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Controlling the Final Frontier: Balance of Power as a Determinant of Military Strategy in Space

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Abstract

What determines a state's grand strategy in space? Through detailed case studies of states with independent orbital launch capability, this study reveals that a state's rational assessment of its threat environment and power distribution vis-à-vis other states compel it to adopt strategies of defense, offense, or a balanced approach. Gaining insight into the motivations driving the adoption of specific strategies in space is essential for guiding policymakers in crafting effective strategies to address and manage future challenges in space. Moreover, detailing the methods and motivations behind states' exploitation of space for their security interests enriches the broader literature on state behavior and security studies. Space strategy has become increasingly relevant as states intensify their efforts to leverage space for national security interests. Since 2005, China has tested eight direct-ascent anti-satellite (ASAT) weapons and, in 2024, abstained from a UN Security Council resolution banning nuclear weapons in orbit. If such devices were deployed and utilized against U.S. assets in space, it would inflict substantial damage on the U.S.'s space infrastructure. Counterspace attacks could cripple critical systems such as GPS, global communications networks, and intelligence capabilities, thereby severely impairing the nation's ability to conduct military operations, monitor threats, and maintain space situational awareness. The deactivation of GPS alone could result in staggering economic losses, estimated at approximately $1 billion per day for the U.S. economy. Meanwhile, the U.S. has adopted a defensive posture by explicitly supporting a ban on direct-ascent ASAT weapons at the UN, investing in constellational satellites, and halting further testing of direct-ascent ASAT weapons. What explains these variations in tactics that states deploy to protect their national security interests in space?

Introduction

In 1903, the Wright brothers successfully tested the world's first powered airplane, marking the dawn of aviation. Forty-four years later, recognizing the growing importance of airpower, the United States established the U.S. Air Force as an independent branch of the military, underscoring airpower's critical role in military strength and solidifying its status as an indispensable pillar of American military superiority. Similarly, in 1958, the U.S. launched its first satellite into orbit, initiating its journey into space. Sixty-one years later, acknowledging the ever-increasing strategic importance of space, the U.S. established the U.S. Space Force as the newest independent branch of the military. Few could have predicted just how advanced and powerful fighter jets would become in the decades following the establishment of the Air Force; the Space Force may be on a similar trajectory of rapid technological and strategic advancement. Contending with these changes in the military landscape requires scholars and policymakers to be acutely aware of how states leverage the space domain for their interests and how these decisions are shaped by external pressures.

Scholarship in the study of space power and military strategy remains a relatively new and underdeveloped field within international relations. Despite growing interest, the field tends to disproportionately focus on a handful of specific themes, while overlooking more theoretical aspects such as the determinants of military strategy in space. Much of the literature is policy-oriented, addressing particular problems within a single state. For instance, Pingrey (2020) examined challenges in forming a space force within the U.S. Army, while Pindják (2016) proposed policies to strengthen the EU's space posture. Other analyses (Overton, 2015; Davenport, 2020; Dolman, 2020; Goodwin, 2023; Bingen et al., 2023) have considered U.S.

strategies for potential space conflicts. Although useful for national security, these studies are limited by their focus on a single state in a single timeframe.

Another approach highlights the history of space programs, particularly the militarization and later weaponization of space. Patil (2017) notes various motivations for space policy, such as national prestige and security, but his work primarily documents state behavior in space rather than explaining underlying motivations. This historical focus is common (Mowthorpe, 2004; Harvey et al., 2010; Harvey, 2019). A third category comprises technical analyses of emerging space technologies and their implications for state interests. For example, the Congressional Research Service studied Iran's space program's impact on its missile capabilities (McCall, 2020), while other works have examined China's satellite system (Sewall et al., 2023) and ASAT capabilities (Moore, 2014; Chow, 2017; Adkison, 2023).

These technological write-ups have limited applicability because they tend to narrowly focus on a single emerging technology, often neglecting to evaluate how that technology integrates with existing capabilities or fits within a broader grand strategy in space aimed at confronting a rival's space power. This limited focus restricts their relevance and fails to provide a comprehensive understanding of the technology's strategic significance. Furthermore, as will be discussed later, the types of technologies emerging in space-faring states are frequently determined by the balance of power, which dictates which kinds of technology require greater investment in light of a rival's capabilities.

Scholars have paid less attention to the determinants of a state's security competition strategy in space, described here as grand strategy.

Theory of Space Strategy

Posen (1984) refers to this grand strategy as "military doctrine"—a framework of ideas setting priorities among military forces and prescribing their structure and use. The study of how states act in response to particular distributions of power or changes to the distribution is a foundational aspect of international relations theory. Regarding the cause of the Peloponnesian War, Thucydides famously concluded that "the growth of the power of Athens, and the alarm which this inspired in Sparta, made war inevitable." The shifting balance of power altered Sparta's strategic calculus, leading to a more confrontational military strategy against the rising Athens. Waltz (1979) expanded on these ideas by exploring how different distributions of power at the system level, such as bipolarity or multipolarity, influence state decision-making processes aimed at protecting their security interests. Waltz demonstrated that the structure of the international system, defined by the distribution of capabilities among states, fundamentally shapes their actions and strategies in their pursuit of security.

Posen's work, *The Sources of Military Doctrine* (1984), serves as a critical reference for this research. He aimed to identify the key determinants of military strategy for France, Britain, and Germany in the interwar period, ultimately concluding that both organizational theory and security competition vis-à-vis the balance of power had significant explanatory value. However, Posen found that security competition theory was a more effective explanation of state military strategy during the interwar period. Modern studies of state behavior continue to use security competition as a key predictor of state behavior and military strategy (Pape, 2005; Mearsheimer, 2014; Allison, 2015; Malik, 2020; Kumar, 2023).

Research on the determinants of security competition strategy in space falls into two main schools of thought: the balance of power and domestic politics. The balance of power perspective (Klein, 2006; Pfaltzgraff, 2010; Klein, 2019) views states and leaders as rational actors formulating policies based on the broader security environment. Pfaltzgraff (2010) highlights realism as a possible explanation for why states act as they do in space, but ultimately fails to present a detailed theoretical framework. Klein (2006, 2019) theorizes that stronger space powers seek offensive advantages, while weaker states adopt a defensive stance until they can transition to offense. However, Klein's framework lacks empirical support or case studies.

The domestic politics perspective (Logsdon, 1970; Manno, 1984; Handberg & Li, 2006) focuses on political decisions and compromises driven by domestic factors as being the primary determinants of strategy in space. Manno (1984) contends that U.S. space policy during the 1970s was primarily focused on enhancing nuclear war capabilities. This strategic direction emerged from extensive deliberations within both the executive and military branches of the government. Handberg and Li (2006) assert that China's space ambitions are driven by domestic politicians seeking prestige and equal status with the U.S. and Russia. Logsdon (1970) states that the U.S. prioritized the moon landing to showcase its democratic system's superiority over the Soviets', reflecting a broader ideology of American Exceptionalism. These studies tend to conflate civilian and military space programs, limiting their analysis of motivations. This paper aims to distinguish between these programs, focusing exclusively on military strategy in space. While the space race of the 1960s captured considerable attention, it is important to note the concurrent existence of a distinct military space program in the U.S. with its own set of priorities. Regrettably, these military objectives were often overshadowed by the public spotlight on lunar missions.

This research aims to enhance the existing literature on security competition and strategy in space through several contributions. First, it expands the scope of traditional security competition domains, which have historically focused on economic, regional, and terrestrial realms, to include outer space. In doing so, this paper builds upon Posen's work on military doctrine (1984) and applies similar analytical frameworks to the space domain.

Second, this research introduces a more robust theoretical framework for categorizing and analyzing a state's capabilities, strategies, and motivations in space. While previous studies have outlined potential strategies adopted by states, my model endeavors to elucidate the determinants underlying these diverse strategies. By employing a decision tree methodology that considers various distributions of power, this approach aims to provide a deeper understanding of the factors shaping state behavior in the space domain.

Third, this research tests its theoretical framework with thorough case studies, spanning diverse contexts and involving two great space powers. Purely theoretical discussions concerning space power and strategy lack real-world grounding, so this approach seeks to bridge the gap between theory and practice. By incorporating empirical evidence, this research endeavors to enhance the accuracy and applicability of the theory.

Finally, this analysis rigorously examines both the competing explanation of domestic politics and the primary explanation of the distribution of power as determinants of state competition strategy in space. While both explanations are deemed significant in both the security competition and space power literature, to my knowledge, no study has conducted a comparative examination of these explanations applied to the same cases.

Theoretical Framework

Domain of Applicability

Contrary to the strategic decisions regarding the establishment of traditional military branches such as the army or air force, not all states prioritize space power as a fundamental component of their military strength. Therefore, this model is confined to explaining the behavior of states that have already attained independent orbital launch capability, thus meeting the minimum threshold necessary to project power effectively in space.

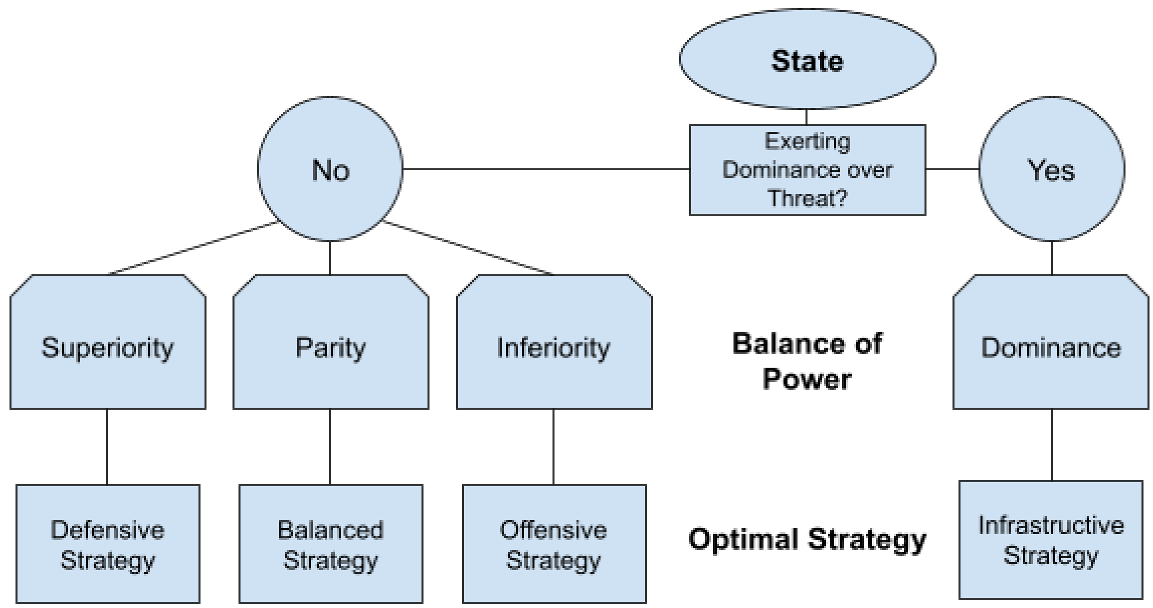
Maintaining independent orbital launch capability as an operational threshold effectively controls for various technological and economic factors that might otherwise influence state behavior in space. States with this capability, as opposed to those with a mere number of satellites launched by others, already encompass significant technological and economic capabilities, ruling out these variables as determinants of state behavior. All states possessing independent orbital launch capability inherently possess the capacity, in the broadest sense, to construct a resilient space infrastructure, defend it, and engage in offensive actions against other states' space assets. While this criterion reduces the number of cases for study, it is essential for isolating the factors driving state behavior from background conditions like GDP or technological capability. Once a state achieves independent orbital launch capability, further increases in economic strength and technological expertise have a diminishing effect on its behavior in space.

Typically, these states belong to the category of great powers such as China, Russia, and the U.S., or regional powers like Japan, India, and Iran. These states possess robust military capabilities and often find themselves confronted with multiple threats stemming from their prominent roles within their respective global or regional systems. These states are not grappling with civil war or significant state fragility; rather, they have stable governance structures and competent bureaucracies. This stability enables them to efficiently allocate resources towards funding expensive space programs, with the aim of gaining a strategic advantage over their security threats.

Balance of Power as a Determinant of State Strategy in Space

The *current* level of a state's space capabilities relative to its security rivals serves as a significant determinant of the specific strategies it employs to achieve its goals in space. Meanwhile, a *change* in the balance of power also has an effect on how a state chooses to invest in its military space program. These state-specific circumstances that dictate military strategy in space can be classified into four grand strategy categories: dominance, superiority, parity, and inferiority. Most states view dominance or superiority as the best end-position for maximizing security and controlling space. This position allows them to freely pursue their objectives in space while preventing rival states from threatening their access. However, the specific path that states follow to achieve this rank in the space hierarchy depends on their current space power relative to other states. Among all the strategies examined below, infrastructive capability serves as the foundation of any successful military space strategy and must be consistently prioritized across the four principal space strategies. In the absence of any infrastructure, no space power can be achieved. Consequently, the distinctions between the following strategies arise from the varying degrees of investment in offensive and defensive assets.

Space Military Strategy as a Function of the Balance of Power



Dominance → Infrastructive Strategy

Dominance in space refers to the situation where a state maintains unparalleled control over the space domain (the physical space 60+ miles above Earth's surface) whereby they can conduct their missions without any potential for losses. This entails exclusive control to such an extent that no other state can threaten its control of space and its ability to leverage space to realize national security interests. States operating from a position of dominance have maximum flexibility to use their monopoly as they please since no state has the ability to challenge or undermine their position in the space domain. The power to exert a monopoly leads the state to persist in its efforts to exploit and expand its absolute control over space. Such a state would be unconstrained in its ability to invest heavily in infrastructive power – launching space-faring rockets and vehicles into orbit; deploying military satellites; conducting intelligence, surveillance, and reconnaissance operations (ISR); facilitating secure terrestrial communications;

deploying satellite-based navigation and position systems; launching and controlling space planes in orbit around the Earth.

None of these manifestations of infrastructive space power are directly capable of attacking or defending other space assets – exploiting monopolized space power emphasizes expanding the pre-existing military infrastructure and logistical support systems. So long as no other states actively develop the ability to diminish the monopoly one state has, there is little reason to invest in defensive measures. Once a state obtains such an ability, the dominance is lost. A monopoly over space also implies that no security threat possesses space infrastructure significant enough to warrant dedicating a substantial proportion of efforts to its destruction, although the dominant space power likely has latent ASAT capabilities should the need arise. Moreover, states that achieve dominance in space likely had to surpass a rival to attain that position. Consequently, these dominant states are likely to have already invested in defensive and offensive strategies as part of their ascent to dominance. However, further increasing investment in these strategies could be considered redundant, as no other state possesses the capability to threaten or challenge their control of space. The natural decision for the state operating from a position of monopoly is to continue expanding its infrastructure and forgo further investments in any defensive or offensive strategy.

Superiority → Defensive Strategy

Superiority in space refers to a state's *significant,* though not exclusive, control of the space domain to the extent that no other state can significantly diminish its control. However, even with this considerable control, security threats still possess the capability to exert influence in space, potentially resulting in losses for the superior state. Nonetheless, these losses do not impede primary missions or strategic objectives. A position of superiority presupposes that, whether in times of peace or conflict, one state will be better positioned to leverage space to its advantage compared to its adversaries, even if the superior state does not possess complete dominance of space. This position recognizes that competing powers often possess comparable, though often less effective, technologies, thereby nullifying any *absolute* advantage a stronger power may have in space. Nonetheless, the superior state will always maintain a *relative* advantage in space power in the aggregate, allowing its space capabilities to yield greater operational success compared to its rival.

However this also means that such a state stands to incur greater losses if its space assets are targeted and destroyed. A state operating from a position of superiority possesses a more extensive infrastructure in space, characterized by a sprawling network of satellites, compared to its adversaries. As such, seeing as how there are fewer satellites to attack than there are to defend, a state operating from a position of superiority will be more likely to prioritize defending its assets in space from aggressive actors. Dominant space powers seek to bolster their hegemonic control through infrastructive strategies, while inferior states employ offensive strategies to diminish a security threat's influence in space. In contrast, the defensive strategies of superior space powers are primarily focused on protecting established gains within the space domain. Defensive strategies may include investing in constellation satellites, which create greater mission redundancy, or establishing enhanced Space Situational Awareness (SSA) capabilities to detect, track, and identify objects in space.[1]

[1] Space situational awareness: "the knowledge, characterization, and practice of tracking space objects and their operational environment. SSA data is used to predict conjunctions between objects and warn space operators of potentially dangerous close approaches to enable collision avoidance maneuvers" (The Aerospace Corporation, n.d.).

Parity → Balanced Strategy

Parity in space means that a state is operating from a position where its space power capabilities are roughly equal to its security threat, meaning no state maintains a decisive advantage from its space assets. For example, if a conventional war broke out between the United States and the Soviet Union in 1965, it is uncertain which state would be able to control space and leverage it more to their advantage to the extent that space could be relied upon as a controlled domain. In this state of affairs, neither country retains enough of an advantage in space power to predict with any confidence which would control space in a hypothetical conflict. The key characteristic of parity is the heightened uncertainty it introduces regarding the outcomes of conflict. In response to this uncertainty, states in parity are motivated to hedge their bets by diversifying their investments across defense, offense, and infrastructive assets. This translates to research and development directed towards offense and defense while still trying to build a robust space infrastructure of satellites and launch facilities that may eventually surpass the enemy state.

Overcommitting to infrastructure investments under conditions of parity can expose vulnerabilities in defense, which adversaries can exploit to their advantage – potentially destroying or disabling satellites with ease. Simultaneously, neglecting offensive measures may enable adversaries to build a more capable system of satellites without fear of retaliation, thereby incentivizing them to expand their capabilities rapidly. Prioritizing offensive measures under parity can successfully prevent other states from leveraging space to their advantage, but it also runs the risk of stretching a state's resources too thin to the point where it cannot effectively build its own space infrastructure. This could ultimately result in a scenario where space access is denied for all involved states. A state would prioritize a defensive strategy only if it already possessed an extensive array of space assets deemed worth defending. It is illogical to defend assets that either do not exist or fail to significantly alter the distribution of power. Therefore, states operating under parity will strive to control the space domain through a gradualistic, balanced approach.

Inferiority → Offensive Strategy

Inferiority in space means that a state is operating from a position where its space power capabilities are considerably less than its security threat, meaning its opponent maintains a decisive advantage from its space assets. If a state's security threat holds a substantial or absolute advantage in space power, the weaker state will move to increase its investment in offensive measures. This offensive strategy aims to diminish the stronger state's influence in space, thereby hastening the narrowing of the gap between their respective space capabilities and comparative advantages.The weaker state acknowledges the vulnerability of any substantial space infrastructure it deploys, understanding that in the event of conflict, it would likely be swiftly targeted and neutralized by the dominant state's limited, but sufficient, offensive capabilities. Therefore, its objective is not to immediately outmatch its adversary's power in space but rather to be equipped to disable or destroy a significant portion of its rival's space infrastructure. Though it may still establish space and ground-based radars to maintain SSA, the primary focus will be on prioritizing offensive capabilities.

As long as the security threat maintains a decisively superior infrastructural advantage, the aspiring challenger faces limited prospects of leveraging space to gain a strategic edge over this threat. In this scenario, the rival state not only possesses all the infrastructural capabilities of the lesser space-power state but surpasses them by a considerable margin in each aspect.

Assuming a continued rate of investment in space power by the superior space state, it will be exceedingly challenging for an ascending space power to effectively wrest away the advantage. Achieving such a process would be a lengthy endeavor, spanning many years, and would require an investment two or three times greater than that of the dominant state. The long-term objective is not merely to catch up but to surpass the space capabilities of the dominant state. Therefore, the weaker state will emphasize developing its capacity to attack and reduce the dominant state's superior space infrastructure. When one state has already surpassed another in development and intends to continue building at a similar or faster pace than the challenger, a more expedient approach is to strategically dismantle the opponent's existing infrastructure rather than attempting to catch up. Hence, an offensive strategy becomes the primary approach whereby destroying segments of the rival's space infrastructure creates an opportunity for the weaker space state to begin exerting greater control of space.

Methods

The overarching method in this analysis is to test the previously developed theory across three longitudinal case studies: the United States during the early space race, the United States in the 21st century, and China in the 21st century. This approach involves evaluating evidence that supports my theory while also outlining and refuting evidence for the competing theory of domestic politics. In each case study, I use process tracing to demonstrate how changes in the independent variable, the balance of power, leads to changes in the dependent variable, military strategy in space. Changes in military strategy are conceptualized as the short-term adoption of additional military capabilities that persist as long as the security threat remains. As such, broad aggregate measures of military power like a state's defense spending are but a piece of how military strategy is measured in this paper.

Military strategy in space is both qualitatively and quantitatively measured across the three case studies via several interconnected components. Posen (1984) assesses military strategy through a state's force posture, and given the recognition of his work as a significant contribution to the field, this study will adopt a similar approach. Posen outlines three broad categories for which doctrines can be classified – offensive, defensive, and deterrent. However, in the specific domain of space, I am categorizing military investments, and therefore strategy, as offensive, defensive, or infrastructive. Offensive assets aim to disable or destroy an opponent's space capabilities, defensive assets aim to protect a state's existing space assets, and infrastructive assets aim to establish a state's presence in space.

The cases selected reflect periods of intense security competition in space by the most powerful actors in space. An intense security competition is characterized by significant political and military preparations in a given domain for potential conflict among rivalrous states, driven by the goal of defending national interests against perceived threats (Mearsheimer, 2014). Meanwhile, a low security competition environment is marked by increased collaboration, diplomacy, and cooperation to address mutual concerns. The case selections were made for several reasons. When there are changes in the level of security competition, different military strategies emerge as a function of different distributions of power. Examining periods characterized by low security competition or where competition is directed towards other domains besides space does little to clarify the determinants behind security competition strategies in space, given that security competition is a prerequisite for this analysis. The theory presented in this paper is only applicable in contexts where there is active security competition in space. However, it does not aim to explain the factors that lead to the emergence or decline of security competitions in space.

Moreover, this paper concentrates on the most active actors in space, as they present the highest security risk to others operating in the same domain. Each of the selected states has a history of investing significantly in space power to enhance their competitive edge over perceived security threats. Moreover, the substantial funding behind these actors' space programs provides researchers with ample data to delve into, offering a rich source of information to uncover the determinants of military strategy in space. Given their larger budgets, these programs receive more attention from government officials, facilitating relatively greater publicility and making it easier to discern the motivations behind specific actions.

The case studies of the U.S. explore two distinct time periods: the mid-1950s to the mid-1960s, marked by the U.S. achieving space parity with the Soviet Union, necessitating a balanced strategic approach; and the 21st century, characterized by the resurgence of great power competition, particularly with China emerging as a rival. During this latter period, the U.S. has been compelled to adopt a more defensive posture than previously observed, reflecting the evolving dynamics of security competition in space and a new distribution of power. Utilizing a longitudinal study accounts for multiple hidden variables, thereby illustrating that the observed variation in change is not solely dependent on shifts in administration but is rather indicative of shifts in the balance of power in space.

The case study of China focuses on the 21st century, marking a period of consistent and significant investment in space power. As China ascended to great power status, it perceived U.S. actions as efforts to achieve unilateral control and weaponize space. This interpretation spurred

China to expand its military space program to prevent a U.S. monopoly. Additionally, China's status as the second most powerful space state also merits inclusion in this exploratory analysis.

Evidence included in this study is drawn from multiple sources. First, I analyzed declassified records and public budgets detailing the procurement of space assets and counter-space weapons to identify force postures. Second, I reviewed public statements from military officials, civilian leaders, white papers, and other official documents to understand a state's primary objectives, motivations and strategies in space. For the United States, sources include the CIA's Records Search Tool (CREST), the National Security Archives, the National Archives and Records Catalog, the Defense Technical Information Center, and presidential libraries from Eisenhower to Biden. Additionally, secondary sources such as the news media, think tanks, academic research, and open-source intelligence offered further details on U.S. space activities beyond official disclosures. Accessing primary sources on China's modern military space program is challenging due to its authoritarian regime. However, white papers and budget reports, when available, provided insights into their military strategy and procurement patterns. Secondary sources were more crucial for analyzing China and particularly for recent developments like ASAT tests and weapons research.

Case Studies

United States of America

Parity → Balanced Strategy (1950s-1960s)

This first case of the U.S. serves as an example of how a state behaves under conditions of relative parity in space with its security rival. The relatively equal space capabilities between the U.S. and the USSR during this period encouraged the U.S. to adopt a balanced military strategy, with roughly equal investments in offensive and defensive capabilities. This case also illustrates how the U.S. rapidly adjusted its military strategy in space—the dependent variable—upon realizing that the USSR could threaten U.S. security interests through its control of space. The rise of the Soviet military space program, representing a change in the balance of power – the independent variable, motivated the U.S. to likewise invest in space power. For my theory to be supported, the empirical record must demonstrate that the U.S. adopted a balanced strategy in space investment and resources. Additionally, my analysis must reveal that this change in strategy was motivated by the rising Soviet threat in space.

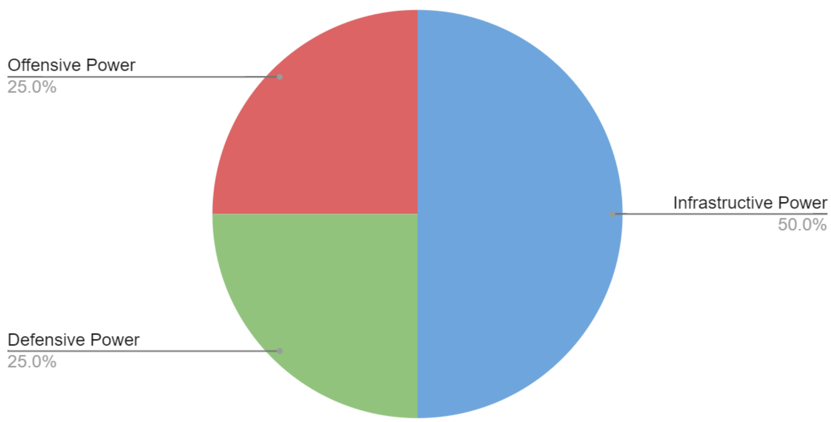
Space Policy Pre-Sputnik

Before the shift in the balance of power marked by the Soviet Union's launch of the world's first satellite, Sputnik (1957), into orbit, the United States had only intermittently pursued the development of space infrastructure and had done so at a lethargic pace (Douglas Aircraft Company, 1946). This early space research became mired in bureaucratic infighting, as both the Navy and Army Air Force sought jurisdiction over space. Eventually, in 1951, the project to develop the first U.S. military satellite program was approved and titled "Feedback," with the stated goal of achieving continuous surveillance of "pre-selected areas of the earth… to determine the status of a potential enemy's warmaking capability" (Erickson, 2005, p. 7). Still, development progressed slowly due to funding constraints (Perry, 1961, p. 56).

This pre-Sputnik space policy offers a glimpse into how the U.S. navigated space during a period of low-intensity security competition. With minimal spending and low prioritization of military projects, the U.S. approach to space was lethargic. The absence of external threats or substantial public pressure to prompt decisive action resulted in a sense of complacency among government officials regarding space initiatives. Following the launch of Sputnik, the U.S.

responded by developing a balanced military strategy in space, marking a clear departure from their previous approach. This balanced strategy is visualized below.

Figure 1: Approximation of Balanced Strategy Investments as % of Total Space Power



Infrastructive Component

Following Sputnik, Eisenhower expedited the research, construction, and launch of the nation's first satellite programs, Vanguard and Explorer (Stares, 1985). Alongside the Explorer and Vanguard missions, Eisenhower had approved the creation of project CORONA, the first reconnaissance and intelligence satellite system in U.S. history (Bateman, 2024).[2] Initially, the eleven CORONA satellites, launched from 1957 to 1960, constituted a majority of the eighteen military satellites launched in Eisnhower's administration (Krebs, n.d). Kennedy greatly expanded space infrastructure through more satellite deployments. Among the sixteen initiatives that were at one point designated a "high national priority" during his administration, twelve were related to space (JFK Library, 1963). Gaining the title "high national priority," enabled greater resource allocation to those programs and served as a "very real indication of national importance" (JFK Library, 1962). Of these twelve space-related initiatives, nine had direct

[2] Operated by the CIA, CORONA satellites were used to conduct photographic reconnaissance missions during the Cold War, capturing high-resolution images of strategic areas on Earth to provide vital intelligence for national security and military planning.

military applications, and seven were explicitly aimed at building a stronger infrastructure in space.[3] Specifically, Atlas, Titan, and Centaur were programs focused on developing and launching rockets capable of deploying satellites into orbit (Gatland, 1975; Arrighi, 2012). Program 162, Program 390, and Discoverer were integral components of the CORONA satellite surveillance system, (Day et al., 1998; Dwayne, 2011; Discoverer 13, n.d.).

From 1961 through 1963, the U.S. launched a total of 92 military satellites that were successfully deployed into orbit (Krebs, n.d.). This represents a 411% increase in total military satellites placed in orbit compared to the Eisenhower administration. These launches expanded the existing CORONA and Samos systems, which spearheaded surveillance efforts, and the MIDAS system, which established an early warning system for ICBMs. Additionally, new programs like Vela and Star-Rad were introduced, focusing on researching and detecting nuclear detonations in space.

Johnson's administration solidified the infrastructive space policies initiated by his predecessors and pursued a permanent space infrastructure by initiating the creation of a Manned Orbiting Laboratory (MOL). The MOL was designed to house two astronauts that would remain in the orbiting space station for extended periods of time and would conduct reconnaissance via an advanced camera system that could take pictures at higher resolutions than any existing satellite system at the time; however it was canceled before completion (David, 2015).[4]

Despite the cancellation of the MOL, the U.S. continued to expand its space infrastructure by increasing the total number of yearly launches and satellites in orbit. During Johnson's administration, the U.S. successfully deployed 268 military satellites into orbit. This

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[3] The remaining two are the Nike-Zeus program which developed missiles that were used in Program 505, the United States' first anti-satellite program, and the second is Program 437, the US's second ASAT program.

[4] While spending on this project alone may have totaled over $2 billion from 1965–1969, it still proved insufficient and competition with the Vietnam War eventually convinced President Nixon to cancel the project (Berger, 2015). Had it been completed, the MOL would have been the first permanent space station in orbit capable of housing humans (Winfrey, 2015).

represents a 191% increase from Kennedy's total number of military satellites, albeit during a long time frame.

<u>Offensive Component</u>

Under the Eisenhower administration, the U.S. Air Force launched a bomber equipped with a Bold Orion missile and successfully intercepted a U.S. satellite orbiting the Earth at an altitude of 156 miles (Bateman, 2024).[5] Concurrently, the U.S. Air Force pursued Project SAINT (1957-192), an ASAT initiative to deploy an autonomous satellite capable of inspecting and, if necessary, neutralizing adversary satellites via kinetic impact (Karas et al., 1995).[6] In response to the potential threat posed by hostile satellites, and amid calls for increased investment in the weaponization of space under the Kennedy administration, Secretary of Defense McNamara directed the U.S. Army to create a more permanent ASAT system that would work as a direct-ascent system, distinct from the Blue Orion test, which was primarily a proof of concept.[7] Program 505 carried out its first successful interceptor test against a point in space in late 1962 and remained a key pillar in the U.S.'s security strategy until 1967. To account for the limited range of the Nike Zeus missiles, McNamara also approved Program 437 (1964-1975).[8]

Beyond ASAT capabilities, the Kennedy administration also tested the effectiveness of nuclear weapons in space via Operation Fishbowl in 1962. Operation Fishbowl encompassed a

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[5] The Eisenhower administration has previously outlined several other ideas that were under active development, such as ballistic missiles, while others were considered "future possibilities," including bombardment satellites (Eisenhower, 1958b, p. 7).

[6] Eventually, Secretary McNamara deemed the Air Force's SAINT project ineffective for potential use during a nuclear conflict, especially considering its budget had exceeded initial estimates without any successful satellite launches (Federation of American Scientists, 2016).

[7] Direct-Ascent: Direct-ascent ASAT weapons are designed to intercept and destroy a target satellite using missiles or other weapons that launch from grounded platforms.

[8] Program 437 (1964-1975) was the United States' second anti-satellite initiative, distinguished by being designated as one of the "Highest National Priority" programs (JFK Library, 1963). The administration justified this high priority by emphasizing the necessity for the U.S. to counter the threat posed by Soviet orbital bombardment systems. As American historian Stares, (1985, p. 82) explains, this level of commitment matched the administration's general approach: "maintain space for the passive use of military systems," yet also be "in the position to respond to any threatening developments in space."

series of nuclear detonations conducted in space to assess the effects of high-altitude nuclear explosions on a range of factors including electromagnetic pulse (EMP) effects, auroral phenomena, radiation belts, and the impact on satellite systems. Starfish Prime, the most powerful and highest-altitude test of Operation Fishbowl, likely caused approximately nine satellites to lose power and subsequently de-orbit due to radiation-induced damage to their electronics (Hess, 1964; Plait, 2012). These tests revealed the effectiveness of nuclear weapons as a potential mass-killer of space infrastructure.

Defensive Component

The Eisenhower administration pursued a "politico-legal" strategy that aimed to establish legitimacy within the international rules-based framework for military activities beneficial to U.S. interests while condemning actions detrimental to those interests (Stares, 1985). In its early years as a space-faring state, the U.S. moved from advocating for an exhaustive "non-military" use of space to a more flexible strategy that allowed for the"peaceful" use of space.[9] An emphasis on acceptable "militarization" of space was also accompanied by a rejection of "weaponization of space" with the Eisenhower administration seeking to ban the use of weapons of mass destruction in orbit (Stares, 1985). The defensive strategy was twofold then: first, to downplay offensive measures to avoid instigating an ASAT arms race with the Soviets and two, to establish a new "international political framework to place U.S. reconnaissance satellites in both a political and psychological context favorable to [protect] them from interference" (Dickey, 2020, p. 5).

The Eisenhower administration also placed significant emphasis on achieving comprehensive awareness of space assets and their locations in orbit and he accomplished this

[9] Satellites operated by the military for reconnaissance or communication are peaceful, but also definitionally part of the military.

via the Air Force's Space Track and the Navy's SPASUR (Miller, 1961; Space Surveillance Fence, 2022). These two systems were later integrated in the mid-1960s to form the Space Detection and Tracking System (SPADATS), which facilitated comprehensive tracking capabilities across numerous ground-based cameras, sensors, and radars distributed around the world (Stares, 1985).[10]

While the U.S. had effectively developed intelligence gathering capabilities on the USSR, establishing the international norm affirming its legal right to conduct such activities remained elusive. To address this, Kennedy convened the Committee on Satellite Reconnaissance Policy, which recommended that the U.S. "take a public stand [on the international stage] for the legitimacy of the principle of reconnaissance from outer space" (Office of the Historian, n.d.). Subsequently, U.S. and Soviet delegates at the UN engaged in debates over the acceptability of observation from space under international law and the U.S. eventually prevailed as the Soviets increasingly recognized the utility of space-based surveillance, rendering the issue moot (Stares, 1985).

Kennedy advanced international norms beyond Eisenhower's efforts by securing a UN-supported ban on deploying weapons of mass destruction in space (United Nations General Assembly, 1963).[11] Johnson completed Kennedy's work by signing and ratifying the Outer Space Treaty of 1967, which explicitly prohibits placing weapons of mass destruction or nuclear weapons in orbit and establishing military bases on celestial bodies (United Nations, 1967). While the 1963 UN resolution under Kennedy promoted the peaceful use of space, it lacked binding enforcement. The treaty, however, demonstrated a mutual commitment by the U.S. and the Soviet Union to prevent space weaponization.

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[10] These initiatives remained at the forefront of achieving space situational awareness (SSA) until 1980.
[11] Resolution 1884.

Balance of Power as a Motivation and Determinant of U.S. Strategy in Space Under Parity

To better understand the U.S.'s behavior in space during this early period, two critical questions must be answered. First, what motivated its military strategy in space: domestic politics or a shifting balance of power relative to the Soviet Union? For my theory to be supported, the change in strategy must be attributed to a shift in the balance of power rather than to domestic political factors. Second, why did the U.S. military strategy in space manifest in that particular way instead of another? For my theory to be supported, the historical record must show that a balanced strategy in space investment is driven by the motivation to minimally address all potential threats while still expanding the space infrastructure.

Sputnik's launch in 1957 dramatically changed the balance of power and, therefore, altered the United State's policy on space. James Killian (1977, p. 7), one of the top scientific advisors for Eisnehower, explained the ramifications as follows: "Overnight there developed a widespread fear that the country lay at the mercy of the Russian military machine and that our own government and its military arm had abruptly lost the power to defend the mainland itself." In the fallout of the satellite's launch, the Eisenhower administration shifted its priorities, noting that "the starkest facts which confront the United States in the immediate and foreseeable future are …[that] the USSR, if it should be the first to achieve a significantly superior military capability in outer space, could create an imbalance of power in favor of the Sino-Soviet block and pose a direct military threat to U.S. security" (Eisenhower, 1958a, p.1). Implicit in this statement is the recognition that the USSR did not yet possess "superior military capability" in outer space, but could gain this advantage if the U.S. did not respond appropriately. This rationale is firmly rooted in power politics: a dominant USSR in space would threaten U.S. national security. Consequently, the Eisenhower administration significantly increased investment in the space infrastructure to keep pace with the Soviets with satellites receiving the highest priority.

Regarding the motivation behind non-infrastructural space assets, one of the stated objectives for U.S. space policy during Eisenhower's time was "to achieve a military capability in outer space sufficient to assure the overall superiority of U.S. outer space offensive and defensive systems relative to those of the USSR" (Eisenhower, 1958a, p. 18). The administration's recognition of the Soviet Union as an emerging threat in space spurred a new objective: invest in space power with the ultimate aim of achieving superiority in space with that superiority measured against the capabilities of the USSR because the USSR posed the greatest security threat in space to the U.S. at this time. The prevailing distribution of space power at the time necessitated significant investment from the U.S. in technology capable of defending their satellites and, if necessary, neutralizing those of the Soviet Union.[12]

Initially, Eisenhower permitted the military to pursue their preferred projects beyond space infrastructure. However, he resisted subsequent pressures to expedite the mass development and deployment of offensive systems, viewing them as unnecessarily hostile that would invite retaliation (Stares, 1985). The Deputy Secretary of Defense at the time, James Douglas, explicitly ruled out the urgent need for such investment, declaring that "there is no urgent requirement for a capability to intercept satellites" nor was there any strong evidence to suggest the Soviets were developing weapon-carrying satellites (Douglas, 1960). Due to the information constraints within the USSR compared to the US, satellite imagery held significantly greater utility for the U.S. than it did for the Soviets. Consequently, Eisenhower hesitated to

[12] In a similar vein, the U.S. Army justified their narrow-focus on developing offensive capabilities by issuing a 1957 report on satellite interceptors that declared that "the United States has an equally urgent national requirement for a satellite defense system. Sooner or later, in the interest of survival, the United States will have to be able to defend itself against satellite intrusion" (White House Office of Special Assistant for Science and Technology, 1957, n.p.)

allocate substantial resources to anti-satellite warfare as he was apprehensive of the Soviet potential for reciprocal actions and mindful of the higher stakes for the U.S. in the event of a satellite conflict (Stares, 1985). Although he permitted the Blue Orion test to proceed, the advancement of more sophisticated ASAT capabilities stalled during his administration.

While the Kennedy administration likewise initially resisted military demands for a stronger ASAT program, bellicose Soviet rhetoric and aggressive actions prompted a reevaluation of priorities, echoing the shift seen during the Eisenhower administration after the launch of Sputnik. In the midst of celebrations over Soviets placing the first human in orbit in 1961, Khrushchev declared that the U.S. does "not have 50 or 100-megaton bombs, we have bombs more powerful than 100 megatons. We placed Gagarin and Titov in space, and we can replace them with other loads that can be directed to any place on Earth" (Wisnewski, 2007, p. 49). Tensions escalated further that same year when the Soviet Union announced its decision to break a previously agreed-upon moratorium and restart nuclear testing (Seaborg, 1983). In response, Robert Harrold, then director of Defense and Research and Engineering, testified to Congress that the U.S. must take a balanced approach to confront these potential threats:

> we must, therefore, engage in a broad program covering basic building blocks which will develop technological capabilities to meet many possible contingencies…we will provides necessary insurance against military surprise in space by advancing our knowledge as a systematic basis so as to permit the shortest possible time lag in undertaking full-scale development programs as specific needs are identified (US Congress, House Committee on Aeronautical and Space Sciences, 1962, p. 355).

This passage, along with the history of space policy in the parity-era, elucidates the second question specified earlier. The immediate goal of the U.S. military strategy in space was to "meet many possible contingencies" and this was accomplished by "engag[ing] in a broad program covering basic building blocks." A narrow focus on infrastructive, defensive, or offensive space power would lead to unaccounted contingencies that the Soviets could exploit. If we liken the balanced strategy to a three-sided pyramid, envision each side representing a distinct component essential to the strategy's integrity. Just as a pyramid's walls are constructed simultaneously layer-by-layer to ensure stability, so too is the pyramid of space strategy under parity built up with its own foundational "building blocks." These building blocks include the infrastructure, offensive, and defensive elements, incrementally layered simultaneously to create a robust and resilient strategy. As efforts are gradually allocated to each facet of the strategy, akin to adding blocks to each side of the pyramid, it ensures that no single component is neglected or overemphasized, thereby maintaining balance and coherence in the overall strategy. While never overbearing, infrastructive space power does inherently command greater attention compared to the other two components. This is due to the fundamental role infrastructure plays as the linchpin for any form of power projection in space, regardless of the prevailing distribution of power.

The even-handed approach is again accentuated just as Johnson was entering office. In his first few months, a report titled "Planning Implications for the National Security of Outer Space in the 1970s" was published, encapsulating what would be the continuation and consolidation of Kennedy's space strategy. It specified that "military activity in outer space will not be *sui generis*; rather, it will relate to the character of, and balance among, earth-based military systems, and should not be considered in a vacuum" (Presidential Papers, 1963, p. iii). This underscores the dynamic nature of space strategy, wherein the prevailing balance of power dictates strategic imperatives. The United States was compelled to adapt its policies to the evolving security landscape, ensuring responsiveness to the unique challenges and opportunities presented at any given juncture. Moreover, the report emphasized the importance of "support missions" in space for enhancing communication, surveillance, and navigation capabilities, while casting doubt on extensive investment in offensive and defensive space weaponry, framing their utility as “a matter of ‘covering bets’ from concern over uncertain and unknown potentialities” (Presidential Papers, 1963, p. 3).

During this initial period of parity with the Soviet Union, the strategic approach was marked by substantial allocations towards space infrastructure, complemented by more limited investments in offensive and defensive capabilities. This comprehensive strategy sought to mitigate potential vulnerabilities and uncertainties, ensuring preparedness for any unforeseen developments or advantages that the Soviets might possess. The balanced strategy does not dismiss the importance of “covering bets;” rather, it acknowledges the inherent vulnerabilities that arise when confronting a rival of comparable strength. In such a scenario, there is a legitimate imperative for maintaining a baseline level of military preparedness encompassing both offensive and defensive capabilities, as potential weaknesses must be addressed. However, it is necessary to recognize that while concerns over uncertainty may warrant attention to offensive and defensive capabilities, a complete shift away from infrastructive power as the primary focus cannot be justified.

While Kennedy’s tenure saw increased security competition with the Soviets in space, Johnson prevailed over what could be considered the very beginning of détente. The slow-death of the U.S.’s premier ASAT system, Program 437, reflected changes in the broader strategic environment and fears about the Soviet threat. Although nominally operational until 1975, the Program 437 was placed on standby in 1970 after the Air Force concluded that “in view of the likelihood that the U.S. would ever use the [redacted] with its nuclear kill mechanism, the Air Force should phase down the system by the end of FY 1970 or as soon thereafter as possible" (Stares, 1985, p. 127). Once the Soviet space threat to U.S. satellites subsided, the U.S. shifted its focus away from the offensive components of its strategy to prioritize other areas.

Evaluation of Alternative Explanation: Domestic Politics

An alternative explanation for U.S. space strategy during this time posits that domestic politics significantly influenced decision-making. Proponents of this view argue that strategic decisions were primarily based on the domestic distribution of political power. Key actors, including politicians and military leaders, made choices aimed at maximizing their power and influence within the U.S. political landscape. This perspective suggests that the response to Soviet advancements in space, such as the launch of Sputnik, was shaped more by the desire to address public anxiety and political pressures than by a direct assessment of Soviet capabilities. From the domestic politics model, Eisenhower's behavior can be understood through two perspectives. First, Eisenhower may have averted a change in policy altogether, upholding a continuity in his policy to prevent the perception of a crisis, thereby enhancing his image as a reliable and steadfast leader in the eyes of the electorate. Alternatively, Eisenhower's policy shift, if it did happen, could be attributed to a desire to regain public support following continued public pessimism about the U.S.'s space capabilities relative to the Soviets.

In his initial press briefing post-Sputnik's launch, President Eisenhower downplayed the military implications of the Russian satellite, asserting it "imposes no additional threat to the United States" and dismissing Sputnik as "one small ball in the air" (Eisenhower, 1957). Nevertheless, public perception portrayed Sputnik as evidence of Soviet technological and military supremacy over the U.S. (Portree, 1998). Despite widespread concerns, Eisenhower resisted early calls for substantial changes to the US's space policy (Eisenhower, 1957). However, public attempts to downplay the threat of Soviet satellites did not always align with actual policy, revealing that the actual response was rooted in a new assessment of the power balance with the Soviets. In the same press conference referenced earlier, Eisenhower misleadingly claimed that satellite surveillance of the USSR was far from feasible, stating, "this period is a long ways off" (Eisenhower, 1957, p. 8). However, the U.S. Air Force had already embarked on preliminary research into reconnaissance satellites in 1956 through the Discoverer program (Rich, 1998). Furthermore, in 1958, Eisenhower directed the CIA to commence development of its own satellite surveillance program, later known as CORONA (Stares, 1985).

Moreover, Eisenhower promptly took decisive steps to consolidate the space program and mitigate inter-service rivalry. In 1958, following the recommendation of the President's Scientific Advisory Committee, Eisenhower established the Advanced Research Projects Agency within the Department of Defense, allocating an initial budget of $520 million for several projects including space research and military applications, encompassing surveillance satellites, manned space stations, lunar military bases, orbital weaponry, and anti-satellite systems (Hafner & Lyon, 1996, p. 8–9). Hans Bethe, a committee member, later recalled Eisenhower's direct inquiry into barriers hindering U.S. technological advancement, to which the committee proposed the establishment of this centralized, military-focused research and development agency—an idea Eisenhower swiftly enacted (Bethe, 1977). Finally, the estimated cost of the U.S. space program (both civilian and military) amounted to a total of around $100 million from the mid-1940s to 1957 and then doubled to $200 million for 1958 alone and then increased to $500 in 1959, and $900 million in 1960 (CIA, 1964). In the aftermath of Sputnik, the United States demonstrated a significantly increased investment in space security compared to the pre-Sputnik era.

These initiatives, set in motion immediately after Sputnik's launch, demonstrate a substantive shift in policy, contrary to Eisenhower's initial remarks denying a change in the U.S. space program and downplaying the Soviet threat. Moreover, the fact that these adjustments were made following consultations with security-focused officials suggests that electoral motivations were not the primary driver behind the changes. This shift in policy was rooted in an acknowledgment of the evolving global power balance, rather than being driven by domestic political considerations.

Table 1: Chronology of the Determinants of Space Strategy under Conditions of Parity

IV: Change in Balance of Power	*DV: Change in Space Strategy*
August 1957: USSR's ICBM program becomes fully operational **October 1957**: USSR launches Sputnik, the world's first satellite **November 1957**: USSR launches Sputnik II, the world's second satellite	**January 1958**: U.S. Launches Explorer 1, the World's Third Satellite **February 1958**: Eisenhower directs CIA to create satellite-reconnaissance program, later dubbed CORONA **June 1958**: Eisenhower National Security Council acknowledges USSR activity in space changes the overall balance of power
April 1961: Soviet Cosmonaut, Yuri Gagarin, becomes first human to travel to outer space **August 1961**: Soviet Union announces intention to resume nuclear weapons testing, rejecting previously agreed upon moratorium **August 1961**: Premier Khrushchev declares that "We have bombs more powerful than 100 megatons. We placed Gagarin and Titov in space, and we can replace them with other loads that can be directed to any place on Earth"	**May 1962**: Project "Mudflap" (Program 505) approved by U.S. Secretary of Defense McNamara; establishes the US's first ASAT system **July 1962:** U.S. conducts Starfish Prime, nuclear test in space **November 1962**: Program 437 approved by U.S. Secretary of Defense McNamara; establishes the US's second ASAT system **October 1963:** U.S. leads secures UN General Assembly resolution calling states to ban WMDs in space
October 1967: The Outer Space Treaty, signed by both the U.S. and USSR, and officially came into effect	**October 1970**: Program 437 placed on standby after the Air Force concluded that "in view of the likelihood that the U.S. would ever use the [redacted] with its nuclear kill mechanism, the Air Force should phase down the system"

Superiority → Defensive Strategy (21st Century)

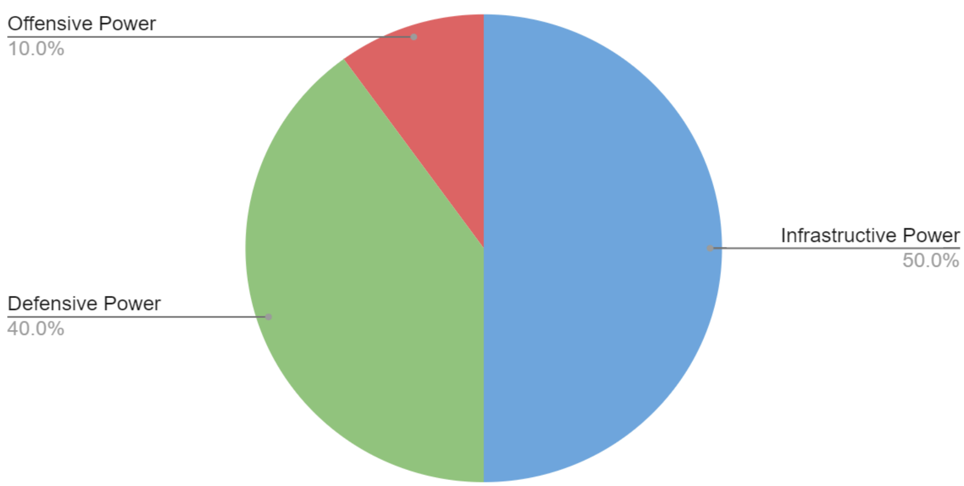
The second case of the U.S. serves as an example of how a state behaves under conditions of superiority in space. The superior space capabilities of the U.S over its rivals during the 21st century encouraged the U.S. to adopt a defensive military strategy, with more investments in defensive than offensive capabilities. This case also illustrates how the U.S.

adjusted its military strategy in space—the dependent variable—upon realizing that China could threaten U.S. security interests through its growing arsenal of counter space weapons. The rise of the Chinese military space program, representing a change in the balance of power – the independent variable, motivated the U.S. to likewise invest more in space power with a focus on defensive assets. For my theory to be supported, the empirical record must demonstrate that the U.S. adopted a defensive strategy in space investment and resources during this time. Additionally, my analysis must reveal that this change in strategy was motivated by the rising Chinese threat in space. The following analysis will first evaluate each component of the space military strategy pursued by the U.S. in the 21st century and then discuss the driving motivations, along with alternative explanations.

Before the Rise of China

The conclusion of the Cold War signaled a shift towards a less intense security environment, especially among great powers capable of space dominance. Consequently, numerous U.S. space programs were either canceled or suspended in response to a shifting balance of power (Patil, 2017). From the time of the Eastern European Revolutions in 1989 to 1993 after the complete dissolution of the USSR, the U.S. decreased its national military spending from around $17 billion in 1989 to roughly $13 billion in 1993 (Vice President's Space Policy Advisory Board, 1992, p. 6). Moreover, despite several ASAT and orbital weapon programs being tested during the early 1990s, none received the necessary funding or support to achieve full operability (Union of Concerned Scientists, 2012). This reflected a growing perception that foreign threats to destroy U.S. space infrastructure were relics of the Cold War and would no longer be a major consideration during space strategy formulation (Bateman, 2024). When Clinton won the presidential election in 1992, this pivot towards a post-Cold War space strategy was complete, solidifying the notion that the "national security space infrastructure would be reoriented toward support functions alone" (Bateman, 2024, p. 194). Military strategy in space became a low-priority issue, underscored by a stagnant budget and the elimination of both the National Space Council and the undersecretary of Defense for Space Policy. (Lambakis 2001, p. 324). However, this approach proved to be short-lived as the rise of China as a significant security threat to the United States in the 21st century prompted a shift towards increased spending on space and the adoption of a defensive strategy. This defensive strategy is visualized below.

Figure 2: Approximation of Defensive Strategy Investments as % of Total Space Power



Infrastructive Component

During his administration, President Bush oversaw the launch of a total of 61 military satellites into orbit. These launches included new generations of GPS satellites, a variety of ISR satellites, and communication satellites.[13] The Bush Administration also sought to increase the rate at which satellites could be replaced in the event of a crisis, so the Operationally Responsive Space (ORS) program was established in 2007 with one of their missions being to build infrastructure capable of reducing launch timelines and costs (Rupp, 2015). This mission was

[13]Intelligence, Surveillance, Reconnaissance: Intruder, KH, Onyx; Milstar and Quasar

later absorbed into Space Force's Tactically Responsive Space program. Following China's destructive ASAT test in 2007, the U.S. redoubled its efforts and the Obama administration launched 124 military satellites, more than doubling the prior administration's count (Krebs, n.d.). The administration's upgrades spanned multiple infrastructure categories including navigation, ISR, advanced military communications, missile defense and early warning systems.[14] His administration also successfully conducted the first launch of the X-37B, the world's first operational, fully reusable spaceplane.

The commitment to strengthening the U.S. presence in space grew significantly under the Trump Administration with the creation of the U.S. Space Force in 2019. Beyond the increased focus and funding available through the Space Force, the rise of SpaceX and its collaboration with the U.S. military has significantly reduced launch costs with reusable rocket technology as they can manufacture 45 satellites per week and launch up to 240 satellites per month (SpaceX, 2024). While the Obama administration launched 72 satellites in its second term, the Trump administration launched 91 satellites in its four years and increased the number of launch sites to include Cape Canaveral Kennedy Space Center in Florida, Onenui Station in New Zealand, and the Mojave Air and Space Port in California (Krebs, n.d.).

Although the Space Force was first established during the Trump Administration, it truly found its footing under Biden's tenure where its budget nearly doubled to $30 billion by 2024. For example, the Space Force's "Victus Nox" mission demonstrated the U.S,'s ability to deploy a military satellite from warehouse storage into orbit in less than a week, down from 21 days previously (Berger, 2023; Space and Missile Systems Public Affairs, 2024). While the Biden Administration continued upgrading existing ISR, navigation, and early warning systems

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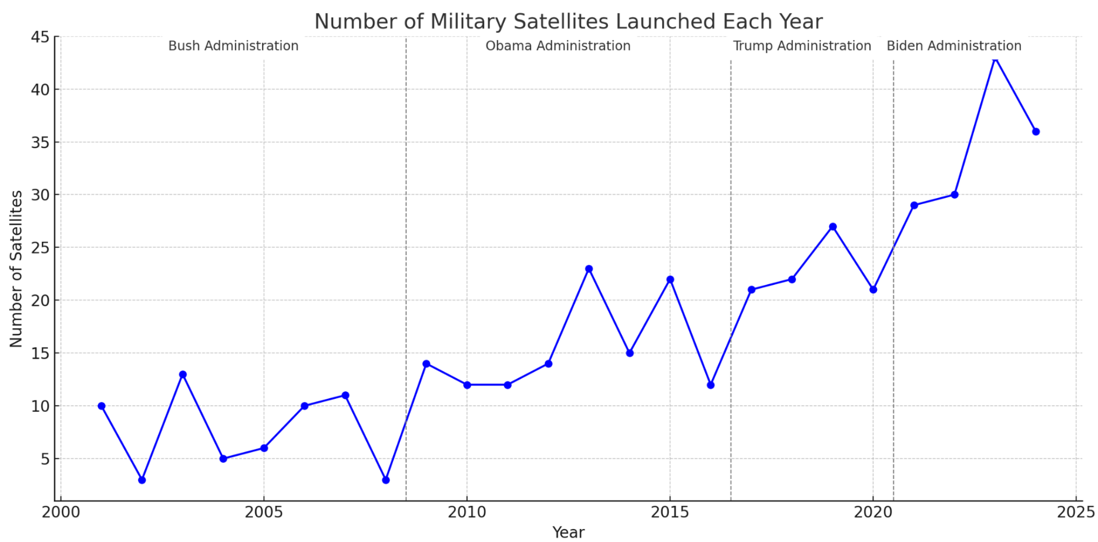
[14] Specific satellite programs: Navigation - GPS. ISR - Intruder, KH, Orion, Topaz. Military communication - WGS, MUOS. Defense and Early Warning - SBIRS

programs, it also initiated new classified programs. Notably, Mission 146 under the National Reconnaissance Office (NRO) has already launched twenty-one satellites into orbit through the "Starshield" initiative, SpaceX's constellation satellite program designed exclusively for military use (Krebs, n.d.; Roulette & Taylor, 2024). Beyond what has already been launched, the Pentagon's future plans emphasize the utilization of Starshield technology to create a new constellation of satellites focused on encrypted communications. This ambitious project aims to deploy over a hundred individual units by 2029, significantly enhancing secure communication capabilities for U.S. military operations (Erwin, 2024).[15]



<u>Offensive Component</u>

In 2002, the Bush Administration initiated two offensive counter-space programs: the Counter Communications System (CCS) and the Counter Surveillance Reconnaissance System (CSRS). The CCS remains operational today, albeit in a significantly upgraded form and with more units, serving as the U.S.'s primary electronic warfare (EW) weapon. This system is capable of temporarily jamming an adversary's communication satellites, thereby preventing them from coordinating with each other and consequently thwarting efforts to jeopardize U.S.

[15] "Number of Military Satellites Launched Each Year" accurate up through June 2024.

interests (L3Harris, n.d.; Erwin, 2021). Presently, CCS remains the only publicly known, operational counter-space weapon available to the United States. Recently, Biden's DoD awarded a $125 million contract to upgrade CCS, raising the total number of satellite jammers to sixteen by 2025 (Erwin, 2021). The U.S. Space Force has also begun testing a new satellite jammer known as the Remote Modular Terminal (RMT) which can be produced in large quantities for minimal costs and easily deployed near battlefields with no pre-existing infrastructure required (Tigley, 2024). Meanwhile, CSRS was aimed at countering an enemy's ISR satellites, however the details of this program remain classified. Despite initial plans for the system to be operable by 2007, funding was cut by appropriators after the Air Force decided to cancel the program (Lewis, 2004).

Additionally, the U.S. conducted its most recent and final direct-ascent ASAT test during Operation Burnt Frost in 2008, when a ground-based missile was launched to intercept and destroy a defunct U.S. satellite (Johnson, 2021). The test demonstrated the U.S.'s latent capability to destroy satellites, even without maintaining a dedicated direct-ascent ASAT program. While no new ASAT tests have been conducted by the U.S. since 2008, it does maintain latent ASAT capability via its midcourse missile defense systems which are designed to intercept incoming long-range warheads mid-flight (Weeden & Samson, 2024). The U.S. currently maintains two such systems – ground based interceptors and ship-based Standard Missile 3 interceptors.

The U.S. has conducted significant research and development, as well as occasional testing, of directed energy weapons (lasers), particularly during the Cold War. However, these capabilities have not yet been fully operationalized and fielded, and the research is generally not focused on space applications (Weeden & Samson, 2024). Moreover, while the U.S. has successfully tested numerous co-orbital space vehicles capable of maneuvering towards and rendezvousing with other space objects, these efforts have primarily emphasized on-orbit space situational awareness and inspection rather than the destruction of other satellites (Weeden & Samson, 2024). Consequently, although a dual-use potential exists, current U.S. strategy indicates that these co-orbital space vehicles are intended to play a more significant defensive role than an offensive one.[16]

Defensive Component

Most of the programs described below upgrade the U.S.'s Space Surveillance Network (SSN). The Bush Administration's DoD explained in their Quadrennial Defense Report that "the Department will continue to develop responsive space capabilities in order to keep access to space unfettered, reliable and secure. Survivability of space capabilities will be assured by improving space situational awareness and protection, and through other space control measures" (US Department of Defense, 2006, p. 55–56). Concurrently, the Ground-based Electro-Optical Deep Space Surveillance (GEODSS) system underwent significant enhancements through the Deep Stare program.[17] The Rapid Attack Identification Detection and Reporting System (RAIDRS) was also developed during this time, a ground-based SSA system focused on identifying, locating, and classifying radio-wave frequency attacks on U.S. military satellites (Singer, 2004).

Under the Obama administration, the Air Force awarded contracts to develop the Space Fence, a second-generation ground-based space surveillance system capable of tracking satellites

[16] While recent satellite experiments like Ascent and Tetra might suggest successful tests of offensive capabilities due to their enhanced maneuverability in orbit (Venable, 2024), the practical use of co-orbital offensive weapons is limited. This limitation arises because SSA satellites can detect and warn countries of potential attacks by co-orbital vehicles hours in advance, allowing the target sufficient time to adjust its orbit and avoid interception (Weeden & Samson, 2024).

[17] This upgrade doubled the accuracy of position measurements, increased the search rate by 40%, allowing GEODSS to cover more area in the same amount of time, and new cameras enabled the system to detect fainter objects than ever before (Lewis, 2012).

and space debris (Gruss, 2014).[18] Space Fence became operational in March of 2020 after $1.5 billion of funding (Erwin, 2020). Development of the Space-Based Space Surveillance (SBSS) satellite first began with Boeing in 2004 and it achieved operability in 2010 when the U.S. Air Force launched SBSS, the first non-experimental space-based SSA sensor capable of tracking man-made space objects. Unlike ground-based SSA systems, SBSS operates without disruptions from weather, time of day, or atmospheric conditions (Space Operations Command Public Affairs, 2021). Additionally, in 2014, the U.S. Air Force Space Command introduced the Geosynchronous Space Situational Awareness Program (GSSAP) to bolster space object surveillance and threat detection (Shelton, 2014).

Moreover, the Space Tracking and Surveillance System (STSS) and the Space-Based Infrared System (SBIRS) saw significant developments with the launch of several satellites carrying SBIRS or STSS payloads (Krebs, n.d.). These satellites are designed to provide early warning of long-range ballistic missile launches aimed at the United States. Primarily serving to augment terrestrial military forces, these satellites can also serve a dual purpose by providing early warnings for direct-ascent ASAT missile threats.

In 2016, a White House Press release highlighted that organizations all over the country "have demonstrated the capability of…constellations of smallsats to support important commercial, civilian, and national-security applications" (White House Office of the Press Secretary, 2016). This aligns with the 2011 U.S. National Security Space Strategy, which advocated for greater resilience in space architecture (Gates & Clapper, 2011), and a white paper from the Assistant Secretary of Defense emphasizing achieving increased resilience through the

[18] Utilizing shorter wavelength radars, Space Fence can detect smaller objects and track about 200,000 objects, making 1.5 million observations per day—about ten times the capacity of the previous system, SBSS is capable of detecting space objects in both low earth orbit and geosynchronous orbit. Series of six satellites acts as a dedicated space-based surveillance network in geosynchronous orbit that is also capable of performing close-up inspections. (Gruss, 2014).

proliferation of satellites of the same variety (Rosenbach, 2015). The Trump administration made a pivotal move towards a constellation-centric future by establishing the Space Development Agency (SDA). This new entity's mission is to "harness commercial development to achieve a proliferated architecture and enhance resilience" in space (SDA, n.d.). The SDA aims to build the Proliferated Warfighter Space Architecture which will feature multiple satellite layers with distinct capabilities made up of approximately 1,000 satellites, with at least 450 launched by the end of 2029 (Albon, 2022). Congressional support has been robust, with funding increasing from $125 million in 2020 to $4.7 billion in 2024 (Hadley 2024b). As of the writing of this paper, the SDA had successfully placed all twenty-seven satellites of "Tranche 0" in orbit (Krebs, n.d.; Hadley 2024). Deploying hundreds of small, relatively inexpensive satellites that perform the same functions builds redundancy and resilience. If an enemy disables a few satellites, the mission can still be completed, ensuring continued operational capability.

Under the Trump administration, the Space Force significantly enhanced existing Space Situational Awareness (SSA) capabilities, most notably in 2020, by awarding a $1.2 billion contract for the MOSSAIC program. This program aims to upgrade telescopes at three existing GEODSS sites and establish two additional locations in Spain and Australia (Erwin, 2020). On the international front, the U.S. introduced the Artemis Accords, a non-binding resolution that specifies the implementation of obligations within the Outer Space Treaty, sets norms for future lunar activities, and outlines how countries can collaborate on building permanent human settlements on the Moon (Foust, 2020).[19] Beyond expanding Artemis Accords, the Biden

[19] These policies align with the Trump Administration's stated policy goal of "transform[ing] to more resilient space architectures" by accelerating enhancements in resiliency, defenses, and the ability to reconstitute impaired space assets (Trump, 2018, p. 3). On the Artemis Accords: It expanded from nine signatory countries under the Trump administration to 43 countries by June 2024 (U.S. State Department, 2024).

administration has successfully spearheaded efforts to ban the testing and deployment of direct-ascent ASAT weapons both domestically and internationally at the UN (Foust, 2022).

Under the Biden administration, the U.S. has upgraded or introduced new defensive space assets. In 2022, the U.S. Space Force awarded a $341 million contract for the Deep-Space Advanced Radar Capability (DARC), a ground-based radar system providing 24/7 SSA coverage, addressing current radars' limitations (Northrop Grumman, 2022). Additionally, in 2023, the U.S. launched the Silentbarker SSA satellite program to replace older Space-Based Surveillance System satellites (Albon, 2023). The U.S. has also strengthened its partnership with SpaceX through their Starshield program. Starshield is designed exclusively for government use, focusing on establishing satellite networks using constellation-like systems. In 2021, the National Reconnaissance Office (NRO) signed a $1.8 billion contract with SpaceX to develop and launch Starshield units into space (Roulette & Taylor, 2024). To date, Starshield has fielded a total of 23 satellites for the NRO since 2020 and is expected to send another 20 by the end of Summer 2024 (Krebs, n.d.; Sharp, 2024; McDowell, 2024). This partnership is expected to expand to include the Pentagon as the Department of Defense expects to field more than 100 Starshield units by the end of 2029 to bolster military communications (Erwin, 2024).

<u>Balance of Power as a Motivation and Determinant of U.S. Strategy in Space Under Superiority</u>

Concerns about the U.S. dependency and vulnerability in space have intensified in the 21st century due to rising great power competition and the growing perception that U.S. superiority in space leaves it uniquely vulnerable to attack. The Bush administration's Rumsfeld Commission warned that the U.S. was especially susceptible to a "Space Pearl Harbor" because of its heavy reliance on space for military operations. This vulnerability was highlighted by Chinese media reports in 2000 that China's military was investing in new technologies and strategies aimed at countering U.S. dominance in space in a future, space-based war (Rumsfeld, 2001, p. 22). While the Rumsfeld report called for the U.S. to invest more in space and adopt a more defensive strategy, the War on Terror shifted the focus from emerging powers with orbital launch capabilities to terrorists and their supporting states, most of which were neither great powers nor space-faring nations.

However, space security took center stage again near the end of Bush's administration when China successfully tested its first anti-satellite (ASAT) weapon in 2007. This test saw the Chinese government successfully deploy a direct-ascent ASAT weapon, which destroyed a Chinese satellite, resulting in approximately three thousand pieces of debris in orbit—the largest man-made debris field ever created in space (Kan, 2007). Each fragment travels at speeds of up to 17,000 miles per hour, posing significant threats to other satellites and increasing the risk of collisions in space. General B. Chance Saltzman, the current Chief of Space Operations within Space Force, was tracking the test as it happened real-time and remembered feeling that "this is a pivot point in the space community and in space operations, and that we're going have to look differently about how we operate space from that day on…the threats are bad enough, our dependencies on space are strong enough, that we're going to have to focus differently and it made sense to build [Space Force]" (as cited in Everstine, 2023).

The ASAT test prompted a series of defensive strategies that would become the cornerstone of future U.S. space policy. Shortly after the test, President Bush issued a classified memo directing executive agencies and the Department of Defense to develop a strategy emphasizing space situational awareness to effectively respond and prevent ASAT attacks from occurring (Butler, 2007). When Congress passed $300 million in funding for upgrading space situational awareness, they cite their primary motivation as follows: "Enhancing these capabilities is critical, particularly following the Chinese anti-satellite weapon demonstration last

January" (US Congress, House of Representatives, 2007, p. 320).[20] Fellows at the Council on Foreign Relations likewise argued at the time that the U.S. needed to adapt its space policy by enhancing redundancy in satellite systems, accelerating the deployment and replacement of satellites, and improving space situational awareness (Zissis, 2007). In his response to the ASAT demonstration, Mastalir with Air University (2009) echoed the defensive strategies of Eisenhower, Kennedy, and Johnson by advocating for enhanced military coordination with space-faring allies and the establishment of a detailed framework for internationally accepted norms concerning the use of outer space – all of which have come to pass across the last several administrations.

Recognition of China's growing threat in space continued in subsequent administrations. Secretary of Defense Robert Gates noted in his report on China that it was "developing a multidimensional program to improve its capabilities to limit or prevent the use of space-based assets by potential adversaries during times of crisis or conflict" (2010, p. 7). When China conducted ASAT missile tests in 2013 and 2014, demonstrating their capability to reach satellites in the far geosynchronous orbit, it prompted a "near-panicked" response from the Department of Defense. This led to an expedited "Space Strategic Portfolio Review" aimed at reassessing the best practices for safeguarding the US's extensive space infrastructure (Hitchens & Johnson-Freese, 2016).

This shifting balance of power in space prompted the White House to advocate for a significant change in military strategy: the establishment of the first new branch of the military in 72 years. Vice-President Pence, referencing a Defense Intelligence Agency report, emphasized

[20] Expanded SSA Programs include: Self Aware Space Situational Awareness, Space Fence, Operationally Responsive Space, Space Control Test Capabilities, Rapid Identification, Detection and Reporting System (RAIDRS) Block 20, Maui Space Surveillance System, Space Situational Awareness research, Panoramic Survey Telescope and Rapid Response System, and the High Accuracy Network Discrimination System.

that "China and Russia are aggressively developing and deploying capabilities — including anti-satellite weapons, airborne lasers, menacing 'on-orbit' capabilities, and evasive hypersonic missiles — that have transformed space into a war-fighting domain" (Pence, 2019). Pence argued that these growing threats necessitate a robust response from the US, which should take the form of the Space Force, a new military branch dedicated to more effectively defending U.S. space assets and streamlining an otherwise dense, redundant bureaucracy.

Such concerns of a growing shift in the balance of power in space continued under the Biden Administration. In his confirmation hearing, Secretary of Defense Lloyd Austin remarked that "space is already an arena of great power competition" where "Chinese and Russian space activities present serious and growing threat to U.S. national security interests" (Austin, 2021, p. 56). The head of U.S. Space command, General Whiting, likewise expressed grave concern about China's rapid ascent in space and the seeming growing collaboration between multiple adversaries of the U.S. in space:

> It does appear there is a growing sense of cooperation in the space sphere between [China, Russia, Iran, and North Korea], at least bilaterally within these four countries…that's something we're keenly observing…[China's rise in space] really is something to behold, and you can kind of bucket that into two aspects: one is how quickly they've moved to field counter space capabilities, everything from offensive cyber capabilities to jammers for GPS [and] SATCOM, high energy lasers, direct ascent ASATs, on-orbit capabilities, just across the breadth of capabilities from reversible to nonreversible, we've seen them move very quickly. They've also moved very quickly to build their own space capabilities to enable their terrestrial forces (Hadley, 2024c).

The resurgence of great power competition, initially with China and now with Russia, has compelled the United States to shift its strategy in space. While the end of the Cold War brought a sense of complacency, believing in the "end of history," the 2007 ASAT test redirected the U.S.'s attention back towards space as a critical domain. As China and Russia's offensive capabilities in space have grown, the U.S. has been motivated to first, change its military strategy, and second, adopt a defensive posture. Although the U.S. still publicly acknowledges the existence of some offensive and latent ASAT systems, the primary emphasis in technology procurement and official statements has shifted towards enhancing the resilience of existing space infrastructure and strategically expanding it with a focus on durability.

Evaluation of Alternative Explanation: Domestic Politics

The alternative hypothesis posits that the shift towards securitizing space is not driven by a genuine reassessment of the security environment but by politicians seeking to maximize their self-interest. For politicians, this means acting in ways that please the electorate to increase their vote share and secure re-election. Since most voters do not closely follow individual satellite launches or new programs to expand SSA capabilities, examining Americans' reactions to the proposed establishment of the Space Force serves as the best metric to evaluate whether politicians are changing military strategy merely for their popularity. If the proposal for Space Force garnered widespread public support, it could indicate that the motivation behind its creation was aligned with political self-interest rather than a response to a genuine shift in the distribution of power. Alternatively, if public polling reveals Americans were ambivalent or opposed to the establishment of the Space Force, then the domestic politics argument would lose much of its strength. Due to most public polling either conflating the civilian and military space programs or ignoring the military program altogether, the establishment of the Space Force serves a critical time in polling when Americans would be both aware of the military space program and more likely to have an opinion on it.

When Trump initially announced that his administration would pursue the creation of the Space Force, it received a mixed public reception. A CNN poll conducted in 2018 found that a majority of Americans opposed the establishment of the U.S. Space Force, with only 37% in support (Sparks, 2018). Pew Research revealed that only 46% of Americans believed the U.S.

would engage in space conflicts with other nations within the next 50 years, thus undercutting the perceived need for a space force (Igielnik et al., 2019). Additionally, a survey by the Ronald Reagan Presidential Foundation and Institute indicated that only 48% supported the creation of the Space Force, while 43% were opposed (Anderson Robbins Research, 2018). Another poll by the Economist and YouGov found that just 29% considered the creation of the Space Force a good idea, 42% a bad idea, and 29% were unsure (YouGov, 2018). However, a couple polls showed more support: The Hill's 2018 poll found that 57% of Americans approved of the Space Force (Manchester, 2018), and in 2021, Morning Consult reported that 52% of Americans viewed China as a significant threat to U.S. space leadership and 61% supported Biden's decision to retain the Space Force as a branch of the U.S. Armed Forces (Sabin, 2021).

Increasing the prioritization of national security interests in space through the establishment of the Space Force was not a top concern for most voters. Although the Republican Party tended to support the Space Force more than independents and Democrats, President Trump would still have needed broader support for the program if he wanted to use it as a political talking point. Despite the apparent lack of public support, the administration continued its efforts and successfully established the U.S. Space Force. This persistence suggests that the push to establish the Space Force was likely driven more by the changing balance of power in space rather than domestic political incentives. The administration's focus on space security, coupled with the perceived threats from other nations, underscored the strategic importance of having a dedicated military branch for space operations, independent of fluctuating public opinion.

Table 2: Chronology of the Determinants of Space Strategy for the U.S. under Conditions of Superiority

IV: Change in Balance of Power	*DV: Change in Space Strategy*

July 2005; February 2006: *Two* failed Chinese ASAT attempt (one per month) **September 2006**: Chinese deploys directed energy weapon test against a U.S. satellite; successfully 'illuminates' U.S. satellite **January 2007**: China conducts its first successful, direct-ascent ASAT weapon test and destroys one of its satellites in orbit, creates thousands of pieces of debris	**Fall 2007**: President Bush orders for increased Space Situational Awareness **November 2007:** Congress allocates an additional $100 million to the $200 million requested by the Bush Administration for SSA **February 2008**: U.S. conducts Operation Burnt Frost against one of its own satellites, the first U.S. ASAT test since 1985
January 2010; May 2013; July 2014: China conducts *three* non-destructive direct-ascent ASAT test – one being in geosynchronous orbit **August 2014**: Russian conducts non-destructive, direct-ascent ASAT test; first test since 1994 **April 2015; October 2015; May 2016; December 2016:** Russian conducts *four* non-destructive, direct-ascent ASAT test	**June 2009:** Contracts awarded for the development of Space Fence, an overhaul of first-generation space surveillance system – completed and deployed in 2020 **Feb 2014: U.S.** Air Force Space Command announce new satellite program, GSSAP, aimed at improving space object surveillance and detecting threats
July 2017: China conducts non-destructive direct-ascent ASAT test **August - December 2019:** Russian conducts destructive, direct-ascent ASAT test and successfully intercepted a Russian satellite **November 2019; April 2020:** Russian conducts *two* non-destructive, direct-ascent ASAT test **June 2020:** Chinese global navigation system, BeiDou-3, becomes fully operational **December 2020:** Russian conducts non-destructive, direct-ascent ASAT test	**March 2018:** National Space Strategy defines space resiliency as a cornerstone of military policy in space **March 2019:** Space Development Agency is established; initiation of 1,000 satellite "Proliferated Warfighting Space Architecture" **December 2019:** The U.S. Space Force is established as the sixth branch of the U.S. military, justified by the threat of China and Russia **June 2020:** Defense Space Strategy cites China and Russia as the greatest space threat due to development, testing, and deployment of counter space weapons **October 2020: U.S.** drafts and signs the Artemis Accords alongside seven other countries, outlining new norms for behavior in space
December 2021: Chinese satellite successfully grappled a defunct Chinese satellite, and physically relocated it away from Earth **April 2023:** China conducts non-destructive direct-ascent ASAT test **April 2024:** Russia vetoed UN Security Council resolution to ban nuclear weapons in orbit; China abstained from voting **May 2024:** Russia launches counter space weapon into the same orbit as U.S. government satellite	**October 2020 - June 2024:** Artemis Accords expand to include a total of 43 signatories **2021:** SpaceX signs $1.8 billion contract to supply NRO with Starshield constellation **April 2022:** U.S. commits to domestic-ban of destructive, direct-ascent ASAT missile testing **February 2024:** U.S. intelligence community suggests Russia is actively developing the capability to deploy nuclear weapons in space **April 2024:** U.S. proposed Nuclear Weapon Ban in Orbit in UN Security Council; Russia vetoed the measure and China abstained

China

Inferiority → Offensive Strategy (21st Century)

This case of China serves as an example of how a state behaves under conditions of inferiority in space compared to its chief security rival. The relatively inferior space capabilities of China compared to the U.S. during this period encouraged China to adopt an offensive military strategy, with greater investments in offensive capabilities than defensive ones. This case also illustrates how China adjusted its military strategy in space—the dependent variable—upon perceiving the U.S. to be a growing security threat in space. The Bush Administration's unilateral rhetoric surrounding space, representing a change in the balance of power – the independent variable, motivated China to invest more consistently in space power. For my theory to be supported, the empirical record must demonstrate that China adopted an offensive strategy in space investment and resources. Additionally, my analysis must reveal that this change in strategy was motivated by growing Chinese concerns about U.S. intentions in space.

For the Chinese case, limitations in language, access to archival material, and the general authoritarian nature of the CCP have prevented me from conducting a competing test of the alternative hypothesis of domestic politics in China. Consequently, this case study is limited to serving as a demonstration proof, evaluating only how the empirical evidence aligns with my theory without accounting for rival explanations.

<u>Before the U.S. Withdraw from the Anti-Ballistic Missile Treaty (2001)</u>

Based on internal Chinese documents, which will be evaluated later, the U.S. withdrawal from the Anti-Ballistic Missile (ABM) Treaty in 2002 and President Bush's militaristic rhetoric on space marked a pivotal moment in China's approach to space strategy.[21] These events

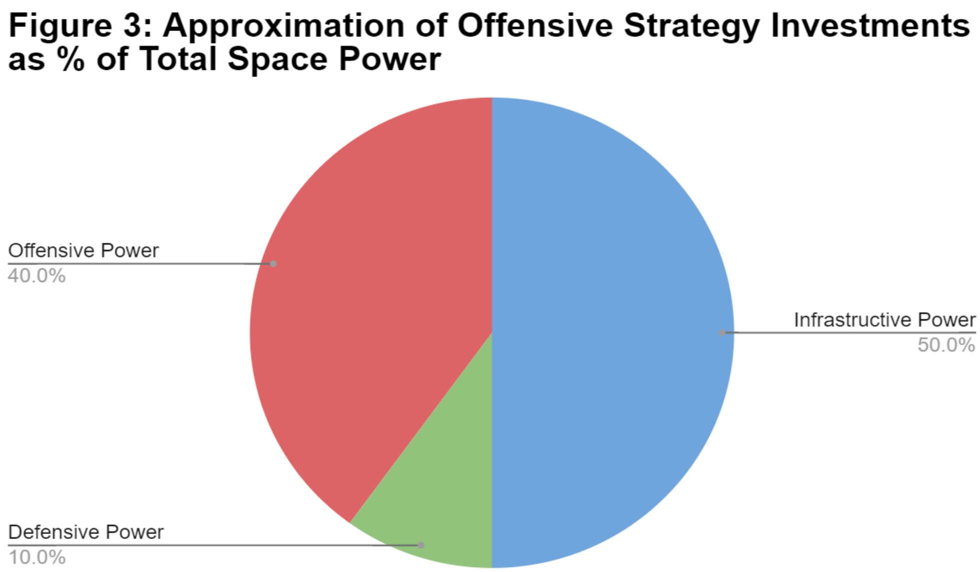
[21] The ABM Treaty banned both the U.S. and Soviet Union from deploying a nationwide missile defense system

convinced China that the United States was intent on weaponizing space, posing a significant threat to China's ascent as a rising global power (Blanc et al, 2022). To assess the change in China's space strategy, it is essential to first establish what their approach looked like prior to 2002.

After the dissolution of the Soviet Union, China exploited its growing economy and an apparent power vacuum to invest more heavily in their military space program (Patil, 2017). From 1975, with the first military satellite launch, to 2001, China launched a total of 23 military satellites, primarily focusing on developing ISR capabilities (Krebs, n.d.). These military launches were sporadic, occurring only every few years and involving only a few satellites per year. Additionally, China likely acquired a few ground-based satellite jammers from Ukraine in the late 1990s and researched directed-energy weapons to establish a minimal offensive component to their space strategy (Stokes et al., 2020). However, direct-ascent and co-orbital ASAT systems did not become operational during this initial period. Concerning defensive measures, the People's Liberation Army (PLA) had limited capabilities, primarily relying on three Yuanwang space tracking ships and various ground-based stations for SSA (Burke, 2022).[22] These early stations included the T&C network with its headquarters originally near the city of Weinan in the province of Shaanxi and subordinate stations in Guangxi, Hainan, Hunan, Shandong, Xinjiang, and Yunnan, as well as the Xuanhua Radar Station (Wood, 2023). While China's space program dates back to the 1970s, a consistently reliable stream of yearly military satellite launches only began in 2002. Before the shift in the balance of power, marked by the Bush administration's unilateral approach to space and foreign policy, China had only

[22] Yuanwang-class ships are designed to maintain contact with satellites once they move beyond the range of the ground-based radar systems.

intermittently pursued the development of space power. Following the shift, China adopted an offensive strategy, as visualized below.

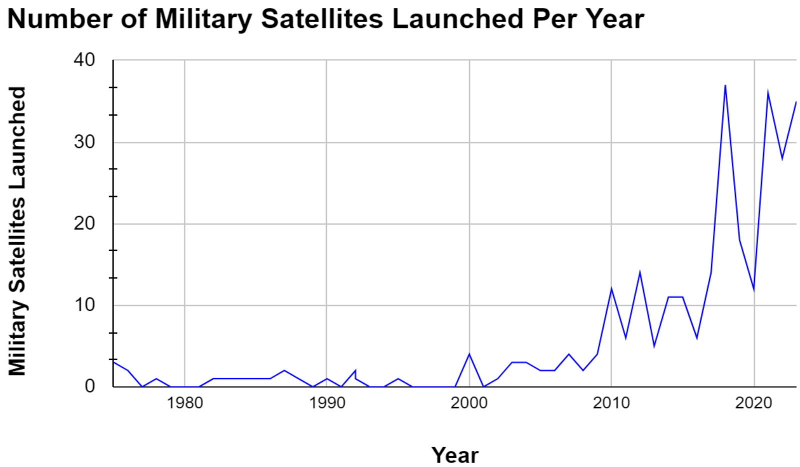


<u>Infrastructive Component</u>

In contrast, from 2002 to 2023, a roughly similar time period, China launched 266 military satellites encompassing a wide range of functions, including ISR, navigation, and communication (Krebs, n.d). This rapid expansion reflects China's commitment to building a comprehensive and advanced space infrastructure. As with all other space strategies, these infrastructive elements make-up the greatest portion of a state's space power since they act directly as a force multiplier to existing conventional military capabilities on Earth.

Besides the rise in annual satellite launches, the number of launch centers in China has also increased in a relatively short period. Initially, from 1958 to 1970, China operated three main launch sites: Jiuquan Satellite Launch Center, Taiyuan Satellite Launch Center, and Xichang Satellite Launch Center. This number has since doubled with the addition of the Wenchang Spacecraft Launch Site in Hainan Province, established in 2016, and the achievement of successful sea launches from two different platform ships in 2019 and 2020 (Wood, 2023). Launching rockets from sea-based sites offers China a cost-effective and flexible method to rapidly expand its space infrastructure. Unlike traditional launch centers, multiple ships can be designed to support launches at a lower cost. These ships can relocate to the most optimal launch locations with favorable weather conditions, enhancing launch success rates and efficiency. By reducing the need for extensive land-based infrastructure and enabling more frequent and flexible launch schedules, sea-based launches significantly bolster China's capabilities in satellite deployment.

China has also recently developed Shenlong, a reusable space plane that appears to mimic the US's X-37B. The Shenlong has been launched into space three times with its maiden voyage being on September 4, 2020. In its most recent mission, astronomers observed the plane testing rendezvous and proximity operations (RPO) (Jones, 2024). In a constructive sense, these could be helpful to repair and maintain friendly assets, or, in a destructive sense, RPO could be used to inspect and attack an adversary's satellite. Similar to the U.S.'s spaceplane, the exact intentions of China with this vehicle are unknown. However, many potential benefits to this technology are known beyond the RPO potential, including the ability to take off and land like conventional aircraft, which allows for more flexible and frequent launch schedules and they can be reused multiple times, thus reducing the overall cost of access to space.



Offensive Component

If China's objective is to exploit the U.S.'s dependence on space systems, it is strategically logical for them to invest heavily in offensive counterspace weapons in the 21st century, and that is precisely what they have done. China has been actively developing and testing their capabilities across the four major counterspace categories—co-orbital ASAT, direct-ascent ASAT, electronic warfare, and directed energy weapons. Weeden & Samson (2024) provide a thorough analysis of China's capabilities in each of these areas and their research heavily informs the following analysis.

Since 2010, China has demonstrated its ability to conduct rendezvous and proximity operations (RPO) with other satellites on nine different occasions, thus overcoming the technological hurdle to obtain a co-orbital anti-satellite (ASAT) capability (Weeden & Samson, 2024). In December 2021, a Chinese satellite conducted a test where it grappled with another, defunct, Chinese satellite and dragged it into a graveyard orbit, effectively removing it from a useful orbit without creating debris. This could be used against an adversary's satellite, moving it from its operational location to a dead zone, rendering it ineffective. While no maneuvers in space have suggested aggressive intent so far, the potential for such actions remains a concern for U.S. officials. This is particularly true amidst reports that Chinese researchers have successfully developed an explosive device that can be attached to the thrusters of an enemy satellite during RPO, remain dormant for hours, and then explode after a set-time in a manner that mimics an engine malfunction (Chen, 2021).

Meanwhile, the direct-ascent ASAT program has been publicly tested repeatedly in an overtly aggressive manner. China's direct-ascent ASAT program is most infamous for its 2007 test that successfully intercepted a Chinese satellite but also created thousands of pieces of space debris, many of which are expected to remain in orbit for decades to come. In total, China has conducted thirteen direct-ascent ASAT tests from 2005 to 2023 and has destroyed three satellites as a consequence (Weeden & Samson, 2024). Based on the variations in the launches, China may be simultaneously developing three direct-ascent ASAT programs, each utilizing specific missiles tailored for different orbital ranges (Weeden & Samson, 2024).

China has also developed robust capabilities in electronic warfare and directed energy weapons (DEW). In 2018, the PLA installed GPS jamming equipment on the Spratly Islands, and by 2019, the Defense Intelligence Agency reported China's development of jammers capable of degrading signals from military SATCOM and reconnaissance satellites. (Gordon & Page, 2018; Weeden & Samson 2024; Defense Intelligence Agency, 2019). Reports from pilots in March 2023 experiencing GPS signal jamming while flying near Chinese warships in the South China Sea corroborates prior claims related to such weapons (Casiano, 2023).

Based on open-source intelligence, Weeden and Samson (2024) conclude that China likely has five operational sites dedicated to developing and testing directed-energy weapons and lasers. China successfully tested its laser against satellites twice, once in 2005 and again in 2006 on a U.S. satellite. Subsequent scientific journals in China report that further research and development has continued to the present day with several articles citing specific developments and breakthroughs in laser technology (Weeden & Samson, 2024). However, these directed energy weapons have not yet been fielded systematically against U.S. satellites, despite early testing in the 2000s.

<u>Defensive Component</u>

China's defensive strategy is limited to ground-based SSA sensors, mobile ship sensors, and the beginnings of proliferated satellite systems. New ground stations include Lingshui Station in the Hainan Province, which began operating in 2008; Menghai Station in Yunnan Province which existed since at least 2010; the Minxi station, which originally closed in 1984, was reopened in and has restarted operations as of 2019; and the Multi-Application Survey Telescope Array (MASTA) in the Qinghai Province in 2021 (Wood, 2023, p. 27–28; Weeden & Samson, 2024). Additionally, the PLA has implemented several upgrades in the 21st century further bolstering the capabilities of stations built decades prior. The Qingado station in Shandong reportedly received a new 18-meter radar dish in 2007 coupled with a doubling of the station's overall size and the Xiamen Station in the Fujian province underwent similarly major upgrades (Wood 2023, p. 28–29).

The Yuanwang fleet of ships has also expanded in this present era of great power competition.While four ships were commissioned in the seventeen years from 1978 to 1995, another five have been commissioned between 2007 and 2016 with three being dedicated to tracking spacecraft and the remaining two for transporting rockets (Wood, 2023, p. 40). In total, four Yuanwangs dedicated to tracking space objects are in operation today. Furthermore, the PLA's navy operates several Auxiliary General Intelligence ships with similar capabilities – up to five have been commissioned since 2002 (Wood, 2023, p. 43; Panda, 2017).

The Chinese government has also begun exploring constellation-satellite technology in a meaningful way. In 2020, China announced Guowang, a constellation satellite system that will be comprised of nearly 13,000 satellites aimed at providing internet for users in East Asia (Jones, 2023).When this technology is explicitly transferred to the military realm, these satellite programs will be more robust against attacks compared to non-constellation programs. However, the PLA has yet to launch any space-based SSA systems into orbit. While the U.S. has heavily invested in various orbital platforms like the Geosynchronous Space Situational Awareness Program (GSSAP) and Space-Based Space Surveillance (SBSS) System, China's efforts have primarily been grounded. Occasionally, Chinese satellites will engage in rendezvous and proximity operations with other satellites and this establishes a marginal increase in SSA as the Chinese satellite is able to interact with the space object its following, but only for that singular object. Despite advancements in satellite resilience through projects like Guowang, China has not yet matched the U.S. in deploying dedicated space-based SSA assets, focusing instead on enhancing its offensive and infrastructive components. This strategic gap underscores the difference in how both nations aim to achieve their self-interests in space.

Balance of Power as a Motivation and Determinant of China's Strategy in Space

To determine that China's increased investment in space infrastructure and offensive capabilities is rooted in changes to the broader security environment and the balance of power, this analysis must illustrate how China perceived specific events as threats or disruptions to its rise as a great power. By examining these perceptions, the strategic motivations behind China's actions and its emphasis on enhancing space capabilities can be better understood. Blanc et al. (2022) conducted a detailed study of how the Chinese perceived and responded to U.S. military actions in the space domain. Their research involved translating military journals, domestic media, academic reports, and government publications to ascertain these perceptions and responses.

China's perception of the U.S. in the 21st century is significantly influenced by the belief that the U.S. aims to monopolize space and weaponize the domain in the process. This viewpoint shapes China's strategic priorities and investments in space infrastructure and offensive capabilities, as they seek to counterbalance perceived U.S. ambitions and ensure their own security and influence in space. In 2001, after the publishing of the Rumsfeld Commission which warned U.S. leaders about a "Space Pearl Harbor," the author of the Chinese publication *Military Astronautics* remarked that

> like land, sea and the atmosphere, space will become a battlefield…If the United States wants to avoid a Pearl Harbor attack in space, it should seriously consider the possibility of launching effective attacks on space systems…the principal mission of the U.S. space power in the 21st century is to gain the upper hand in space (Chang, 2005).

From this perspective, the U.S. will inevitably weaponize space as doing so aligns with its national security interests. Failing to secure the space domain would leave the U.S. vulnerable to attacks from adversaries. Therefore, China's engagement in the space domain aims to contest it and prevent the U.S. from being the sole great power with weaponized space capabilities. By doing so, China seeks to counter a rising space threat, as space is increasingly viewed as a battlefield, and to deter unilateral space dominance by the US. However, this report only framed the U.S.'s mindset towards China. The subsequent actions sent even stronger signals about how the U.S. would treat space in the 21st century.

On June 13, 2002, the U.S. withdrew from the ABM Treaty. An Academy of Military Sciences book contended that this move was the natural progression for the US, a nation determined to achieve dominance in space. The book stated that "the pace at which [the United States] has enhanced the ability of its space operations for actual warfare has continually accelerated, continually widening the gap of its advantages over other nations" (Jiang, 2013, p. 23). Chinese concerns about the U.S. seeking military dominance and control in space were seemingly validated further when the White House released the 2006 National Space Policy. This policy rejected any future arms-control agreements that could limit the US's ability to use space power to protect its interests. PLA literature reflected on this policy, interpreting it as the U.S. "vainly seeking to dominate space, treating space as its own unique territory…[it] also proposes to openly discuss the possibility of destroying other countries's satellites. The Bush's space strategy has brought unilateralism and hegemonic thinking to the fullest" (Gaoyang & Ke, 2014, p. 1–5, 45). This perspective that the U.S. sought to use offensive measures to unilaterally control space to rule as a space hegemon undergirds China's shift towards a more aggressive space doctrine.

As Weeden and Samson (2024) observe, domestic Chinese analysts contend that their country must actively develop counter space weapons to defend China's national security interests and balance against U.S. superiority in space (Yang & Ai, 2010; Xu & Huang, 2014). A 2014 report from the U.S. Department of Defense corroborates these motivations, stating that "PLA writings emphasize the necessity of 'destroying, damaging, and interfering with the enemy's reconnaissance ... and communications satellites,' suggesting that such systems, as well as navigation and early warning satellites, could be among the targets of attacks designed to 'blind and deafen the enemy'" (2014).

The US's superiority in space, marked by its extensive space infrastructure, presents a significant vulnerability, making it an attractive target for PLA warfighters. Conversely, neutralizing China's satellite system would likely be deemed less critical in a conflict between the two great powers, as China's satellites do not confer the same strategic advantages to the

PLA as the U.S.'s satellite infrastructure does to American forces. The perception of U.S. efforts to establish hegemony in space as a potentially weaponized domain prompted China to significantly invest in its own space capabilities. Additionally, the existing distribution of power motivated China to adopt an offensive strategy against a nation heavily reliant on its satellites.

Table 3: Chronology of the Determinants of Space Strategy for China under Conditions of Inferiority

IV: Change in Balance of Power	*DV: Change in Space Strategy*
December 2001: U.S. declares intent to withdraw from Anti-Ballistic Missile Treaty **June 2002:** U.S. withdraws from ABM Treaty **October 2006:** Bush's National Space Policy rejects future arms-control agreements that would limit freedom of U.S. action in space, reserves right to deny hostile adversaries access to space **February 2008:** U.S. successfully conducts Operation Burnt Frost, a direct-ascent ASAT test	**Oct 30 2000:** China launches (regional) Beiudou satellite system, separate navigation satellite system from US-operated GPS **July 2005; February 2006:** *Two* failed Chinese ASAT attempt (one per month) **September 2006**: Chinese deploys directed energy weapon test against a U.S. satellite; successfully 'illuminates' U.S. satellite **January 2007**: China conducts its first successful, direct-ascent ASAT weapon test
Feb 2014: U.S. Air Force Space Command announce new satellite program, GSSAP, aimed at improving space object surveillance and detecting threats **March 2019:** Space Development Agency is established; initiation of 1,000 satellite "Proliferated Warfighting Space Architecture" **December 2019:** The U.S. Space Force is established as the sixth branch of the U.S. military, justified by the threat of China and Russia	**January 2010; May 2013; July 2014:** China conducts *three* non-destructive direct-ascent ASAT test – one being in geosynchronous orbit **July 2019:** GPS jamming and spoofing affects three hundred ships in Shanghai **June 2020:** Chinese global navigation system, BeiDou-3, becomes fully operational **July 2021:** China conducts test of Fractional Orbital Bombardment System **December 2021:** Chinese satellite successfully grappled a defunct Chinese satellite, and physically relocated it away from Earth

Conclusion

Changes in a state's military strategy in space are determined by shifts in the surrounding security environment. When the status quo remains stable for extended periods, there is minimal incentive to modify the strategy. Conversely, when states perceive threats to be growing or feel sufficiently powerful to exert greater influence, their strategies evolve accordingly. Heightened security competitions and rivalries drive these strategic shifts. The Soviet Union's rapid emergence as a competent space power disrupted the security equilibrium with the U.S. Similarly, following the end of the Cold War and the dissolution of the Soviet Union, the United States grew comfortable and complacent, as no state appeared capable of challenging its unprecedented military power or dominant position in space. However, this complacency was disrupted by the rise of China, particularly after its 2007 anti-satellite (ASAT) test, which successfully destroyed a satellite. This event underscored the unique dependence of the United States on satellites and highlighted their vulnerability. Likewise, China altered its space strategy in the early 2000s after President Bush withdrew from the ABM Treaty and, in 2006, issued a new National Space Policy that conveyed unilateralist and hegemonic themes regarding U.S. control of space. To safeguard its national security interests from the perceived threat and maintain its ability to leverage space, China significantly increased its investment in space compared to the late 20th century.

Once the military strategy has adapted to a new security environment, its precise form will be influenced by the existing distribution of power relative to other major spacefaring powers within the international system. In space, strategic decisions involve trade-offs between offensive and defensive capabilities. Infrastructure capability is the cornerstone of any successful military space strategy and must be consistently prioritized in any of the four main space strategies. This ensures that spacepower effectively enhances conventional terrestrial forces, fulfilling its primary function.

During the early space race, the U.S. operated under conditions of parity with its rivals. Consequently, the U.S. pursued substantial growth in space infrastructure, alongside the development of capable ASAT programs and strategic defensive maneuvers to protect its burgeoning satellite networks. In the 21st century, the U.S. operated from a position of superiority and explicitly pursued a strategy of resiliency and redundancy to protect its expansive space infrastructure from emerging space powers like China. This strategy involved increased investments in space situational awareness capabilities, the deployment of proliferated satellite systems, and the establishment of the Space Force. Meanwhile, China, confronting a state with far superior space capabilities, prioritized investments in offensive weapons over defensive measures, recognizing that a defensive approach alone would not suffice to challenge the dominant power effectively.

Understanding the determinants of shifts in military strategy in space is crucial because it allows policymakers and academics to comprehend state decisions in space and formulate the most effective responses. Additionally, the evolution of space strategies affects not only the immediate security environment but also the long-term stability of the international order. By examining how major powers like the United States and China adapt their approaches in response to shifting threats and opportunities, we gain valuable insights into the mechanisms driving global security policies and the future trajectory of space as a domain of strategic competition. For example, U.S. intelligence officials have confirmed that Russia is actively developing a nuclear weapon designed to be deployed in outer space (Harpley, 2024). This technology represents the most destructive form of ASAT weapons currently available. A nuclear explosion in space is capable of destroying dozens and dozens of satellites via radiation and would likely emit an EMP that would short circuit power grids on Earth. Understanding the theory behind why states make certain decisions like this is essential for policymakers, military planners, and scholars to anticipate these kinds of challenges, mitigate their risks, and effectively plan for future shifts in the balance of power. Understanding that Russia is operating from a position of inferiority compared to the U.S. suggests to policymakers that Russia will likely continue investing in offensive space technology, indicating that the development of the space nuke will not be an isolated incident.

There are several avenues for future research into the determinants of a state's military strategy in space. Scholars should test the theory presented here in various new contexts and across different states. For instance, applying it to the middle and end of the Cold War and examining the strategies of the USSR and the U.S. could provide valuable insights. At some point during the Cold War, the U.S. surpassed Soviet capabilities in space and became the superior space power – how did that affect each state's respective strategy? How does Reagan's famed Strategic Defense Initiative (a.k.a. Star Wars) fit into the theoretical framework presented here? Furthermore, examining the space strategies of emerging space powers such as India, Japan, Iran, and European nations, along with their responses to U.S. and Chinese space policies, would provide a broader perspective on global space strategy dynamics. Another variable not accounted for in this analysis is the importance of space allies and their role in shaping strategy. This factor is likely more crucial for countries like Japan or South Korea than for a superpower like the United States. Finally, future research could fully explain the case of China. Scholars with greater access to archival material and proficiency in the language would be better equipped to rigorously test my theory by examining the role domestic politics may have played in shaping China's offensive space strategy in the 21st century.

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