Liberty University Journal of Statesmanship & Public Policy

Volume 3 | Issue 1 Article 4

September 2022

Anti-satellite Tests: A Risk to The Security and Sustainability of Outer Space

McKayla Swan
Liberty University

Introduction

The new and perplexing challenges in the outer space domain have outgrown the framework that states have used to address them. Due to the expansion and development of technology, the space environment has become congested and threatening, if not hostile. To preserve the domain for future use, the United States should take a leadership role in developing new international norms for space. Anti-satellite weapons (ASAT) are at the crux of the domain's security and sustainability issues. Therefore, the United States should propose a partial ASAT test ban at the United Nations Conference on Disarmament, and initiate confidence-building measures to secure the outer space environment for long-term use.

The Space Race

In October 1957, the Soviet Union launched its first satellite, *Sputnik I*, into space. The Soviet satellite prompted the United States to develop its capabilities in space, resulting in the famous "Space Race." The United States launched its first satellite into orbit, *Explorer 1*, in January of 1958.[1] In April of 1961 Russian cosmonaut, Yuri Gagarin became the first man in outer space. Following this Soviet accomplishment, it seemed as if the Soviet Union had won the Space Race. Yet, in July of 1969, the most profound development of space exploration would occur: American astronauts Neil Armstrong and Buzz Aldrin became the first men to step foot on the moon.[2] On that day, Armstrong famously stated: "That's one small step for man, one giant leap for mankind."[3] With these words, the Space Race would transition into a new era: one of scientific discovery, and more importantly, one of strategic development.

The strategic value of space is positively correlated with scientific and technological development. As a result, the advancements in space technology during the Space Race placed science and prestige at the forefront of the nation's psyche.[4] After the launch of *Sputnik I* the development of reconnaissance satellites, also known as spy satellites, increased dramatically. This technology uses sensors to collect data, such as images of the earth's surface, as it orbits above other countries. These satellites provide valuable intelligence that previously could only be collected using aircraft imagery. Historically, this intelligence collection could constitute a breach of international law as it would violate airspace sovereignty; however, the relative newness and continuous development of space technology have made it difficult to establish international legal guidelines. Additionally, satellites are more difficult to track than aircraft. Consequently, the strategic value of reconnaissance satellites spurred the development of countermeasures, such as antisatellite weapons.[5]

The United States conducted the first anti-satellite weapons test in 1959 under project Bold Orion. Under project Bold Orion, a missile was aimed to intercept the U.S. satellite, *Explorer VI*. Flight data revealed that the objectives of the mission were met, and the United

---

[1] National Archives, "Space Exploration: timeline," Archives Library Information Center, last modified August 21, 2016, https://www.archives.gov/research/alic/reference/space-timeline.html

[2] National Archives, "Space Exploration," 2016.

[3] Neil Armstrong. "One Small Step," *Apollo 11 Lunar Surface Journal*, copywrite by Eric M. Jones, NASA, 1995. https://www.hq.nasa.gov/alsj/a11/a11.step.html

[4] Paul B. Stares, *The Militarization of Space: U.S. Policy, 1945-84* (Ithaca, NY: Cornell University Press) 23.

[5] Stares, *The Militarization of Space*, 30.

States had just conducted the first successful ASAT test.[6] This program was later canceled by the United States not only because of its expense but the risk of creating an international incident because of its nature as a dual-use system, meaning it could be used for an activity outside of its original design. In 1968 the Soviet Union began to test its first ASAT system, a satellite interceptor. The initial test was successful, and the Soviets continued to develop their ASAT programs throughout the 1970s. Through multiple ASAT tests during this period, the Soviets demonstrated their ability to intercept and destroy satellites.

At the beginning of the 1980s, the Reagan administration prioritized the continued development of the U.S. ASAT program.[7] The U.S. pursued a strategy of deterrence in space. The administration believed that an operational U.S. ASAT program would deter the Soviet's use of their weapons system. In 1981 The Soviet Union brought an arms control proposal called the "Draft Treaty on the Prohibition of the Stationing of Weapons of Any Kind in Outer Space" to the UN General Assembly. The proposal was focused on the placement of orbiting weapons in outer space but did not prohibit ASAT systems.[8] Although it prohibited the destruction or disturbance of other states' space systems, the United States rejected the proposal. The 1981 draft treaty only banned space weapons in orbit, it did not address ground-based or air-launch systems which were of concern to the United States.[9] Furthermore, the treaty would have prevented space-based ballistic missile defense (BMD), a priority of the Reagan administration, under the "Star Wars" program.[10] The Soviets submitted another draft of the proposed treaty in 1983. The draft included major developments including a complete ASAT test ban and a provision that required the destruction of current ASAT systems, including the Soviet's interceptor system. The United States denied the treaty because it was unverifiable and lacked provisions for attribution in the event of an attack.[11] After failing to ratify the agreement, both states continued to develop their counter-space capabilities in an attempt to gain strategic superiority in space. Since the 1980s, there have been significant advancements in technology; however, little progress has been made on the creation of norms in outer space. Yet, the environment has grown increasingly congested and contentious due to space debris and the proliferation of weapons systems.

Examining the Problem

ASAT weapons and the limited international norms surrounding their use present a challenge to the stability of outer space. Unlike the Cold War period, more nations and private companies are utilizing space. As the access to space has increased, the environment has become more congested with satellites and debris. This congestion increases the probability of collisions, threatening the sustainability of the domain. The sustainability of the environment is critical to the modern world which is heavily dependent upon space. Most modern technology relies upon space, including telecommunications, GPS, agriculture, financial institutions, and nuclear early-warning satellites. If orbits in space become inoperable, much of modern life will be forced to adapt. Further, global powers such as the United States depend on space systems to conduct

---

6 Stares, *The Militarization of Space*, 109.
7 Ibid., 219.
8 Ibid., 229.
9 "ASAT Arms Control: History," Ch. 5, https://www.princeton.edu/~ota/disk2/1985/8502/850207.PDF
10 "ASAT Arms Control," 97.
11 Stares, *The Militarization of Space*, 232.

military operations. Therefore, the increasing levels of debris and the militarization of the environment, by way of ASAT and dual-use systems, are risks to the security and sustainability of the environment.

Space security and sustainability are interconnected, thus both are vital to the preservation of space for future generations. There is not a single agreed-upon definition for space security.[12] Since the Cold War era, security in space has referred to a state's military or national security interests. More recently, "security" has been used more broadly to describe other challenges in space such as environmental concerns.[13] While multiple challenges in the space domain may be described as security issues, for clarity, here, security refers to a state's military interests. Space sustainability refers to the preservation of the space environment for future, peaceful use.[14] One of the greatest sustainability challenges is the growing quantity of space debris.[15]

Anti-satellite weapons and their testing intersect space security and sustainability. These weapons threaten a nation's space security because they are a form of asymmetric warfare. ASAT systems can be used to destroy a state's critical security systems such as satellites used for military communications or nuclear early-warning satellites.[16] Additionally, some forms of ASAT testing create large debris fields, contributing to the congestion of the domain and threatening space sustainability.[17] The existence and testing of ASAT weapons are areas that must be addressed on an international level to protect the stability and sustainability of space.

Currently, there are limited international guidelines that regulate activities in space and fewer that regulate anti-satellite capabilities. However, the United States has taken the initiative to establish norms promoting security and sustainability in the space arena. On April 18, 2022, the Biden administration announced the United States' commitment to refrain from conducting destructive, direct ascent anti-satellite missile testing. During the announcement, Vice President Harris called on other nations to make the same commitment, she also emphasized the importance of U.S. leadership in space. Harris noted the strategic importance of reducing ASAT testing and debris creation for the future of U.S. national security interests in the domain. [18]

[12] Ntorina Antoni, "Definition and Status of Space Security," in *Handbook of Space Security* (Schrogl, KU: Springer, Cham, 2020), 12, https://link.springer.com/content/pdf/10.1007/978-3-030-23210-8_126.pdf

[13] Ntorina, "Definition and Status," 12.

[14] United Nations, "Guidelines for the Long-term Sustainability of Outer Space Activities," Committee on the Peaceful Uses of Outer Space, 2018, 2/20. https://www.unoosa.org/res/oosadoc/data/documents/2018/aac_1052018crp/aac_1052018crp_20_0_html/AC105_2018_CRP20E.pdf

[15] United Nations, "Guidelines for the Long-term," 2/20.

[16] Victoria Samson and Brian Weeden, "Enhancing Space Security: Time for Legally Binding Measures," *Arms Control Association*, December 2020, https://www.armscontrol.org/act/2020-12/features/enhancing-space-security-time-legally-binding-measures.

[17] United Nations, "Space Debris Mitigation Guidelines of the committee on the Peaceful Uses of Outer Space," Office for Outer Space Affairs, 2010, https://www.unoosa.org/pdf/publications/st_space_49E.pdf

[18] "FACT SHEET: Vice President Harris Advances National Security Norms in Space," Statesments and Releases, White House Briefing Room, April 18, 2022, https://www.whitehouse.gov/briefing-room/statements-releases/2022/04/18/fact-sheet-vice-president-harris-advances-national-security-norms-in-space/#:~:text=The%20destruction%20of%20space%20objects,risk%20to%20astronauts%20in%20space

Space Security

Due to the proliferation of space weapons, the security of the space domain is at risk. The United States has a strong interest in the protection of space satellites, given their strategic value. From communication systems to intelligence gathering and nuclear early warning satellites, space is a strategic domain. The backbone of the U.S. military and its global power projection is not brute strength, but rather the logistical systems that facilitate efficient operations. Such systems include positioning, navigation, intelligence, and surveillance.[19] The value of these space-based systems has caused the proliferation of technology, such as ASAT weapons, designed to defend critical infrastructure or initiate an attack in the event of a military confrontation.[20] Recently, testing of such weapons has significantly increased, with over 20 ASAT weapons tests carried out by four countries in the last two decades.[21] The United States' current strategy in space security is deterrence, as evidenced by the creation of the Space Force and the Biden administration's commitment to a more resilient, strong posture in space.[22] Thus, U.S. leadership has not pursued legally binding arms control agreements, which could restrict this strategy and would be difficult to verify compliance. However, as other space-faring states begin to develop assets aimed at the destruction of U.S. military capacity, it may be necessary to pursue a fair and equitable agreement.

Space Security Threats

The United States' greatest strategic threats in space are Russia and China. Russia is the classic competitor, with a long history of U.S. competition and cooperation. Though the relationship on the ground can be tense and adversarial, in space the accord has been largely cooperative, highlighted by the close cooperation on the International Space Stations (ISS) and the use of Russian rockets.[23] Yet, the cooperative spirit in space relations does not negate Russia's strategic capabilities. For decades the Russians have proven the operability of their ASAT systems through both direct-ascent and co-orbital tests. Direct-ascent means the weapon is launched from earth, and co-orbital means the weapon is first placed into orbit before conducting the attack.[24] More recently, its military has focused on the development of electronic warfare capabilities and signals intelligence (SIGINT) satellites.[25] Electronic warfare capabilities allow the Russians to reduce the strategic capabilities of other states by jamming satellites or disrupting GPS signals. In particular, The Liana Constellation of SIGINT satellites can be used to intercept communications.[26]

---

[19] Colby Elbridge, "From Sanctuary to Battlefield: A Framework for U.S. Defense and Deterrence Stratedgy for Space," *Center for A New American Security*, (2016): 4. https://www.jstor.org/stable/resrep06428#metadata_info_tab_contents

[20] Samson and Weeden, "Enhancing Space Security," 2020.

[21] Ibid.

[22] The White House, *United States Space Priorities Framework* (Washington D.C., 2021), 6.

[23] John M. Logsdon and James R. Millar, "U.S.-Russian Cooperation in Human Space Flight Assessing the Impacts," *Elliott School of International Affairs The George Washington University*, (2001): 9.

[24] Todd Harrison et. al., "Space Threat Assessment 2022," A Report of The CSIS Aerospace Security Project, CSIS, 2022, 13. https://www.csis.org/analysis/space-threat-assessment-2022

[25] Harrison et. Al., "Space Threat Assessment 2022," 3.

[26] Ibid., 13.

Equally as competitive as Russia in the space arena is China. More recently, China has developed a strong presence in space and has developed counter-space capabilities.[27] Counter-space systems refer to any space capability, offensive or defensive, designed or used to disrupt or destroy another space system.[28] A ballistic missile directly striking a satellite or a laser disrupting a satellite's sensors, for example, would both be counter-space systems.[29] China's continued development of strategic capabilities will become a challenge for the United States. The Chinese are developing various counter-space capabilities ranging from on-orbit systems, ground-based ASAT weapons, and cyberspace systems.[30] They have not been transparent with these technological developments, which suggests they are building up covert weapons systems. For example, Tianjin University has developed a space robot supposedly intended to attach to space debris to remove it from orbit. However, its design would make it difficult to attach to debris. The targeted debris "would likely need to be in a predictable motion in an established orbit in order for capture by the robotic arm to be possible. The design of this satellite lends itself to a co-orbital ASAT, even if that is not the stated intent."[31]

Space weapons have already been developed, and there is no going back. The question thus becomes, what is the best way to mitigate their negative effects? In a testimony before the House Science, Space, and Technology Committee, Todd Harrison, director of the Aerospace Security Project at the Center for Strategic and International Studies stated:

> the real objective of this [new space] race is to see who can build the broadest and strongest international coalition in space. Whatever group of nations emerges as the leading coalition in space over the next decade will be the ones that set the de facto norms for the space commerce and exploration that follows.[32]

Given its strategic value, the United States should continue to lead in the space environment by introducing equitable norms which align with U.S. national security and commercial interests. Although the United States faces formidable competition from Russia and China, a diplomatic approach is possible. The cooperation between the United States and the Soviet Union during the Cold War serves as an example of historical cooperation and transparency in space, which may translate to establishing a modern framework for dialogue in an increasingly militarized space environment.[33]

---

[27] Mark Stokes et al., "China's Space and Counterspace Capabilities and Activities," report prepared for The U.S.-China Economic and Security Review Commission. March 30, 2020, 22. https://www.uscc.gov/sites/default/files/2020-05/China_Space_and_Counterspace_Activities.pdf

[28] Brian Weeden and Victoria Samson. "Global Counterspace Capabilities: An Open-source Assessment," Secure World Foundation, April 2022. Iv. https://swfound.org/media/207346/swf_global_counterspace_capabilities_es_2022_en.pdf

[29] Harrison et. al., "Space Threat Assessment 2022," 2-3.

[30] Todd Harrison et. al., "Space Threat Assessment 2021," A Report of The CSIS Aerospace Security Project, CSIS, 2021, 10. https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/210331_Harrison_SpaceThreatAssessment2021.pdf?gVYhCn79enGCOZtcQnA6MLkeKlcwqqks

[31] Harrison et. al., "Space Threat Assessment 2021," 10.

[32] Todd Harrison, Statement before the House Science, Space, and Technology Committee Subcommittee on Space and Aeronautics, "NASA's Future in Low Earth Orbit: Consideration for International Extension and Transition" (Washington, D.C., CSIS) September 21, 2021, 3.

[33] Harrison, "NASA's Future in LEO," 3.

Space Sustainability

The sustainability of the space environment is critical to its long-term use for peaceful purposes. Currently, the greatest threat to sustainability is the growing volume of space debris. Much of modern technology relies on space-based satellites; thus, Low Earth Orbit (LEO) has become congested with new space objects and continues to worsen. New orbital debris is created in various ways, including satellite collisions, launching debris, and destructive ASAT weapons tests. Concern over the increase of space debris in LEO is often articulated using the "Kessler Syndrome," which explains the impact of continued in-orbit collisions. The theory predicts that in a congested orbit, space debris will collide and produce more debris. New debris will continue to collide at higher velocities, creating a cascade of collisions and ultimately, causing the orbit to become too crowded and unusable.[34] Kessler cites three different types of collisions: negligible non-catastrophic, non-catastrophic, and catastrophic.[35] The first two types of collisions, negligible non-catastrophic and non-catastrophic, do not create large debris fields, at worst the non-catastrophic collision may threaten operational spacecraft in the short-term, yet the debris created is too small to collide with other debris, thus it would not create collision cascades.[36] Non-catastrophic collisions generally occur between a fragment and an intact object.[37] A catastrophic collision is the most dangerous type of collision, impacting both the short-term and long-term sustainability of the environment. A catastrophic collision produces small and large fragments. Unlike the small debris created in the negligible and non-catastrophic collisions, the large debris fragments impact the long-term sustainability of space through collision cascades. Data suggests that any fragments 20 cm or larger colliding with an intact space object would result in a catastrophic collision.[38] Generally, debris-creating ASAT tests are examples of catastrophic collisions. Consequently, the debris created from a single ASAT test may continue to produce more debris after the initial collision.

Space Sustainability Threats

Although the United States, China, and India have all conducted debris-creating ASAT tests, Russia's most recent test has drawn international criticism. On November 15, 2021, Russia tested a direct ascent ASAT missile hitting their defunct COSMOS 1408 satellite.[39] The United States has reported that their test created at least 1,500 fragments of trackable debris (at least 10cm in diameter), with many smaller fragments.[40] The test forced astronauts at the ISS to undergo safety procedures in the event of a collision. Bill Nelson, administrator of the National Aeronautics and Space Administration (NASA), condemned Russia's action stating:

---

[34] Donald J. Kessler et. al., "The Kessler Syndrome: Implications to Future Space Operations," *American Astronautical Society*, February 2010, https://www.threecountrytrustedbroker.com/media/kesseler_syndrome.pdf

[35] Kessler et al., "The Kessler Syndrome," 2010.

[36] Ibid.

[37] Ibid.

[38] Ibid.

[39] Ankit Panda, "The Dangerous Fallout of Russia's Anti-Satellite Missile Test," *Carnegie Endowment for International Peace*, November 17, 2021, https://carnegieendowment.org/2021/11/17/dangerous-fallout-of-russia-s-anti-satellite-missile-test-pub-85804

[40] Panda, "The Dangerous Fallout," 2021.

> It is unthinkable that Russia would endanger not only the American and international partner astronauts on the ISS but also their cosmonauts. Their actions are reckless and dangerous… all nations have a responsibility to prevent the purposeful creation of space debris from ASATs and to foster a safe, sustainable space environment.[41]

Though Nelson calls for all states to refrain from conducting debris-creating ASAT tests, there are minimal international legally binding norms to prevent such actions. Rather, the current international perspective on intentional debris creation is evidenced through non-legally binding agreements. First is the 2010 Debris Mitigation Guidelines established by the U.N. Committee on the Peaceful Uses of Outer Space. These voluntary, non-legally binding guidelines primarily address debris mitigation for the construction, orbiting, and de-orbiting of satellites. According to Guideline 4, states should not intentionally destroy on-orbit spacecraft due to the long-term generation of space debris.[42] Russia is a signatory of this agreement, yet did not honor its provisions. Further, Russia did not honor its submission of space norms included in the U.N. Resolution "Reducing Space Threats Through Norms, Rules, and Principles of Responsible Behavior." This resolution, adopted in December 2020, asked states to submit suggestions for responsible norms in outer space. Russia suggested that states should "not construct, test or deploy space weapons, regardless of where they are based, for any purpose, including for missile defense or as anti-satellite capabilities."[43] Russia's actions indicate that voluntary norms will not suffice to prevent weapons testing and that legally binding, verifiable norms are necessary.

Lack of Norms and Regulation

The primary governing law related to the use of outer space is the multilateral *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*. Adopted by the U.N. General Assembly in 1967, this treaty is more commonly referred to as the Outer Space Treaty (OST). The treaty recognizes the interest of all states to explore and utilize space for peaceful purposes.[44] This purpose statement affirms the interest of all to preserve the security and sustainability of the environment. Further, the treaty bans signatories from placing any nuclear weapons or weapons of mass destruction in space.[45] The OST only contains provisions barring nuclear weapons from outer space and does not prohibit the use of other weapons such as anti-satellite systems. Thus, there are no legally-binding agreements protecting space from continued militarization by modern space weapon systems.

The most recent attempt at a legally binding arms control agreement was jointly proposed by Russia and China in 2008. Their proposal, which was later revised and resubmitted in 2014, was the *Prevention of Placement of Weapons in Outer Space, the Threat of Use of Force against Outer Space Objects* (PPWT). The treaty's stated purpose is to prevent space from becoming a

---

[41] "NASA Administrator Statement on Russian ASAT Test," Press Release, *NASA*, November 15, 2021, https://www.nasa.gov/press-release/nasa-administrator-statement-on-russian-asat-test

[42] United Nations, "Space Debris Mitigation," 3.

[43] United Nations, "Reducing space threats through norms, rules and principles of responsible behaviours" Prevention of an arms race in outer space, Report of the Secretary-General, 2020, https://undocs.org/A/76/77

[44] United Nations Treaties and Principles on Outer Space, *Treaties and Principles Governing the Activities of States in the Exploration and use of Outer Space* (New York: United Nations, 2002), 1.A.

[45] United Nations, *OST*, Art. IV.

new area for military confrontation, posing a threat to international peace.[46] The draft prohibits the placement of any weapons in outer space.[47] Under the treaty, a "weapon in outer space" is defined as, "…any outer space object or component thereof which has been produced or converted to destroy, damage or disrupt the normal functioning of objects in outer space."[48] In addition, the draft emphasizes the implementation of transparency and confidence-building measures (TCBMs).[49] It suggests that states should, collectively share and analyze data.[50] The United States did not sign either version presented in 2008 or 2014 because there was no verification protocol to ensure compliance with the treaty. The PPWT simply suggested the need for potential "additional protocol" to verify treaty compliance.[51] In addition, the proposal did not address the development or testing of ground-based ASAT weapons. This was another major concern for the U.S. and its allies because without addressing ground-based systems, the PPWT would not be a comprehensive space arms control agreement. Ground-based ASATs are also more plentiful and easier to develop than space-based systems.[52] The PPWT is important to the discussion of space arms control for two reasons: first, it was proposed by Russia and China, two traditionally competitive powers. Although it was largely a political strategy to shame the U.S. for developing space weapons, it demonstrates an openness to a legally binding arms control agreement.[53] Secondly, the proposal revealed gaps in assurances of regulatory compliance which will need to be remedied before a similar treaty can be considered.

Risks of Current U.S. Strategy

Historically, policymakers have been hesitant to pursue any agreement which would undermine the United States' freedom to pursue specific activities in space. This presupposes that the United States is ahead of its competitors in spacefaring capabilities. However, the increasing competition from Russia and China in space should change the United States' calculus.[54] The proliferation of space weapons and increased technological capabilities demonstrate that the United States' strategic advantage in space is waning. This is evidenced by competitors' technological developments and plentiful ASAT tests demonstrating new capabilities.[55] Thus, it is time for the United States to consider a legally binding agreement, while there is still strategic leverage.

Destructive ASAT tests have and will continue to contribute to a congested LEO. An overcrowded space environment increases the likelihood of collision cascades, contributing to the inoperability of orbits. As previously highlighted, much of modern technology relies upon space; therefore, the United States' current policy trajectory may result in negative consequences

[46] Conference of Disarmament, *Draft Treaty on the Prevention of Placement of Weapons in Outer Space the Threat or Use of Force against Outer Space Objects* (Geneva: CD/1985, 2014), Preface.
[47] CD, *OST*, Art. II.
[48] CD, *OST*, Art. I.
[49] Ibid., Art. V.
[50] Ibid., Art. VI (f).
[51] Ibid., Art. V.
[52] "Statement by Ambassador Wood: The Threats Posed by Russia and China to Security of the Outer Space Environment," Conference on Disarmament Plenary Meeting, U.S. Mission to International Organizations in Geneva, August 14, 2019, https://geneva.usmission.gov/2019/08/14/statement-by-ambassador-wood-the-threats-posed-by-russia-and-china-to-security-of-the-outer-space-environment/
[53] Samson and Weeden, "Enhancing Space Security," 2020.
[54] Ibid.
[55] Harrison et. al., "Space Threat Assessment 2022," 10.

for scientific and technological advancement. In addition, as the quantity of debris increases it is more difficult to catalog and track debris, and challenging for satellite operators to maneuver satellites to avoid collisions. Not only would accidental collisions produce more debris, compounding the problem, but it could result in a miscalculation between states. Ultimately, both security and sustainability concerns may reduce the long-term usability of space and should be a concern for policy-makers.

Paths Forward for U.S. Space Policy

The future of U.S. space policy could move forward in multiple directions. First is the status quo strategy of deterrence. The Biden administration's space policy aims to, deter aggression in space to ensure strategic stability, build resilient space systems, and strengthen the United States' ability to attribute hostile actions in space.[56] The U.S. can continue to meet these goals through improvements in space systems and technological resiliency. To address current challenges, the Space Force is updating and enhancing existing GPS satellites with anti-jamming software.[57] In addition, they are creating many smaller satellites, which are more difficult to destroy and place less value in each target. This is a strong strategy to increase the resiliency of U.S. systems.[58] These actions will continue to bolster U.S. deterrence and is a viable path for future space operations.

Second, the United States could pursue an alternative strategy to deterrence by engaging in talks for a limited, legally binding option. A partial ASAT test ban and increased TCBM's would be the first step to comprehensive norms for outer space. Such an agreement would ban debris-causing ASAT tests and involve TCBMs on debris tracking and non-sensitive space situational awareness information (SSA). The TCBMs should also include discussion on rules of engagement, and responsible norms in space.[59] This double-layered approach would mitigate some sustainability issues arising from space debris, and it would build confidence in legally binding measures to eventually bolster space security.

Lastly, the United States could pursue a more comprehensive legally binding arms control agreement, similar to the PPWT proposed by Russia and China. For an agreement to be successful it must have provisions to verify treaty compliance and address ground-based ASAT systems. Although challenging, verification is not impossible. Debris-creating collisions or a close approach by another state's satellite can be verified using SSA data.[60] SSA data includes the tracking and categorizing of objects and movements in space. In the event of a major disruption to normal orbiting patterns, such as a destructive ASAT test, the event and perpetrator can be identified by analyzing data from before and after the disruption occurs.[61] Further, the United States and Canada have tested systems containing sensors that would allow in-orbit inspection of a satellite. Through sensors, these systems analyze the physical form of a space object to determine its intended function.[62] This technology could be utilized to verify the

---

[56] The White House, *United States Space Priorities Framework*, (Washington D.C., 2021), 6.

[57] U.S. Senate Committee on Armed Services Subcommittee on Strategic Forces, *Space Force, Military Space Operations and Programs*, 117th Cong., 2021, 12.

[58] Ibid., 53.

[59] Ibid., 37.

[60] Samson and Weeden, "Enhancing Space Security," 2020.

[61] Ibid.

[62] Ben Baseley-Walker and Brian Weeden, "Verification in Space: theories, realities and possibilities," (Geneva: United Nations Institute for Disarmament Research, 2010), 42.

function of other states' satellites and could be the space equivalent to an on-site inspection of nuclear facilities.[63] To address concerns on ground-based ASAT systems, a treaty would include limits on how many weapons could be developed. This is a similar provision to the aggregate limits placed on nuclear warheads and ICBMs under the New START treaty.[64]

Criteria for Analysis: Viability, Benefit, Equity

To determine the best policy path for the United States, it is important to identify criteria for analysis. The three criteria that will be used to analyze the policy alternatives are viability, benefit, and equity. Viability is the likelihood that the policy could be successfully implemented, and that compliance is verifiable. This includes the probability that other states would agree to the policy. If key actors are unwilling to sign a treaty or if their compliance cannot be verified, states will not relinquish their freedom of action.[65] The second criterion, benefit, is the projected success of the policy to solve the problem. In this case, the ability of the policy to improve both the stability and sustainability of the space domain. This criterion is rooted in U.S. Space Policy which emphasizes U.S. leadership and diplomatic engagement to promote stability in space.[66] Lastly, equity refers to the fairness of the policy both to the U.S. and other states operating in space. As evident in the United States' rejection of the PPWT, a treaty must apply equally to all parties to ensure treaty benefit and continued compliance by all parties. These criteria were selected because they cover critical components of a successful policy outcome.

Projected Outcomes and Tradeoffs

Deterrence

The first policy option for the U.S. is the status quo of deterrence. This is a viable option for the United States. It does not require participation from other states; therefore, consensus and unilateral decision-making are benefits of this policy, as the focus is U.S. strategic benefit. Although deterrence may bolster U.S. strategic interests in the short term by enhancing technological resilience, it will not be successful as a long-term strategy. If other spacefaring states pursue deterrence the domain will continue to militarize. This increases the probability of negative consequences such as a miscalculation. As a result, deterrence alone does not provide the greatest benefit because it does not comprehensively address both security and sustainability issues. Deterrence is an equitable option for the United States because it enhances U.S. national security interests and does not concede ground to other states' objectives.

In the short term, this policy may preserve the somewhat stable space environment, yet it is passive stability that will not produce long-term benefits. In a hearing before the U.S. Senate Armed Services Committee, Senator Fisher asked Assistant Secretary of Defense for Space Policy, Mr. John Hill, if a defense-only approach will be successful in the space domain. Mr. Hill stated, "Defense is one piece of mission assurance, but it is better to start off with architecture

---

[63] "New START Treaty," *Bureau of Arms Control, Verification, and Compliance.* U.S. Department of State.

[64] "New START," U.S. Department of State.

[65] Roger G. Harrison, "Space and Verification," Eisenhower Center for Space and Defense Studies. Vol.1, Policy Impliactions, November 2010. 3 https://swfound.org/media/37101/space%20and%20verification%20vol%201%20-%20policy%20implications.pdf

[66] White House, *U.S. Space Priorities*, 6.

and do not require so much defense in the first place. What we face today is the legacy of having designed architectures in an era when we did not face the kinds of threats we face today and transitioning to a new era."[67] Mr. Hill's statement demonstrates that a short-term policy solely focused on deterrence does not address more substantial, long-term issues. Thus, deterrence is a short-term strategy that trades off with long-term security and sustainability.

Limited Arms Control Agreement

The second policy option for the United States is a ban on destructive ASAT tests and an increase in TCBMs on SSA and data sharing. To determine if this path is viable, it is important to explore the willingness of the most dominant space powers -- the U.S., China, and Russia -- to participate. First, the United States would most likely support a partial test ban because it does not hurt strategic interests, it simply bans dangerous, debris-causing explosions. The current U.S. policy affirms that the U.S. will lead in protecting the space environment and engage with competitors diplomatically to ensure stability in the domain.[68] Proposing an agreement that prevents the creation of new debris is a leadership action that would improve space stability. China, as a growing space power has expressed its willingness to participate in the creation of international norms. In a recent white paper published by the Chinese, they affirmed their commitment to form international norms and ensure the long-term sustainability of space.[69] Lastly, on paper Russia affirms its commitment to space sustainability, but its recent actions demonstrate otherwise. Russia may be willing to ratify a binding treaty if it is articulated as a precursor to a more comprehensive arms control agreement, in which they have expressed interest through the PPWT. Thus, if properly articulated, this option is viable because the most dominant space powers have expressed openness to such an agreement.

A partial ASAT test ban and increased transparency measures would be effective to bolster the security and sustainability of space, meaning the policy would satisfy the benefit criterion. It is effective at increasing sustainability by preventing deliberate human debris creation currently contributing to the issue. This policy is equitable because debris-causing ASAT attacks and tests are highly attributable as current technology is sufficient to determine which state deployed an ASAT weapon. Greater SSA sharing will prevent accidental collisions, hence reducing preventable debris creation. The TCBMs in this policy are key because they produce trust and provide a framework for future cooperation. Data sharing and communication are key to the verification of actions in space. Therefore, this aspect of the policy may be a necessary first step before there could be a more comprehensive space arms control agreement. Lastly, the policy is relatively equitable. The debris-producing test ban applies to all states equally, and with SSA tracking there are sufficient means to verify state's treaty compliance. It is plausible that the data sharing involved in the TCBMs would not take place equally among signatories of the treaty. Either due to lack of ability or lack of transparency. Yet generally this policy would be a beneficial first step toward concrete norms in space.

---

[67] Senate Committee, *Space Force, Military Space Operations*, pg. 24.

[68] White House, *U.S. Space Priorities*, 6.

[69] China National Space Administration, "China's Space Program: A 2021 Perspective" The State Council Information Office of the People's Republic of China, January 2022 http://www.cnsa.gov.cn/english/n6465652/n6465653/c6813088/content.html

Comprehensive Arms Control Agreement

Last is the more comprehensive space arms control agreement. The viability of this option is low, because of the serious concerns expressed by the United States and its allies. Although there may be some ability to verify actions in space, the United States does not consider current technology to be sufficient to verify treaty compliance of a complete ASAT ban. Further, if the issues of verification and ground-based ASAT systems could be addressed in a revised PPWT there is no assurance that Russia and China would still support the agreement. This option would be the most comprehensive in addressing the security challenges of space, thus providing the most benefit. In theory, it would prevent the continued militarization of the domain and address some sustainability concerns. Yet these benefits would only exist if there was complete compliance by all parties. Without a strong verification mechanism, there is no way to assure the treaty is applied equally to all parties. Thus, this presents an interesting tradeoff as the policy could significantly reduce space militarization, but there is a risk that other parties would not comply. Therefore, the tradeoff may result in a significant loss of U.S. dominance in space.

General Recommendations

The United States should pursue a policy that both benefits strategic interests and preserves the space environment for long-term use. A partial ASAT test ban and an increase in TCBMs satisfy both goals. The United States' proposal of a partial ASAT test ban will demonstrate leadership in space sustainability. Further, it would prevent purposeful debris creation, thus preserving the space domain for U.S. military and commercial assets. This policy would mitigate sustainability issues, but does not hurt the U.S. strategic interests in space. This partial ASAT test ban could be proposed using multilateral methods, including the United Nations Conference on Disarmament (CD). The CD would allow these talks to take place in a multilateral setting, consequently preventing direct engagement with the Russians, which is unfavorable in light of the Ukraine war.

In addition to the partial ASAT test ban, the focus on TCBMs is critical to space sustainability and future arms control measures. Data sharing increases capacity for conjunction assessment, also known as the prediction of collisions, allowing satellite operators to maneuver to prevent accidental collisions and debris creation. Currently, the United States operates the largest surveillance system known as the Space Surveillance Network. It currently tracks over 21,000 objects which are at least 10 cm in diameter. Russia currently has a similar system, with a smaller catalog.[70] At the moment, there is no streamlined way to share collision information, especially with U.S. competitors. Because there is no streamlined mechanism, Russia and China do not easily engage with the United States on basic data sharing. To contact satellite operators from Russia or China, it must be done through diplomatic channels, such as communication through defense attachés.[71] This data sharing would establish a communication channel that would not involve strategic information, but rather key data pertaining to safety and flight operations.[72]

[70] Walker and Weeden, "Verification in Space," 43.
[71] Senate Committee, *Space Force, Military Space Operations*, 38.
[72] Ibid.

Lastly, increased data sharing would be a first step to preventing the continued militarization of space. Data sharing and better SSA are crucial to the development of a verification regime, to be used in a future arms control agreement. Sharing of SSA information could eventually be used to create a surveillance system with the capacity to track and catalog the orbital measurements of satellites. This system could differentiate between an ASAT attack or an accidental collision.[73] Thus, TCBMs mitigate debris creation and also increase the probability of developing a verification mechanism crucial for future norms in the domain. Given their goal of a comprehensive arms control agreement, Russia and China would be inclined to accept the proposed treaty as a necessary first step. All states, including the United States' most formidable competitors, have a vested interest in the sustainability of space as the modern world relies upon it. Therefore, it is likely Russia and China would be open to a diplomatic approach. In addition to the partial ASAT test ban and TCBM, the United States should continue to pursue strategic deterrence in space. These courses of action are not mutually exclusive; rather, in conjunction, they represent a comprehensive approach to mitigating risks in space. The United States should continue to bolster deterrence in space to protect U.S. national security and strategic interests. Yet, it is vital to simultaneously pursue a diplomatic approach to mitigate security and sustainability issues that impact space.

Conclusion

To secure the space environment for future use, the United States should take a leadership role in the development of new international norms. The current U.S. deterrence strategy alone will not benefit the long-term security and sustainability of the environment. It only encourages other states to proliferate counter-space capabilities. The opposite of the current U.S. strategy is a comprehensive space arms control agreement like the PPWT proposed by Russia and China. The lack of a verification mechanism means that this policy is not viable and could not be implemented equitably by all state parties. The United States should pursue a mediated approach through a partial ASAT test ban and increased TCBMs that emphasize SSA data sharing. This path aligns with the space policy of most critical spacefaring states; hence it is a viable option. Further, it benefits the security and sustainability of space by providing a framework for a verification mechanism that could be used for a future arms control agreement. Lastly, debris causing ASAT attacks and tests are highly attributable because current technology is sufficient to determine which state deployed an ASAT weapon. Attribution is critical because it means the treaty could be equally applied to all signatories. These measures are key to the preservation of the space environment and peaceful relationship-building among states.

---

[73] Walker and Weeden, "Verification in Space," 43.

Bibliography

Antoni, Ntorina. "Definition and Status of Space Security." in Handbook of Space Security. Schrogl, KU. Springer, Cham, 2022. 12. https://link.springer.com/content/pdf/10.1007/978-3-030-23210-8_126.pdf

Armstrong, Neil. "One Small Step," Apollo 11 Lunar Surface Journal, copywrite by Eric M. Jones, NASA, 1995. https://www.hq.nasa.gov/alsj/a11/a11.step.html

"ASAT Arms Control: History" Ch. 5, https://www.princeton.edu/~ota/disk2/1985/8502/850207.PDF

Ben Baseley-Walker and Brian Weeden. "Verification in Space: theories, realities and possibilities." Geneva: United Nations Institute for Disarmament Research, 2010.

China National Space Administration. "China's Space Program: A 2021 Perspective" The State Council Information Office of the People's Republic of China. January 2022 http://www.cnsa.gov.cn/english/n6465652/n6465653/c6813088/content.html

Conference of Disarmament. *Draft Treaty on the Prevention of Placement of Weapons in Outer Space the Threat or Use of Force against Outer Space Objects*. Geneva: CD/1985, 2014.

Elbridge, Colby. "From Sanctuary to Battlefield: A Framework for U.S. Defense and Deterrence Strategy for Space." *Center for A New American Security*, (2016): 1-33. https://www.jstor.org/stable/resrep06428#metadata_info_tab_contents

"FACT SHEET: Vice President Harris Advances National Security Norms in Space" Statements and Releases, White House Briefing Room, April 18, 2022, https://www.whitehouse.gov/briefing-room/statements-releases/2022/04/18/fact-sheet-vice-president-harris-advances-national-security-norms-in-space/#:~:text=The%20destruction%20of%20space%20objects,risk%20to%20astronauts%20in%20space

Kessler, J. Donald et. al., "The Kessler Syndrome: Implications to Future Space Operations," American Astronautical Society, February 2010, https://www.threecountrytrustedbroker.com/media/kesseler_syndrome.pdf

Logsdon, John M. and Millar, James R. "U.S.-Russian Cooperation in Human Space Flight Assessing the Impacts," Elliott School of International Affairs The George Washington University, (2001): 1-31.

Mark Stokes, et al. "China's Space and Counterspace Capabilities and Activities." report prepared for The U.S.-China Economic and Security Review Commission. March 30, 2020. https://www.uscc.gov/sites/default/files/2020-05/China_Space_and_Counterspace_Activities.pdf

NASA. "NASA Administrator Statement on Russian ASAT Test." Press Release. American Astronautical Society, February 2010, https://www.threecountrytrustedbroker.com/media/kesseler_syndrome.pdf

National Archives. "Space Exploration: timeline." Archives Library Information Center. Last modified August 21, 2016, https://www.archives.gov/research/alic/reference/space-timeline.html

Panda, Ankit. "The Dangerous Fallout of Russia's Anti-Satellite Missile Test." Carnegie Endowment for International Peace. November 17, 2021. https://carnegieendowment.org/2021/11/17/dangerous-fallout-of-russia-s-anti-satellite-missile-test-pub-85804

Stares, Paul B. The Militarization of Space: U.S. Policy, 1945-84. Ithaca, NY: Cornell University Press, 1985.

The White House. *United States Space Priorities Framework*. Washington D.C., 2021, pg. 6.

Todd Harrison. Statement before the House Science, Space, and Technology Committee Subcommittee on Space and Aeronautics. "NASA's Future in Low Earth Orbit: Consideration for International Extension and Transition." Washington, D.C., CSIS. September 21, 2021.

Todd Harrison et. al. "Space Threat Assessment 2021." A Report of The CSIS Aerospace Security Project. CSIS. 2021. https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/210331_Harrison_SpaceThreatAssessment2021.pdf?gVYhCn79enGCOZtcQnA6MLkeKlcwqqks

Todd Harrison et. al., "Space Threat Assessment 2022," A Report of The CSIS Aerospace Security Project, CSIS, 2022, 13. https://www.csis.org/analysis/space-threat-assessment-2022

United Nations. "Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space." Office for Outer Space Affairs. 2010. https://www.unoosa.org/pdf/publications/st_space_49E.pdf

United Nations. "Guidelines for the Long-term Sustainability of Outer Space Activities" Committee on the Peaceful Uses of Outer Space. 2018. 1-20. https://www.unoosa.org/res/oosadoc/data/documents/2018/aac_1052018crp/aac_1052018crp_20_0_html/AC105_2018_CRP20E.pdf

United Nations Treaties and Principles on Outer Space. Treaties and Principles Governing the Activities of States in the Exploration and Use of Outer Space. New York: United Nations, 2002.

United Nations. "Reducing space threats through norms, rules, and principles of responsible behaviours" Prevention of an arms race in outer space. Report of the Secretary-General. 2020, https://undocs.org/A/76/77

U.S. Department of State."New START Treaty." *Bureau of Arms Control, Verification, and Compliance* https://www.state.gov/new-start/#:~:text=Treaty%20Structure%3A%20The%20Treaty%20between,all%20Russian%20deployed%20intercontinental%2Drange

U.S. Mission to International Organizations in Geneva. "Statement by Ambassador Wood: The Threat Posed by Russia and China to Security of the Outer Space Environment." Conference on Disarmament Plenary Meeting. August, 14, https://geneva.usmission.gov/2019/08/14/statement-by-ambassador-wood-the-threats-posed-by-russia-and-china-to-security-of-the-outer-space-environment/

U.S. Senate Committee on Armed Services Subcommittee on Strategic Forces. *Space Force. Military Space Operations and Programs*.117th Cong., 2021. 1-60. https://www.armed-services.senate.gov/imo/media/doc/21-44_05-26-2021.pdf

Victoria Samson and Brian Weeden. "Enhancing Space Security: Time for Legally Binding Measures." Arms Control Association, December 2020. https://www.armscontrol.org/act/2020-12/features/enhancing-space-security-time-legally-binding-measures

Weeden, Brian and Victoria Samson. "Global Counterspace Capabilities: An Open-Source Assessment," Secure World Foundation, April 2022. Iv. swf_global_counterspace_capabilities_es_2022_en