan, "Iraq and the Space Factor," *Aerospace America*, August 2003 <http://www.aiaa.org/aerospace/Article.cfm?issuetocid=393&ArchiveIssueID=41>.

Through these initiatives, space systems became an indispensable part of U.S. military operations. Robert J. Butler, then the Deputy Assistant Secretary of Defense for Cyber and Outer Space Policy indicated during his 2010 congressional testimony that space systems in U.S. military operations have moved from being something "nice to have" to being a "must have."[40]

Growth of the Control School

In this way, space systems began taking on a new meaning. They came to contribute to the execution of combat in terms of C4ISR in addition to performing their traditional role since the Cold War period. In this context, it was the debate of the control school that began to gain momentum. As discussed earlier, the control school contends that space control must be established as a prerequisite for using highly valuable space systems. Gray argues in "The Influence of Space Power upon History" that it is crucial for spaceways to remain unchallenged as a prerequisite for the provision of information by space systems. Furthermore, Steven Lambakis claims that the unilateral space superiority seen during Operation Desert Storm cannot be taken for granted, and emphasized the importance of space control, recognizing the emergence in the future of opponents who will attempt to deny the U.S.'s utilization of outer space.[41] *Space Power Theory* by James E. Oberg published in 1999 following research sponsored by then-U.S. Space Command also notes that space control is a core part of space power.[42]

Nevertheless, the necessity for space control throughout the 1990s remained latent. During the Cold War era, the Soviet Union's ASAT weapons were recognized as a potential threat to U.S. outer space utilization.[43] However, following the end of the Cold War, such threats decreased significantly. U.S. outer space utilization was not interrupted during neither Operation Desert Storm nor Operation Allied Force in the 1990s. It was only after the 2000s when such a threat began to surface once again. During the 2003 Operation Iraqi Freedom, the U.S. confronted GPS jamming by Iraqi troops.[44] Lance W. Lord, then the Commander of Air Force Space Command, described that the war in outer space was triggered by the actions of the Iraqi troops.[45] Additionally, the jamming of satellite communications has arisen as another concern,[46] and since 2004, the U.S.

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40 Robert J. Butler, then Deputy Assistant Secretary of Defense for Cyber and Space Policy, *Statement before the Subcommittee on Strategic Forces, House Armed Services Committee*, April 21, 2010, p. 2 <http://democrats.armedservices.house.gov/index.cfm/files/serve?File_id=aa48bd33-2429-4f0d-b568-312ca214f4ed>.

41 Steven Lambakis, "Space Control in Desert Storm and Beyond," *Orbis*, Vol. 39, Issue 3, Summer 1995, pp. 417-433.

42 Oberg, *Space Power Theory*. Established in 1982, Space Command was a unified command responsible for space operations, but the command was abolished in 2002 with its mission acquired by the United States Strategic Command.

43 In his 1983 paper, Gray stated that from a military perspective the U.S. was increasingly relying on space systems, which would be the Achilles heel of the country. Colin S. Gray, "Space is not a Sanctuary," *Survival*, Vol. 25, No. 5, September/October 1983, p. 203.

44 Iraq deployed in action six GPS jammers, which were sourced from other countries. These devices were incapacitated by air strikes, and it is deemed that they did not have any direct influence on GPS. Jim Garamone, "CENTCOM Charts Operation Iraqi Freedom Progress," *American Forces Press Service*, March 25, 2003 <http://www.defense.gov/News/NewsArticle.aspx?ID=29230>; Donna Miles, "Iraq Jamming Incident Underscores Lessons about Space," *American Forces Press Service*, September 15, 2004 <http://www.defense.gov/News/NewsArticle.aspx?ID=25298>.

45 Lance W. Lord, "Space Superiority," *High Frontier*, Vol. 1, No. 3, Winter 2005, p. 3.

46 Satellite jamming technology is widespread, and it is believed that since the 2000s, countries such as Iran, Libya and Ethiopia have jammed satellite communications.

has been carrying out Operation Silent Sentry, which detects jamming and identifies the source.[47] In 2007, China successfully destroyed a satellite in Low Earth Orbit (LEO) during ASAT testing. The testing broke a moratorium that the U.S. and Russia had maintained over 20 years, which said the two countries would not conduct ASAT testing that would result in the creation of debris.[48] In recent years, North Korea conducts GPS jamming repeatedly. It is believed that in 2012, the jamming influenced the navigation of aircrafts, vessels and vehicles operating in close proximity to the Military Demarcation Line.[49] For these reasons, the recognition that outer space is no longer a sanctuary off-limits to war is becoming a more commonly held view within the U.S. The "National Security Space Strategy (NSSS)" submitted by the Secretary of Defense and the Director of National Intelligence to Congress stated that outer space is increasingly contested.[50] As counterspace capabilities proliferate globally, it is no longer easy for a few great powers including the U.S. and Russia to determine whether outer space will be kept as a sanctuary.

At the same time, actors other than the U.S. have already commenced military utilization of outer space, and that has prompted a debate within the U.S. over the necessity of denying the use of outer space by adversaries during times of war. As described earlier, the Soviet Union's maritime reconnaissance satellites were already recognized as a threat to U.S. vessels in the 1980s and the need for ASAT weapons as a countermeasure was acknowledged.[51] During the Gulf War, it is said that as a means of restricting Iraqi outer space utilization, restrictions on the distribution of images from earth observation satellites were enforced[52] and air strikes on communications satellite base stations were carried out.[53] More recently, there has been a growing debate with China in mind, and it has been recommended that Chinese reconnaissance satellites are disabled during times of war in order to ensure the freedom of U.S. vessel operations.[54]

Opponents that the U.S. actually fought with since the end of the Cold War have had limited capacity to deny U.S. utilization of outer space and restricted capacity to utilize outer space for military purposes themselves. However, with the global proliferation of Anti-Access/Area Denial (A2/AD) capabilities, the era of unchallenged U.S. space control, in addition to sea control and control of the air, is drawing to a close. Additionally, other nations who have maintained keen interest in the American means of fighting wars have begun utilizing outer space for military purposes.

Against this backdrop, it was the George W. Bush Administration that clearly demonstrated

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47 Bryan Swink, "'Silent Sentry' Gives Deployed Airmen Upper Hand in Space Superiority," *Air Force News*, October 9, 2012 <http://www.af.mil/news/story.asp?id=123321419>.

48 As stated earlier, the U.S. destroyed a satellite in orbit during its air-launched ASAT weapon test in 1985. It was only on this occasion that the U.S. conducted this kind of test. The Soviet Union conducted approximately 20 ASAT weapon tests that resulted in the creation of debris between 1968 and 1982. The NASA Orbital Debris Program Office, "Chinese Anti-satellite Test Creates Most Severe Orbital Debris Cloud in History," *Orbital Debris Quarterly News*, Vol. 11, Issue 2, April 2007, p. 3.

49 "Massive GPS Jamming Attack by North Korea," *GPS World*, May 8, 2012 <http://www.gpsworld.com/massive-gps-jamming-attack-by-north-korea/>.

50 U.S. Department of Defense and Director of National Intelligence, *National Security Space Strategy*, p. 3.

51 The Aspen Strategy Group, *Anti-Satellite Weapons and U.S. Military Space Policy.*

52 France limited the distribution of images of the Gulf Region taken by the SPOT system to nations belonging to the allied forces. Lambakis, pp. 419-420.

53 Anson and Cummings, "The First Space War: The Contribution of Satellites to the Gulf War," p. 122.

54 Refer to the following reference for more information: Jan Van Tol, Mark Gunzinger, Andrew Krepinevich, and Jim Thomas, *AirSea Battle: A Point-of-Departure Operational Concept*, Center for Strategic and Budgetary Assessments, May 2010 <http://www.csbaonline.org/publications/2010/05/airsea-battle-concept/>.

that it would place emphasis on space control.[55] The Administration's 2001 "Quadrennial Defense Review (QDR)" recognized that space control had the potential of becoming a key objective of future military competition.[56] On the other hand, while the Obama Administration is not as keen to use the term "space control" as the previous administration,[57] President Obama places greater emphasis on space situational awareness (SSA), which lays the foundation of space control, and the free utilization of outer space by the U.S. and its allies.[58]

As examined above, the debate within the U.S. since the end of the Cold War has revolved around how space systems can contribute to wartime military engagements. In this context, military operations since Operation Desert Storm have proven that space systems offer extremely high military value in terms of C4ISR. At the same time, as the perceived value of space systems increases, the view that space control should be acquired as a prerequisite of the utilization of outer space is gaining ground.

The Future of the Debate — The Future of the Control School and the Potential of Outer Space as the High Ground

Today, space systems have become an indispensable part of U.S. military activities. On the other hand, a military engagement in outer space, or a power projection from outer space, has never taken place. In contrast to land, sea or air, the role of space has only been ancillary. Discussed below is how the argument of the control school and debate over the utilization of space as the high ground will progress in light of the ongoing changes in the strategic environment.

The Future of the Control School

In the current situation, it is not necessarily the case that the views of the control school will continue to gain traction. As discussed earlier, in the midst of the increasing reliance on the use of outer space, the U.S. recognizes that it is imperative that the free utilization of outer space by the nation and its allies is maintained.

On the other hand, the renewed recognition of the vulnerability of space systems has given rise to the view that it is difficult to maintain consistent utilization of outer space. Space debris, which has increased in volume following the 2007 Chinese ASAT test and the 2009 U.S.-Russia satellite collision, poses challenges to the operation of military satellites.[59] Additionally, it is generally believed that in outer space, offense is more advantageous than defense, and therefore, the

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55 Refer to the following reference for more details: Yasuhito Fukushima, "*Uchu Riyo no Kakudai to Beikoku no Anzenhosho: Uchu Contororu wo Meguru Giron to Seisaku* [The Proliferation of Space Capabilities and its Impact on the U.S. National Security: Focusing on the Issue of Space Control]," *The Journal of Strategic Studies*, Vol. 9, March 2011, pp. 23-38.

56 U.S. Department of Defense, *Quadrennial Defense Review Report*, September 30, 2001, p. 7.

57 The Obama Administration's QDR does not reference space control. U.S Department of Defense, *Quadrennial Defense Review Report*, February 4, 2010.

58 Refer to the following reference for more information: Yasuhito Fukushima, "*Uchu Kukan de Gunjitekina Chosen wo Ukeru Beikoku: Anmoku no Ryokai no Genkai to Obama Seiken no Taio* [The United States Facing Military Challenges in the Space Domain: Limits of 'Tacit Agreement' and Responses of the Obama Administration]," *The National Institute for Defense Studies News*, Issue. 159, November 2011, pp. 1-4.

59 Approximately half of the cataloged objects (those objects registered with the U.S. Space Surveillance Network) in orbit at a height lower than 1,000 km can be attributed to these incidents. The NASA Orbital Debris Program Office, "An Update of the FY-1C, Iridium 33, and Cosmos 2251 Fragments," *Orbital Debris Quarterly News*, Vol. 17, Issue 1, January 2013, p. 4.

protection of satellites from threats such as ASAT weapons, which are quickly becoming common, is limited.[60] As such, the Obama Administration has been strengthening the resilience of mission-essential functions to allow the continuation of missions in a degraded environment, where the utilization of outer space is somewhat compromised.[61] The focus of the initiative is to strengthen the resilience of the entire architecture, including the systems of other domains (land, sea, air), required to complete the given mission. In other words, the Administration is undertaking efforts to establish a readiness to supplement space systems with systems based on other domains.[62]

Furthermore, the view that it is not easy to deny enemy utilization of outer space, which is another point of contention of space control, has become commonly accepted. Using ASAT weapons that can physically destroy satellites in orbit is a difficult option for a country to make, such as the U.S., which relies heavily on the use of outer space. As John J. Klein argues in his book *Space Warfare: Strategy, Principles and Policy* (2006), if a satellite in orbit is destroyed by an ASAT weapon, the impact may not be limited to the targeted satellite alone. Damage may extend to other satellites that travel a similar orbit, including the satellites of the aggressor, as the orbit may be used by numerous actors.[63] The ASAT testing conducted by China in 2007 implied this possibility.[64]

Given this, whether or not the views of the control school will continue to gain traction depends on such factors as the advancement of technology that enables the removal of debris, the repair of satellites in orbit, the swift launch of replacement satellites, and the availability of replacement operated in other domains than outer space.

The Potential of Outer Space as the High Ground

If, hypothetically, the establishment of space control is within grasp, the potential of using outer space as the high ground may become a point of contention. For instance, space-based BMD

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60 David C. Gompert and Phillip C. Saunders, *The Paradox of Power: Sino-American Strategic Restraint in an Age of Vulnerability*, National Defense University Press, 2011, p. 104.

61 U.S. Department of Defense, *Fact Sheet: Resilience of Space Capabilities* <http://www.defense.gov/home/features/2011/0111_nsss/docs/DoD%20Fact%20Sheet%20-%20Resilience.pdf>. The continuation of the mission in a degraded environment has also become an issue in cyber space. Jim Garamone, "DOD Must Train for 'Degraded' Environments, Official Says," *American Forces Press Service*, February 9, 2011 <http://www.defense.gov/news/newsarticle.aspx?id=62750>.

62 For example, the possibility of communications relays using unmanned aerial vehicles to supplement satellite communications and the possibility of positioning and navigation using image gyros to supplement GPS have been discussed. Refer to the following for information about communications relays: U.S. Department of Defense, *Quadrennial Defense Review Report*, 2010, p. 34. Japan-U.S. joint research on the latter is underway. Ministry of Defense, *Nihonkoku to Amerikagatshukoku tonoaidano Sogoboeienjokyotei (MDA Kyotei) ni motozuku Kokukiki eno Oyo notameno Gazo Jairo nikakaru Kyodokenkyu oyobi Dokyotei ni motozuku Kyodokenkyu ni kansuru Aratana Keikaku no Sakusei nitsuiteno Jitshisaimoku Torikime no Teiketsu nitsuite* [A program for the cooperative research on Image Gyro for Airborne Applications and concerning the formulation of additional programs for cooperation research under the Mutual Defense Assistance Agreement between Japan and the United States of America (MDA Agreement)], February 17, 2010 <http://www.mod.go.jp/j/press/news/2010/02/17a.html> However, the objective of the policy currently promoted by the Obama Administration is to decrease the level of dependence on space utilization but not break away from dependence entirely. Space systems have become a vital part of U.S. military activities, and it has become extremely difficult to limit space system utilization to times of peace.

63 John J. Klein, *Space Warfare: Strategy, Principles and Policy*, Routledge, 2006, p. 51.

64 For this reason, the U.S. Department of Defense places greater emphasis on means that are less likely to result in the creation of debris, such as jamming and attacks on ground stations, than kinetic-energy ASAT weapons, which are designed to physically destroy satellites in orbit. Spacesecurity.org, ed., *Space Security 2012*, Project Ploughshares, September 2012, p. 138.

systems are believed to be suitable for intercepting ballistic missiles during their boost phase when detection and tracking are relatively easy.[65] The boost phase is extremely short, meaning that the interception system must be deployed within close proximity of the anticipated launch site.[66] In this sense, space-based systems capable of providing global coverage without violating the sovereignty of other nations are suitable for this purpose.

Currently, nevertheless, the debate is not as fierce as it was in the 1980s. The plans for a space-based BMD system promoted by the Reagan Administration were inherited by George H. W. Bush. However, the following William J. Clinton Administration canceled the program.[67] As ballistic missiles became widespread throughout the world, the George W. Bush Administration once again promoted the plan but the Obama Administration later canceled the program.[68]

Whether the debate over the utilization of outer space as the high ground will gain prominence in the long term is dependent on the development of related technologies, among other factors.[69] Space-based BMD systems must be deployed in LEO in order to intercept ballistic missiles because they have, as described earlier, a very short boost phase. However, systems in LEO are unable to remain in a fixed location,[70] unlike satellites in geostationary orbit. Therefore, it is estimated that anywhere from hundreds to thousands of interception systems must be deployed to be ready for launches from any location. To manufacture and launch such a vast number of satellites into orbit is currently both financially and technically fraught with difficulties.[71] Moreover, the practical application of laser weapon technology, which is believed to be a viable candidate for space-based BMD systems, is still a long-term challenge that may not be realized for some time.[72]

Conclusion

Drawing on U.S. Space Power Theory, this paper looked at the developments in the debate over the military value of outer space. The focus of the debate during the Cold War period was how space systems were able to contribute to nuclear deterrence and strategic stability between the U.S. and Soviet Union. Since the Eisenhower Administration, the sanctuary school, which recognizes the military value of outer space in the observation of areas within the boundaries of other sovereign

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65 Ballistic missiles in the boost phase are literally in the process of burning boosters. This phase comes prior to the separation of the warhead and the decoy. For these reasons it is said that detection and tracking are relatively easy. Hideaki Kaneda, *Dando Misairu Boei Nyumon: Aratana Kakuyokushi Senryaku to Wagakuni no BMD* [Introduction to Ballistic Missile Defense: New Nuclear Weapon Deterrence Strategy and Japan's BMD], Kaya Book, 2003, pp. 117-118; Peter L. Hays, *Space and Security*, ABC-CLIO, 2011, p. 75.

66 Kaneda, p. 118.

67 Hays, pp. 70-74.

68 Ibid.

69 On the technical issues of space-based BMD systems, the following was referenced: Union of Concerned Scientists, *Fact Sheet*: *Space Based Missile Defense* <http://www.ucsusa.org/assets/documents/nwgs/space-based-md-factsheet-5-6-11.pdf>.

70 Geostationary orbit occurs at approximately 36,000 km above the equator. Satellites traveling in a geostationary orbit complete one orbit of the earth in the same time that it takes the Earth to perform one axial rotation, meaning that the satellites appear stationary when observed from Earth.

71 For example, 84 satellite launches occurred across the world in 2011, 18 of which were conducted by the U.S. Space Foundation, *The Space Report 2012*, 2012, pp. 70-71.

72 Airborne laser weapons developed by the U.S. Missile Defense Agency successfully intercepted a short-range ballistic missile during testing in 2010. However, development of the weapon was cancelled in 2012. U.S. Missile Defense Agency, *Fact Sheet: The Airborne Laser Test Bed* <http://www.mda.mil/global/documents/pdf/laser.pdf>.

nations, had been the prevailing view of the debate and was also the official U.S. doctrine. However, the inauguration of the Reagan Administration, which implemented the Strategic Defense Initiative, relativized the views of the sanctuary school. In tandem with these moves by the government, the views calling for positioning outer space as the ultimate high ground and the interception of ballistic missiles from outer space were increasingly articulated. Furthermore, as the military value of outer space increased, the idea that space control would become a prerequisite for the utilization of outer space began to attract more attention.

The main point of contention of the debate following the Cold War has been about how space systems can contribute to wartime military engagements. The Gulf War, which has come to be known as the First Space War, saw the rise in the military value of space systems in terms of C4ISR. The U.S. has since maintained its policy of pursing the C4ISR value of space systems in military operations through the 1990s and into the 2000s and consequently space systems have become an indispensable part of U.S. military operations. At the same time, as the perceived value of space systems increases, the view that space control should be established as a prerequisite of the utilization of outer space has gained traction.

Nonetheless, when considering the future path of the debate, space control has a number of issues in terms of feasibility, and therefore, the trajectory of the control school is dependent on the progress of related technologies, among other factors. If the establishment of space control moves within sight, the utilization of outer space as the high ground may become the point of contention. However, various obstacles, including technical challenges, must be overcome before space-based BMD systems and other alternatives can be deployed.

As discussed at the beginning of this paper, compared to land, sea and air, the military value of outer space has not been thoroughly considered. Still, as this paper examined, since the Cold War era, as the strategic environment changed, new military uses and benefits of outer space have been discovered and have shaped today's use of outer space. It is expected that moving forward the debate will take on new dimensions in parallel with various developments, including policy changes and advancements in technology.