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FUTURE WAR PAPER

Spacepower: Weaponizing Space to Advance American Military Dominance

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OF THE REQUIREMENTS FOR THE DEGREE OF
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I. INTRODUCTION

The space environment is vital to the current American way of war and will exponentially increase in importance moving into the future. Space systems give the United States unequalled advantages in communications; command and control; intelligence, surveillance and reconnaissance (ISR); positioning, navigation and timing (PNT); and environmental monitoring.¹ These capabilities directly contribute to America's warfighting dominance – a dominance driven by the ability of the United States (U.S.) to project joint combat power anywhere in the world, maintain all-encompassing information and awareness, and conduct effective command and control better than any other military force in the world. The space environment and its assets are a critical source of strength for the U.S. military to the point that the United States must have unfettered access to, and freedom of action in space in order to deter, defend and wage offensive war against adversaries from a position of advantage. Even with all the capabilities and advantages provided by and through space, the United States has yet to realize or exploit the space domain to the fullest extent possible and must now move forward in order to advance its military dominance in the future.

Despite its importance to the U.S. military, there are inherent problems with space that make it an uncertain and unexploited domain. First, space is increasingly becoming congested, contested, and competitive.² Technological advances, international competition, and reduced barriers to entry have enabled an increasing number of states, adversaries, and commercial entities to enter, operate, influence, and challenge the United States in space. Second, U.S. space systems currently have minimal protection and are highly vulnerable to disruption and attack.³ For example, some current military assessments assert that almost every U.S. satellite in orbit can be threatened.⁴ This vulnerability to the United States has been identified by adversaries

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such as China and Russia, and raises questions about securing and protecting what is a strategic source of strength for the United States.⁵ Third, international treaties, conventions, and agreements that govern the use of space were developed during the Cold War; therefore, they are outdated and reflect a vastly different world than that which currently exists in the 21st century based on technological advances, the rise in commercial space activities, and a new multi-competitive world order.⁶ Fourth, the United States has been, and still is the preeminent space power in the world and currently maintains an advantage over its adversaries through its technology, systems, budgets, and experience.⁷ While this is positive, it has had a potentially negative side effect in that it has created complacency in the United States where focus and prioritization of space has decreased and presented openings for other states, to include adversaries, to take advantage of.⁸ All of these factors, along with the fact that space is misunderstood and uncertain have left U.S. policy towards space unclear, slow to adapt, and unexploited for military purposes.

In the midst of this confusion, uncertainty and risk, a military opportunity emerges in outer space. This opportunity stems from the premises that space is vital to waging modern war, military forces that control space have a tremendous warfighting advantage, the weaponization (deployment of weapons) of space is inevitable, the future operating environment will be competitive and chaotic, and U.S. terrestrial military advantages are diminishing.⁹ Therefore, the United States should exploit its current superiority in space by being the first nation to weaponize the domain by deploying space weapons, establishing the capability to control activities in space by force, and by setting-up a new international framework for outer space in order to advance America's military dominance into the future. To effectively support the assertion that the United States should weaponize space and will gain significant military

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advantages from doing so, it is necessary to first go over the basics of military operations in space, then focus on how to weaponize space by providing evidence and a vision for future space warfare, and lastly, assess the implications of a weaponized space domain for future warfare.

II. MILITARY OPERATIONS IN SPACE

What constitutes space? What is the difference between militarization and weaponization? What are the types of orbits and what impact does that have on military capabilities? Because space is relatively unfamiliar to military professionals that do not have a specific background in space operations, it is necessary to go over some basic definitions, principles, and mission areas in order to establish a baseline prior to discussing the specifics of weaponizing space and future space warfare.

The space domain is defined as the area above the altitude where the atmospheric effects on airborne objects become insignificant.¹⁰ There is no physical boundary that separates the atmosphere from space as there is between land and water, and there is no firm consensus, either in international law or from the United States, on where space truly begins. To overcome this lack of consensus and provide some clarity, one view is that space begins approximately 93 miles above the earth's surface, which is the closest point to the earth where space vehicles are able to orbit.¹¹ The four primary orbital categories used by the military are: Low Earth Orbit (LEO), which is the closest to Earth and orbits up to 1,000 miles above the Earth's surface.¹² Medium Earth Orbit (MEO), which orbits in between 1,000 to 22,000 miles above the Earth's surface.¹³ Highly Elliptical Orbit (HEO), which orbits over 25,000 miles above the Earth's surface.¹⁴ Finally, Geosynchronous Earth Orbit (GEO), which orbits in synchronization with the Earth's rotation and is approximately 22,236 miles above the Earth's surface.¹⁵ Orbital characteristics are relevant to military operations because the altitude affects coverage area,

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coverage timing, resolution, ability to be jammed or disrupted, signal strength, and radiation levels.¹⁶ Orbital characteristics also are important for discussions concerning the weaponization of space and space control, as these orbital characteristics determine what space assets can accomplish for specific mission sets.

Militarization of space is defined as the military use of space-based assets to enhance and facilitate military operations. Weaponization of space is defined as the deployment of weapons to space that have destructive capabilities for use against space or terrestrial targets.¹⁷ The distinction between the two terms is important because space has been militarized – the deployment and use of satellites for military communications, command and control, ISR, environmental monitoring, PNT, and missile defense warning – starting during the initial stages of the space race in the 1950s, whereas weaponization of space has still not yet occurred. The main reasons that militarization has occurred, but weaponization has not, is due to the international framework for space that was established at the start of the Cold War and is still agreed upon as the rules governing the use of space to the present day.

While there are many international treaties, conventions, charters, and agreements that have contributed to the current set of laws governing the use of space, the three most important in terms of shaping modern U.S. space policy are the 1947 United Nations Charter, the 1967 Outer Space Treaty (OST), and the 1963 Limited Test Ban.¹⁸ The key points from these agreements that continue to shape space policy are: space is an open domain and available to all nations, space is intended for peaceful purposes, and Weapons of Mass Destruction (WMD) are prohibited from being placed in space.¹⁹ These documents were written during the Cold War where the United States and Soviet Union were the primary nuclear and space powers in the world. These documents seem so outdated they may not be relevant, but the *National Space*

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Policy of the United States of America from 2010 and the recent fact sheet from the *National Space Strategy* from 2018 affirms many of these same principles of openness, transparency, peacefulness, and cooperation over competition that were present during the Cold War.²⁰ The point of discussing these laws and agreements is to provide insight into the history and thought processes that have driven policy with respect to military operations in space and why space has been militarized, but not yet weaponized.

Within the framework of international law and national policies, there are ten primary military space operations and associated capabilities for the U.S. military: space situational awareness, space control, PNT, ISR, satellite communications, environmental monitoring, missile warning, nuclear detonation detection, spacelift, and satellite operations.²¹ Space situational awareness is critical to space operations and refers to the knowledge and understanding as to what is occurring, and what will occur, in the space-operating environment.²² This includes all physical, virtual, informational, and human activities that impact the space environment, or will impact the space environment.²³ Space situational awareness is maintained through integrated and layered collections assets both in space and on Earth to ensure an accurate picture of the operating environment in space is maintained and predictive capabilities are enhanced.²⁴

Space control refers to the ability to employ Offensive Space Control (OSC), Defensive Space Control (DSC), and Navigation Warfare (NAVWAR) to “ensure freedom of action in space and, when directed, defeat efforts to interfere with or attack U.S. or Allied space systems.”²⁵ Space control moves into the kinetic realm, but does not specifically discuss the weaponization of space to accomplish the stated objectives of space control.

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PNT refers to operations that provide continuous access to precise and reliable geolocation, navigation, and time reference services that are vital to modern military operations.²⁶ Ensuring access to accurate PNT services is accomplished through protection and active cyber operations, space operations, and electromagnetic warfare operations.²⁷

Space-based ISR assets synchronize and integrate “sensors, assets, and systems for gathering data and information on an object or in an Area of Interest (AOI) on a persistent, event-driven, or scheduled basis.”²⁸ Space-based ISR capabilities include strategic early warning, targeting analysis, battle damage assessment (BDA), enemy threat capability assessment, high-resolution imagery and provide collections capabilities that cannot be obtained on the ground, sea, or in the air.²⁹

Satellite communications provide beyond line of sight, worldwide communications coverage from the strategic to tactical levels. Satellite communications assets contribute to enhanced situational awareness, flexibility, and speed and provide U.S. decision makers with command and control capabilities that are global, persistent, and independent of terrestrial based communications architectures.³⁰

Environmental monitoring from space based systems enable weather forecasts and environmental impact assessments on both friendly and enemy operations and also provide for the collection of environmental data and effects in remote or hostile areas where data cannot be obtained through terrestrial based systems.³¹

Space-based missile warning systems provide early warning of hostile attacks against the United States or allies through persistent overhead sensors. This detection capability contributes to deterrence, and national and military decision-making.³²

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Similar to missile warning, space-based assets give the United States the capability for persistent, global, integrated sensor coverage to identify and gather data in the event of a nuclear detonation anywhere in the world.³³

Spacelift is the capability to deliver satellites, equipment, personnel, and other objects into space and is a critical component to assured access and freedom of action in space.³⁴

Satellite operations refer to the capability to maneuver, sustain, and operate on-orbit assets. Satellite operations are critical to the “movement and maneuver, protection, and sustainment of space based assets.”³⁵

Now that a basic foundation for analysis about current and future military operations and capabilities in space has been established, it is appropriate to lay out how the United States should exploit its current superiority in space, weaponize space, and advance American’s military dominance well into the future.

III. WEAPONIZING SPACE

In order to exploit the military opportunity presented by space and advance America’s military dominance well into the future, the United States should treat space like the vital source of strength that it is and develop and deploy powerful capabilities to protect, control, and dominate the domain – just as the United States has done on land, in air, and sea. To accomplish this, three steps need to be taken: first, the U.S. should take the initiative and act first. The nation that acts first to weaponize space will reap the rewards of such bold action and immediately gain a position of dominance relative to adversaries. With space systems so critical to future warfighting success, it is unrealistic to think that space will not be targeted, or be a domain of conflict. As the Commission to Assess United States National Security Space Management and Organization (The Rumsfeld Commission) reported:

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“Every medium of transport – air, land, sea – has seen conflict. Space will be no different...Explicit national security guidance and defense policy are needed to direct development of doctrine and concept of operations for space capabilities, including weapons systems that operate in space and that can defend assets in orbit and augment current air, land, and sea forces. This requires...a greater range of space capabilities.”

Competition and conflict in space are inevitable; therefore, the first step to exploiting the advantage of space dominance is to be the first to seize the opportunity and weaponize the domain before adversaries do so.

Second, the United States should deploy weapons to space that have destructive power, the capabilities to execute space-to-space and space-to-Earth attack profiles, and are part of a resilient system of hardened assets that are highly survivable and maintain sustainability in conflict. By deploying weapons to space, the United States will set conditions to enable space interdiction, space control, and the ability to seize and dominate LEO to create significant military advantage in space and on Earth. There are various options for future space weapons like Kinetic Energy Weapons (KEW), Directed Energy Weapons (DEW), microsatellites, and swarming technologies. KEWs destroy targets in space or on Earth by delivering mass using kinetic energy of their own velocity, or the stored chemical energy of conventional explosives.³⁶ An example of a KEW is the hypervelocity rod bundle system – sometimes referred to as “Rods from God” – that consists of tungsten rods dropped from space that can generate velocity up to ten times the speed of sound.³⁷ DEWs destroy targets using energy transmitted at the speed of light over long distances and can be used to jam, lase, or obliterate targets.³⁸ Examples of DEWs are high-energy lasers and microwave weapons.³⁹ Additionally, the potential exists to take advantage of emerging technologies to develop microsatellites and swarming capabilities to add additional space weapons to the mix.⁴⁰ Space weapons under development and in the future provide numerous benefits when compared to conventional weapon systems such as: access and

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reach, rapid response time, effective ranges, and difficulty for adversaries to defend against these space-based capabilities. The point is that unique capabilities exist, should be prioritized and developed further, and the United States should take on the role of global leader in space by developing and deploying destructive weapons into space.

The third action the United States should take to exploit the military opportunity presented by space and advance America's military dominance well into the future is to take the lead and restructure the international framework on operations in space. The current legal framework is outdated and reflects a world that does not exist anymore. Similar to the post-World War II period, the United States must use its current position as the primary space power to update the international legal framework to reflect a competitive, chaotic world where adversarial superpowers want to destabilize the current balance of power and do not follow established rules and norms. The United States must revise the legal framework for space in order to protect assets and long-term interests, get international backing to weaponize space, and deter hostile actions from adversaries. The key take-away from this step is that the United States maintains its global leadership with respect to international laws and norms, takes on the role of defending space for like-minded democratic nations and allies, and takes appropriate actions in advance to adapt to the future operating environment and protect its interests - just as the United States has done on land, sea, and in the air.

To effectively support the assertion that the United States should weaponize space and will gain significant military advantages from doing so, a vision of future space warfare that is credible, identifies potential risks and opportunities, and highlights the importance of space for all military professionals will be valuable.

IV. VISION FOR FUTURE SPACE WARFARE

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The year is 2040. Earth is a multi-polar world with Countries X, Y, and Z all being peer competitors of the United States. Additionally, multiple non-state actors and groups pose threats and contribute to destabilization around the world. Countries X, Y, and Z have all achieved military parity with the United States in technology, global command and control, and air and naval superiority. Countries X and Y both have significant advantages compared to the United States in terms of sheer numbers of forces, fires assets, and high-end military equipment. The United States is viewed as a soft, declining power that is more and more capable of being disregarded, influenced, and isolated by Countries X and Y. However, despite certain disadvantages, the United States prioritized the space domain over the previous 25 years, and while its adversaries were developing and modernizing terrestrial military capabilities, the United States greatly extended its dominance in space-based systems and the space environment. The United States established a Space Corps as an independent branch within the Department of the Air Force, restructured and modernized the international framework for space operations and coordination, and most importantly, took bold action within this new legal framework and weaponized space by deploying dual-use space systems with extensive military capabilities into the domain. These actions did not happen in isolation and were contested by adversaries. However, through exploiting space as an opportunity and maneuvering effectively to take advantage of the opportunity, the United States achieved a decisive edge and was able to set conditions to be able to dominate space. The United States took these actions to weaponize space after Countries X and Y continued to jam, interfere, and intercept data from commercial and military satellites despite repeated warnings from the United States and international community that such behavior would not be tolerated. Thus, the United States weaponized space

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in the name of protecting space sovereignty and freedom – for itself and other peaceful nations around the world.

On Earth, Country X, acting aggressively, conducts a pre-emptive attack that threatens vital U.S. national interests. Seeing terrestrial conflict as pitting U.S. weaknesses against adversary strengths, the United States focuses on space operations where the United States has a distinct advantage and can conduct military operations while balancing escalation by not causing extensive damage to life and property on Earth.

The United States activates its space-based weapon systems for war and conducts an extensive shaping campaign using electronic warfare (EW), KEW, DEW, and microsatellite swarming technology to jam, and engage Country X's space-based assets. Hundreds of miles above the Earth's surface U.S. attacks attrite adversary command and control, ISR, PNT, strategic warning, commercial systems, and weapons platforms in space – effectively making Country X blind, mute, and impotent, while essentially forcing them back to 20th century capabilities and technologies. Before Country X can react to the space-based attacks, the United States effectively targets both space-based and terrestrial Anti-Satellite Weapons (ASAT) and delivery systems. Knowing full well that all peer adversaries have redundancies built into their capabilities and that shaping operations cannot achieve one-hundred percent success, U.S. defensive countermeasures and years of investing into hardening and enhancing the resilience of its space systems ensure that in the chaos and uncertainty of war the United States, even if plans do not go accordingly, will be able to gain and maintain space superiority.

After establishing space superiority and degrading Country X's ability to wage war in space or on Earth, the United States moves to implement space control of LEO. Creating a space blockade, the United States establishes a layered architecture of space-based weapons with EW,

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KEW, DEW and microsatellite technologies in conjunction with terrestrial based weapons and collections assets to prevent any other state from deploying systems, weapons, or assets into space that could interfere with U.S. domination of the space environment.⁴¹ By serving as gatekeeper into and out of space, the United States has the ability to ramp up escalation with space-to-Earth attacks, or ramp down by reducing barriers to space as an incentive to get Country X to do what the United States wants them to do. Having the strategic initiative, the United States can force negotiations, or can choose to continue attriting Country X's military forces until their will is broken and they are compelled to do whatever the United States wants them to do.

The United States decides to consolidate its gains and force negotiations before escalation occurs and the conflict expands. From a position of advantage the United States gets backing from the international community and terminates military operations under the agreement that commercial, economic, and scientific space operations are opened up to the world with the United States maintaining its leadership role permanently controlling access to and from space in the name of peace, stability, and freedom from aggression.⁴² From this position, the United States would not only have the upper hand in military operations in space and on Earth, but could be in the best position to take advantage of gaining space resources, space-based power, and exploring other space interests that can enhance the position and well-being of the United States and world into the future.

This future space warfare vision is intended to highlight how critical the space domain is to future military operations, and show that dominance in space can impact any and all terrestrial military capabilities. This vision is also intended to give military professionals who serve on

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land, sea, and in the air a better understanding of the space domain and why the United States should weaponize space and will gain significant military advantages from doing so.

V. IMPLICATIONS

Space is an uncertain and unexploited domain and this presents a unique opportunity to advance U.S. interests as it looks to the future of warfare. As adversaries are working hard to gain military parity and wrestle influence away from the United States on Earth, the time is ripe for the United States to look to the heavens, the ultimate high ground, and outmaneuver competitors by seizing control of outer space, setting conditions to ensure dominance, and using the space domain as the decisive foundation of power into the future. Space dominance will provide an enduring advantage for the United States for a number of reasons: First, the U.S. military, currently the strongest in the world, relies on unfettered access and freedom of action in space to wage war and protect National interests. By seizing the initiative, weaponizing, and establishing the ability to control space, the United States ensures the ability to protect itself, deter aggressive adversaries, and wage offensive wars from a position of advantage well into the future. Access, freedom of action, and the ability to dominate space are directly related to the ability of the United States to remain the strongest and most lethal military into the future. Second, space opens up tremendous opportunities for new resources, energy sources, business, and economic wealth. As the world's population grows and resources become scarce, it is only natural to seek an untapped, promising environment that could enhance the interests of those on Earth. By seizing the initiative, weaponizing, and establishing the ability to control space, the United States must ensure access and freedom of action in order to take full advantage of space, and to benefit from all the resources and economic opportunities that space has to offer. Additionally, by having military advantage in space, the United States can encourage and protect

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commercial investment and business in space, further giving the United States an edge in technology development and innovation. Space is not only of value for military purposes, but may very well be an economic center of gravity in the future.⁴³ Third, as the information age continues to change almost every aspect of life, space becomes intimately linked with data collection, information processing, instantaneous communications, and cyberspace operations. By seizing the initiative, weaponizing, and establishing the ability to control space, the United States ensures the protection of these vital sources of information and prevents external forces from being able to negatively impact the resources that have become a basic requirement to live, trade, communicate, and do business on Earth. Space provides an alternate method of information traffic and prevents the United States from relying solely on terrestrial architecture. Fourth, as hegemon, global leader of the free world, and most advanced space power in the world, the United States is in the best position to take action and responsibility for the future of space.⁴⁴ Even with the current standing laws governing the use of space, there is uncertainty with respect to space, and uncertainty with respect to certain emerging powers and whether or not they follow any rules at all. The world needs positive leadership in space and the United States is in the best position to provide the effective, tough, non-arbitrary, and efficient leadership that is needed to ensure space is controlled and used for good purposes, not bad.⁴⁵ By seizing the initiative, weaponizing, and establishing a new international legal framework that guides space operations, the United States should take the global leadership role head on and ensure that space is controlled, its interests are secured, and the space domain is safe for economic, scientific, and peaceful development.

Space is going to continue to grow in importance and will have a large impact across all elements of national power and on everyday life in general. As with any source of power, space

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will increasingly be contested and this will lead to conflict. Due to this inevitable conflict, the weaponization of space will eventually occur and the first nation, or actor, to effectively weaponize space will gain a dominant advantage over all others. The United States has been the global leader in space since the Cold War and is in the best possible position to continue that leadership as the world adapts to the information age and future operating environment. The United States must exploit its current superiority in space by being the first nation to weaponize the domain, deploy space weapons, establish the capability to control space through the use of force, and by restructuring a new international framework for outer space. All of these actions will help advance America's military dominance and interests well into the future.

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