Space Power and Trajectory of U.S. Influence in Space

Takuya Wakimoto

Takuya Wakimoto is a M.A. student in International Science and Technology Policy program at the Elliott School of International Affairs. Before pursuing a master's degree, he worked in the aerospace division at IHI Corporation in Japan for more than four years, where he gained expertise about how national defense policies affect the industry. He has interned at the UN's International Civil Aviation Organization in the Air Navigation Bureau as a commercial space policy researcher and at the Hudson Institute in the Center for Political-Military Analysis as a non-resident researcher. He has a bachelor's degree in Policy Studies from Kwansei Gakuin University Japan.

ABSTRACT

The United States has utilized the space domain to enhance national security and to improve national prestige. However, a growing number of governmental and commercial participants in the space domain are creating complications and increasing risks such as collisions with space objects or debris. This trend pressures the United States to find ways to protect and preserve its valuable assets in space. It is, therefore, necessary for the U.S. to acquire capabilities to manage and control the space domain. Historically, control of a domain was pursued through military capabilities such as sea, air, or land powers; however, space power is yet an undefined concept. This article explores the historical development of space technologies in the context of national security, how we should approach the undefined concept of space power, and the policies the U.S. should pursue to advance its interests in space.

INTRODUCTION

Recent announcements by the United States government have pushed forward long-stalled conceptual discussions on space power. The Trump administration's 2017 National Security Strategy made it clear that the U.S. "considers unfettered access to and freedom to operate in space to be a vital interest."[1] The U.S. Missile Defense Review released in January 2019 reveals a growing interest by the Department of Defense to deploy space-based interceptors in the future.[2]

President Trump's fourth space policy directive (SPD-4), issued in February 2019, cements the desire to create a "space force" to oversee U.S. military space activities.[3] While these developments signal the U.S.' increasing defensive and offensive capabilities in space, they don't provide us with a definitive space force doctrine or stance on space power itself. Policy makers, military officials, and scholars are left to their own tools to define the concept of space power, and answer questions such as: What is space power? Is space power akin to air, ground, and sea powers? How should the U.S. act in this sector in the future? This article reviews these discussions on the nature of space power and analyzes how the U.S. should handle its security objectives in space.

RECENT U.S. EMPLOYMENT OF SPACE CAPABILITY IN MILITARY

Development of space capabilities has been a part of the U.S.' strategic planning since the Eisenhower administration. The primary national security purpose for using space technologies was to conduct surveillance on a potential adversary: these systems were used to gather information from space and transmit them to ground, and had an important role in strategic planning during the Cold War. For example, the Corona, Gambit, and Hexagon satellite series were developed for photo-reconnaissance. The space-based, infrared Missile Defense Alarm System (MiDAS) and its successor, the Defense Support Program (DSP), satellites were developed to "provide high confidence warning of a Soviet nuclear attack…as early as possible."[4]

Later, the Global Positioning System (GPS) and communication satellites gained more importance in strategic planning as well as real-time military operations. During Operation Desert Storm in 1991, communication satellite systems provided command and control networks between frontline troops and commanders, while GPS networks eased troop movement across the desert.[5] Thereafter, space systems were acknowledged as a crucial component for enhancement of U.S. terrestrial military operations.

Today, space systems have become increasingly important to the U.S. in achieving national security goals. Many aspects of military strategy, such as early warning, intelligence, surveillance and reconnaissance, positioning, navigation and timing, communications, and command and control are now dependent on space systems. As such, it is important to understand how better they relate to the concept of space power.

COMPARISON OF SPACE POWER WITH OTHER MILITARY POWERS

For years, space systems have been deployed in military strategic planning as well as in real-time combat, yet there is no concrete definition or theory of space power. Some argue that it is too soon to theorize about space power, citing that Alfred Thayer Mahan and Carl von Clausewitz developed their respective theories on sea and land power only after several thousand years of human experience in these domains.[6] Others suggest the difficulty of theorizing space power stems from the peculiar physical condition of outer space, as well as the fundamentally unique capabilities of space systems compared to conventional military powers. Scott Pace, current Executive Secretary of the National Space Council, states that "[s]pace-based forces lack widely accepted military doctrine, which is not the case for land, sea, and air forces. Part of the challenge is that space systems do not directly represent 'hard' or traditional military capabilities. Rather, space systems enable these capabilities."[7]

The following section attempts to analyze the contemporary military aspects of space power by comparing space power with other military powers, including sea power, air power, and cyber power. To make a clear comparison, each military power is examined at three mission levels: domain control, enforcement, and application.

SEA POWER AND SPACE POWER

Sea power is often used to gain maritime control, which involves ensuring a nation's free access to high seas and deny adversaries' access to the littoral zone.[8] As an instrument of military operations, sea power provides an important force enforcement capacity that enables transport of military troops, logistics, and communication channels for land warfare much faster and more easily than relying on land transport. Sea power is also used in force application, for instance, through guiding precision munitions.[9] From a defensive perspective, the force application capability of sea power is used to protect the territory against invasion from the ocean.

AIR POWER AND SPACE POWER

Similar to the concept of sea power, one of the goals of air power is to achieve air control (or air supremacy) to protect a nation's airspace and deny adversaries' access to airspace, if necessary.[10] A force enforcement aspect of air power is that aircrafts can transport troops and logistics faster than sea or land transportation. A force application capacity

of air-power is that it can "[shoot] down enemy fighters in air-to-air combat, [attack] enemy air bases and [suppress] enemy air defenses."[11] Moreover, as Benjamin Lambeth suggests, "airpower now does most of the actual killing before launching any land invasion."[12] These force enforcement and application aspects of air power are vital for military operations.

Moreover, air power has become indispensable for enabling command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) capabilities during pre-conflict and conflict phases.[13] It is often difficult to build communication infrastructure at the frontlines but aircraft act as communication hubs that allow soldiers to communicate and coordinate with commanders. In addition, given their high-altitude capabilities, air power is less concerned with line-of-sight restrictions compared to land or sea powers.[14]

CYBER POWER AND SPACE POWER

Unlike sea or airspace, controlling cyberspace is difficult because it does not consist of a physical domain; rather, it is conceptually unlimited and reproductive.[15] Instead of considering cyberspace as a controllable domain, cyber power can be analyzed in the context of assuring one's access to "open and closed networks"[16] and to protect said networks from adversaries. Cyber power cannot transfer tangibles in its own right, but can be used as a tool to transfer and manage information for "military administration, personnel management, medical care, and logistics."[17] Importantly, most C4ISR operations are implemented via cyberspace; in other words, cyber power is integrated into all military operations.[18] Cyber power also has a force application capacity. It can destroy or degrade adversaries' military equipment, facilities, or communication networks by attacking their cyber networks.[19]

RESULTS OF THE COMPARISON

Each form of military power has a force application capacity. By contrast, only space power lacks force application capacity. While we have seen maritime and air warfare, and experienced cyber-attacks, the same could not be said for space: "no nation has tried to seize or mount destructive attacks against the operational satellites of another."[20] A space-based missile defense system could enhance force application capabilities of space power, but the technology does not yet exist. Without technological advancement, it is unlikely for space-to-space battle to occur in the future.

While space power generally does not have the function to attack adversaries yet, it has strong force enforcement capabilities. Well-equipped space systems can enhance C4ISR capabilities even less hindered by distance

or topography than fighter jets. While space power currently cannot transport troops or logistical equipment, it can enhance these military operations by providing "geodesy, weather, communications, navigations, early warning and attack assessment, and surveillance and reconnaissance" services.[21] As Watts observes, "[f]or the United States, the military value of orbital systems rests almost exclusively in force enhancement rather than force application."[22]

Overall, the attributes of all military powers are similar because they are used to assure freedom of access to the respective domains while prohibiting action by adversaries. This attempt to control a domain is similar to what the U.S. is attempting to achieve in space. The U.S. Space Command's *Long Range Plan: Implementing USSPACECOM Vision for 2020* defines "space control" as "the ability to assure access to space, freedom of operations within the space medium, and an ability to deny others the use of space, if required."[23] The U.S. National Security Space Strategy states that "access to these [space system] capabilities must be assured" in order to execute the National Space Policy.[24]

MILITARY POWERS	MISSION LEVELS		
	CONTROL OF DOMAIN	FORCE ENHANCEMENT	FORCE APPLICATION
SEA POWER	-Assure free access and denial to adversary, if necessary	- Transport of goods, logistics and troops	- Physical force: Precision strikes - Sea-to-sea battle
AIR POWER	- Assure free access and denial to adversary, if necessary	- Transport of goods, logistics and troops - Relay of information: C4ISR	- Physical force: precision strikes - Air-to-air battle
CYBER POWER	- Non-controllable domain - Assure access to "open and close network" and protect these networks from adversaries	- No transport of goods - Relay of information: C4ISR	- Non-physical force: degrade, damage adversaries' electronic devices
SPACE POWER	- Assure free access and denial to adversary, if necessary	- No transport of goods - Relay of information: C4ISR including geodesy, weather, navigations, early warning and attack assessment services	- Non-physical force: degrade, damage adversaries' electronic devices - Physical force: not yet achieved, but eventually Anti-satellite weapons (ASAT) or space-based Ballistic Missile Defense (BMD).

TABLE 1: COMPARISON OF MILITARY POWERS BY MISSION LEVELS

IMPORTANCE OF SPACE POWER AND ITS LIKELY TRAJECTORY

Space systems play a significant role in achieving military objectives and national security goals. The Trump administration's National Security Strategy released in December 2017 re that the United States "considers unfettered access to and freedom to operate in space to be a vital interest" and will "preserve

peace through strength by rebuilding our military" including strengthening space capabilities.[25] General John E. Hyten, commander of the U.S. Strategic Command, suggests that without space assets, "you go back to World War II... or industrial age warfare."[26] However, high dependence and increased demands on space systems also accentuates the vulnerabilities of U.S. space systems, which remain susceptible to hostile actors' denial-, disruption- or destruction-oriented actions. For example, U.S. assets are not protected against anti-satellite (ASAT) weapon attacks. Koplow suggests that "prolonged interruption of satellite services could now have grave consequences."[27] How should the United States deal with this vulnerability?

The United States is the largest investor in space systems across the civil, commercial, and military sectors. According to a report from Euroconsult, the U.S. government's expenditure on space programs in 2016 was approximately $35 billion, which accounted for about 58 percent of global government expenditures on space systems.[28] Although it is difficult to separate military expenditures from aggregate spending as space systems are inherently dual-use, this large expenditure gap -- seven times the combined spending of Russia, China, Japan, and the European Union -- illustrates how critical space systems are to the United States. This *status quo* also implies why the United States is keen to protect its space assets.

THE 3CS: IMPLICATIONS FOR U.S. SPACE POWER

The U.S. has been taking measures to mitigate risks from two perspectives: as a user of the space environment and as a seeker of space dominance. As a user of space environment, the U.S. concerns center around the so-called 3Cs: the Congested, Contested, and Competitive nature of the space domain. The 2010 National Space Policy[29] and the 2018 Space Policy Directive-3[30] address the challenges posed by 3Cs and urge responsible actions from each country to prevent mishaps and protect the space environment.

As a seeker of space dominance, the U.S. considers superiority in the space domain vital for defending America. From a national security perspective, various scholars have suggested that U.S. military operations would dramatically decrease in efficiency if space systems were degraded or disabled: "the U.S. military is not currently superior to its potential adversaries because it has stronger soldiers, bigger guns, or more tanks. Rather, it has the upper hand because it can better understand what is taking place in the midst of conflict, what its own forces are doing, and what those of an enemy are doing amidst the 'fog of war' using space systems."[31] Space systems are being increasingly relied upon by the military, and this trend will continue.[32]

The 2001 Rumsfeld report concluded that the U.S. is not prepared to

defend its enormous dependence on satellites -- and it remains true today.[33] In dealing with the vulnerability, the United States' 2018 National Space Strategy explicitly states that the U.S. space system should enhance its resilience, defensibility, and ability to reconstitute and restore lost capacities in order to retain and harness the strength of U.S. national security.[34] Moving forward, Trump administration's approach, as elucidated in the SPD-4, is to consider space as a warfighting domain[35] and establish a separate Space Force.[36]

In order to protect assets, pursuing innovative and stronger space power will remain of vital importance for the United States. Among other things, the impact of commercial activity in the space domain will grow in coming decades. An increasing number of private companies are planning to send thousands of micro-to-small satellites into the Low Earth Orbit – a huge leap from the current worldwide level of 1,800 operating satellites in the orbit.[37] However, from a national security standpoint, this trend will accelerate the concerns around 3Cs in the space environment and create more space debris if not coordinated with respective governments. Additionally, recent research suggests that commercial space companies are driving innovations in this sector and will increase the global market size from an estimated USD 350 billion a year to USD 1 trillion by the 2040's.[38] With these commercial trends in mind, the space domain will become an important economic sphere with commercial interests the United States military would need to protect.[39]

POLICY RECOMMENDATIONS

The United States should continuously pursue and improve its space power not only to ensure its access to space, but to deny access to malevolent space actors.[40] However, attempts to dominate space may end up fostering a harsher 3C space environment, which are already degrading the U.S.' ability to do so.[41] When the space age began, only a few countries had the necessary technology to access space. Today, there are more than a dozen space-faring nations and more than fifty countries operating satellites. Globally, more commercial companies are finding business opportunities in or from space. An increasing number of participants in space means a higher presence of countries and commercial companies capable of conducting malevolent actions (e.g., jamming, cyberattacks and direct ASAT) targeted at U.S. space assets.[42] To preserve the ability to access outer space, while denying access to malevolent actors in the 3Cs space environment, the U.S. should promote international cooperation, especially with regard to information sharing. As it currently possesses the greatest space power capacity, the U.S. government could take the lead in promoting international cooperation and encourage information sharing among major players in this domain. Streamlining domestic regulatory

frameworks for commercial space activities will make it easier for other countries and commercial players to find practical ways to cooperate with the U.S. Furthermore, international cooperation and regulation would also increase the grounds upon which U.S. and other top players could deny rogue elements' access to space. A limitation of this policy strategy would be the degree to which international cooperation is possible, especially given the limits of trusting foreign satellites in military operations.[43]

Involvement of the commercial space sector is necessary to forge innovative solutions and develop advanced technologies in the space domain. However, heavy reliance on the commercial sector would be risky as profit-seeking commercial companies are driven by market factors and not necessarily national security concerns.[44] With this in mind, future studies should explore ways to balance the degree of international cooperation and domestic programs with public versus private interests.

As the National Space Strategy implies, robust international cooperation will be a catalyst for burden-sharing and create a cooperative environment to survive against threats. Freedom of access and the use of space can be pursued not only by seeking better national space-power capacity, but also by promoting international cooperation to offset vulnerabilities.[45]

ENDNOTES

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