

**A New Era of Space: The Outer Space Treaty and Its Applicability to Anti-satellite
Weapons Testing and Space Debris**

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

Sierra Shuman

Spring 2023

On my honor as a University Student, I have neither given nor received unauthorized aid on this
assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Advisor

Kent Wayland, Department of Engineering and Society

It is no question that humans have been fascinated with exploring outer space ever since we developed the scientific capabilities to. From humankind's first moonwalk to recent missions aiming to photograph distant planets, as a species we have always been curious about what exists beyond Earth. In addition to scientific curiosity, we also have found practical uses for space; communication in the modern world relies on the network of satellites that have been placed in Earth's orbit. These satellites facilitate the broadcasting of some radio and television, are necessary for cellular networks, and drive the technology behind navigation services such as Google Maps. From 2020 to 2021 alone, the number of active satellites in orbit more than doubled from around 2000 satellites to over 4800 (Meyer, 2022).

These feats of exploration and use of space benefit the whole world, and are possible due to international cooperation among the nations of Earth. This cooperation is based in various treaties and agreements, one such being the Outer Space Treaty of 1967, which has served as a basis of international space policy since it was adopted.

Although the Outer Space Treaty has legally established the promise of using space only for peaceful purposes, signatories of the treaty have still conducted tests of anti-satellite weaponry. These tests often create immeasurable amounts of space debris, which threaten to collide with satellites and disrupt our network of communications. Additionally, these tests may indicate a frightening disregard for the international agreement of peace and a trend towards the increased militarization of space. This paper seeks to evaluate the effectiveness of the Outer Space Treaty in modern times, and determine whether it is still relevant as a binding agreement given current geopolitical relations.

Context: Weaponry, Debris, and The Outer Space Treaty

In 1966, during the height of the Cold War and the Space Race, both the United States and the Soviet Union independently submitted letters to the United Nations proposing they draft an international treaty regarding the use of the moon and other bodies in space. Both states had similar proposals, and wanted to ensure that exploration of the moon and space as a whole would be used for peaceful reasons only (Lai, 2021). In 1967 this treaty was completed. It became known as the Outer Space Treaty and has since been signed by 109 countries (Ishola et al., 2021). The finished Outer Space Treaty outlines various guidelines for the peaceful use of space with the overall goal of ensuring the use and exploration of space are to be “carried out for the benefit and interests of all countries” (Treaty on Principles, 1967).

Although the United States and the Soviet Union reached this agreement on using space for peaceful purposes, there was still a lack of trust between the countries during the Cold War. Both countries were attempting to develop anti-satellite weapons (ASAT), with the intention of being able to destroy enemy satellites in orbit. However, from the 1980s to the 2000s, there was an unspoken suspension on ASAT testing among all countries (Meyer, 2022). In general, until recently, there has been a lack of a weaponization of space, which is defined by Porrás as the “development and deployment of ground-based or space-based weapons that can target and disrupt space systems or strike ground targets” (2019).

Part of the reason countries refrained from testing ASAT and other weapons is because of the potential to create space debris from the destruction of a satellite. Space debris, or space junk, consists of old satellites, parts of rockets, and other discarded fragments of human-made space vehicles stuck in orbit. A majority of these pieces cannot be tracked from Earth (Zannoni, 2022). There exist over 30,000 pieces of trackable debris in Earth’s orbit, and almost a million that are

not trackable. The high speeds of these pieces in orbit means that any collision of a piece with a satellite or other body in orbit could destroy that body (Meyer, 2022). As more debris is created, the rate of collisions will increase which then would cause more collisions (Zannoni, 2022). One test of an ASAT on a country's own satellite has the potential to create thousands more pieces of debris, which would accelerate the growing rate of space debris (Meyer, 2022).

There have been many attempts by scholars to evaluate the Outer Space Treaty as it stands in relation to both space debris as a whole, and more specifically, ASAT testing, as well as the weaponization of space. Some claim that the creation of space debris through ASAT tests violates the Outer Space Treaty, while others claim that the treaty does not adequately address these actions and others taken by countries. Although these analyses are valuable, many fail to address the social issue of geopolitical relations when considering these issues. This paper seeks to place the Outer Space Treaty in the context of the current geopolitical climate to understand why countries may have incentive to apply the Outer Space Treaty to ASAT testing or not.

Methods

Most of the evidence for this paper consists of secondary sources, such as academic journal articles, of which I sought out two types. The first were articles that evaluate the Outer Space Treaty and its applicability or lack thereof to ASAT, the weaponization of space, and the issue of space debris. The second type of articles I reviewed were ones that are not necessarily about the Outer Space Treaty, but that discuss current international relations in regards to space and space defense. Additionally, the original document of the Outer Space Treaty of 1967 serves as a primary source that I will use and reference directly in my analysis. To analyze this

evidence, I synthesized claims from the literature in order to form an argument regarding my research question, specifically what I perceive as the relevancy or lack thereof of the Outer Space Treaty.

The Weaponization of Space

In the past few decades, there has been an increase in ASAT testing among world powers; multiple countries have discarded the traditional unwritten ban on these types of tests. In 2007, China tested an ASAT at a high altitude, which produced thousands of pieces of debris in orbit. In 2008 the United States demonstrated the use of an ASAT to explode an American satellite that was reentering the atmosphere (Meyer, 2022). In 2019 India conducted its own ASAT test (Johnson-Freese & Burbach, 2019), followed by Russia using ASAT to detonate its own satellite in 2021. These tests have faced global backlash for the debris created as a result of the explosions. Primarily, China faced criticism from Western countries for its original display. Notably, the United States' own test followed soon after, although was justified by authorities as being necessary since the reentering satellite contained toxic fuel. The states that conducted more recent tests have claimed the ASAT produced minimal debris, however, experts have challenged these claims (Meyer, 2022).

This trend of ASAT testing becoming prevalent in the 2000s may be due to increased fears for space security and a distrust between nations. Russian military analysts have claimed that their 2021 test, which spawned 1500 pieces of debris, was a necessary defensive display following the introduction of the United States' Space Force in 2019 (Sankaran, 2022). Other nations may agree about this distrust. China's original establishment of aggressive space defense

practices in 2007 and Russia's annexation of Crimea in 2014 indicate an overall trend of more aggressive displays of dominance, and may have prompted nations into exhibiting their own space capabilities (Meyer, 2022).

As evidenced by these actions and more, there has been a “global turn towards nationalist politics” (Johnson-Freese & Burbach, 2019) in the last two decades. As some countries become more aggressive, others must display their defensive capabilities, all with the goal of appearing the most dominant. As we enter a modern era of military and technological development, many of these nations see counterspace operations as necessary to introduce and develop in order to achieve this goal (Porras, 2019). These ASAT tests can be considered acts of intimidation, since they communicate to other states that the testing country is capable of disrupting their claim to Earth's orbit. Given that the nations conducting these tests all signed the Outer Space Treaty, an act of intimidation such as this, even when simply a display of defensive capabilities on a nation's own satellite, could be considered a non-peaceful use of space and a breach of the agreement.

Application of the Outer Space Treaty

An issue when considering whether the Outer Space Treaty applies to ASAT testing and the creation of space debris is how the weaponization of space works. Johnson-Freese and Burbach introduce the idea of space being “offense dominant,” meaning that countries feel threatened by the space capabilities other countries have and it becomes a race to develop the best weapons in order to use intimidation as defense. Additionally, they claim that space technology is almost always dual-use. With our current limitations on technology, the way to

create effective defensive—or even fully peaceful—space capabilities would be a weapon that can be used offensively if wanted or technology that can aid the development of one (2019). These considerations must be kept in mind while analyzing the language of the Outer Space Treaty.

Firstly, we must consider whether the treaty protects the testing of weapons on a country's own satellites. Article IV of the Outer Space Treaty states, “the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden,” while Article VIII expresses that any state that launches an object into space “shall retain jurisdiction and control over such object,” and Article VII affirms that any countries that launch objects to space shall be “internationally liable” for any damage it causes to another country or its property (Treaty on Principles, 1967). Article IV explicitly bans the testing of weapons on celestial bodies. However, while the treaty is not explicit in its definition, manmade objects such as satellites are not considered celestial bodies. Since Article VIII affirms that a nation's satellite remains its property in orbit, the treaty appears to implicitly protect the destruction of a country's own satellite with weapons testing. Article VII makes it so that the country would be liable if they damaged another nation's satellite, but no ASAT testing has directly done so.

Another method of evaluating the Outer Space Treaty is to look at its overall principles. One of the ideas proposed by the treaty is that “outer space shall be free for exploration and use by all [signatories]” (United Nations Office for Outer Space Affairs, n.d.). This notion is supported by Article IX: “A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space...would cause potentially harmful interference with activities in the peaceful exploration and use of outer space...may request consultation concerning the activity or experiment” (Treaty on Principles, 1967). It can be

assumed that offensive weapons testing meant to intimidate other countries from freely using space would be objectively against these regulations put in place by the treaty. However, this is where the concept of dual-use is relevant. Although ASAT testing may be seen as an act of aggression, these tests may also be interpreted as testing defensive procedures. This would fall under that country's guarantee of free use of space since it does not directly interfere with other countries' peaceful use of space.

Lastly, we must consider how the Outer Space Treaty relates to the creation of space debris. In general, most launches of rockets, satellites, and other objects into space results in some creation of debris. This includes launches solely for scientific and peaceful purposes. These launches are explicitly protected by the treaty, so the creation of space debris itself is not in violation of the agreement. Based on the previous interpretation of Articles IV, VII, and VIII, it appears that a country would only be held accountable by the Outer Space Treaty if an ASAT test or other activity in space directly harms another country's property. This may apply to pieces of debris that collide with a satellite directly after an explosion, but likely would not apply to debris that remain in orbit for long periods of time. Untraceable orbital debris is the main concern involving debris, but according to this interpretation, it is not in violation of the Outer Space Treaty.

International Attitudes Towards the Outer Space Treaty

More things to consider about the Outer Space Treaty when evaluating its relevancy to ASAT and space debris are the actions taken by countries in relation to agreements on use in

space. In particular, since the adoption of the Outer Space Treaty, there have been multiple proposals for new international treaties that have not reached fruition.

Most international collaboration about the use of space is handled by the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), which was formed in 1959 (Ishola et al., 2021). Relating to space debris, in recent years the UNCOPUOS has published voluntary guidelines for sustainability in space use, however, there have not been any binding agreements made (Zannoni, 2022). In this case, it is at the discretion of countries' governments to introduce governing laws within their own sovereign state.

Relating to the issue of peaceful uses of space, many resolutions have been proposed but have not made it to final agreement. In 2008, China and Russia jointly introduced a draft treaty called Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (PPWT) with the aim to ban using force against space objects such as satellites. The attempt died when the United States refused to consider the treaty, and the same fate befell it when it was reintroduced again in 2014 (Meyer, 2022). The United Nations is currently considering a resolution called the Proposed Prevention of an Arms Race in Space (PAROS) Treaty, which would prevent nations from putting objects carrying weapons into orbit (Nuclear Threat Initiative, 2022). There are disagreements on whether this treaty should be legally binding or whether it should promote non-binding transparency. China, Russia, India, and others want it to be legally binding, while the United States and others want it to function as a non-binding set of norms (Meyer, 2022).

With most recently proposed treaties regarding both peaceful uses and space and the creation of debris, there are fundamentally two different perspectives that have caused a lack of agreement among all nations: whether the agreement should be binding or not. With so many

different levels of space capabilities and differing national interests, many United Nations member states cannot agree on how best to implement new treaties. Some countries support a binding treaty against conflict, while some support voluntary measures (Porrás, 2019). When considering space debris the same conflicting opinions apply, except with the added question of responsibility for handling debris (Zannoni, 2022). Overall, considering the number of proposals and support for various additions to international space regulations it is clear that countries assume the Outer Space Treaty does not prohibit the creation of space debris and the testing of ASATs and other weaponry in space. Even though there are disagreements on how best to implement an agreement on the peaceful uses of space, there is clear national consensus that some sort of resolution would be beneficial.

The same attitudes that contribute to the overall rise in space weaponization seem to also contribute to the reluctance among world powers to reach a binding agreement. The United States refusing to consider the PPWT put forth by China and Russia is an example of a distrust between nations, especially considering China and Russia have both conducted actions that have globally been seen as aggressive in recent decades. Additionally, the United States not supporting new international law and instead opting for voluntary guidelines reflects its stance as wanting to dominate the race for space militarization with its Space Force.

Overall, it is clear that the Outer Space Treaty has been abandoned by global powers in favor of proposing new solutions regarding the peaceful and sustainable uses of outer space. However, given the aggressive status of current geopolitics, it appears unlikely for superpowers to reach a consensus on any agreements, which could render any new international guidelines or proposals completely irrelevant and disregarded.

The Argument for the Outer Space Treaty

Although this argument has been that the Outer Space Treaty does not address and therefore protects the testing of ASAT and creation of space debris, many scholars argue that the treaty can be interpreted as prohibiting these actions. Albert K. Lai details the intended purpose of the Outer Space Treaty in his book *The Cold War, the Space Race, and the Law of Outer Space: Space for Peace*. He states that the main purpose of the explicit disarmament in the Outer Space Treaty, such as the banning of nuclear weapons in space, is to promote international cooperation and scientific collaboration (2021). Following from this fact, it would make sense that the treaty could be interpreted as implicitly prohibiting any other sorts of weapons or technology that would interfere with international partnership in exploratory and scientific endeavors.

Diego Zannoni, a professor of Political Sciences, argues that specific language in the Outer Space Treaty can be applied to the creation of debris and ASAT technology. According to him, Article I can be interpreted as allowing space operations only for exploration or use that is beneficial to all of humanity. Therefore, since space debris is nonfunctional, he claims that its existence and creation would be prohibited by this interpretation. Zannoni also claims that one might argue that Article IX, interpreted alongside the aforementioned UNCOPUOS guidelines for sustainability, implicitly bans the destruction of any objects in space (2022). This interpretation would prohibit ASAT usage, including testing on one's own satellites.

Ishola et. al. agrees with Zannoni that the Outer Space Treaty can and should be interpreted to ban certain weapons testing. In addition, they claim that the issue with interpreting the Outer Space Treaty this way is that the agreement introduces regulations without adding an effective method of enforcement. The Outer Space Treaty, along with all international law, relies

on signatory states to take responsibility and comply with the treaty without a threat of international punishment, since states are sovereign (2021). The problem with these interpretations of the Outer Space Treaty is that they are implicit. When the treaty explicitly bans other types of actions, such as the harboring of nuclear weapons in space in Article IV and the contamination of space bodies in Article IX (Treaty on Principles, 1967), it is difficult to provide strong evidence for why countries should be following implicit interpretations of the treaty as well.

Conclusion

After over 50 years of the Outer Space Treaty serving as the basis for international space policy, technological and geopolitical developments have called its relevancy and applicability into question. With new issues such as aggressive ASAT weapons testing and the resulting debris collecting in orbit, there exists questions of whether the Outer Space Treaty protects or prohibits such actions. With a recent global shift towards more nationalist, offensive militarization, it is clear that an arms race to weaponize space is possible.

The Outer Space Treaty does not appear to prohibit the ASAT testing and subsequent increase in space debris that have been commonly conducted in recent decades. While the treaty does prohibit certain types of technology from being tested in space, such as nuclear weapons, it does not explicitly limit the testing of weapons in general as long as they are not conducted on naturally formed celestial bodies. Additionally, since ASAT tests have been performed on states' own satellites and have not caused direct damage to other satellites in orbit, no countries could be held liable for these tests by the Outer Space Treaty.

Coinciding with the increase in space weapons testing, there have been multiple attempts by various states to introduce updated international law regarding both space debris and the peaceful uses of space. In general, there is a lack of agreement and distrust between nations that has not allowed for any of these proposals to be passed yet. Multiple countries have acted in ways that others perceive to be aggressive, such as the United States creating their Space Force to conduct military operations. Since agreements seem to be hard to reach and distrust between powers has been growing, outer space weaponry may signal an entirely new type of warfare, one that has not been a concern since the days of the Space Race. The impacts of a type of conflict like this are unknown, but considering our vast network and uses for satellites it could be devastating to current ways of life on Earth. Whether space continues to be used for the benefit of all humankind as dictated by the Outer Space Treaty relies on the international cooperation that the treaty itself was built on 50 years ago.

References

- Ishola, F. R., Fadipe, O., & Taiwo, O. C. (2021). Legal Enforceability of International Space Laws: An Appraisal of 1967 Outer Space Treaty. *New Space*, 9(1), 33–37.
<https://doi.org/10.1089/space.2020.0038>
- Johnson-Freese, J., & Burbach, D. (2019). The Outer Space Treaty and the weaponization of space. *Bulletin of the Atomic Scientists*, 75(4), 137–141.
<https://doi.org/10.1080/00963402.2019.1628458>
- Lai, A. K. (2021). *The cold war, the space race, and the law of outer space: Space for peace*. Routledge.
- Meyer, P. (2022). Restraining an Arms Race in Outer Space. *Survival*, 64(2), 81–94.
<https://doi.org/10.1080/00396338.2022.2055825>
- Nuclear Threat Initiative. (2022, May 31). *PAROS Treaty*. Retrieved March 31, 2023, from <https://www.nti.org/education-center/treaties-and-regimes/proposed-prevention-arms-race-space-paros-treaty/>
- Porras, D. (2019). Anti-satellite warfare and the case for an alternative draft treaty for space security. *Bulletin of the Atomic Scientists*, 75(4), 142–147.
<https://doi.org/10.1080/00963402.2019.1628470>
- Sankaran, J. (2022). Russia’s anti-satellite weapons: A hedging and offsetting strategy to deter Western aerospace forces. *Contemporary Security Policy*, 43(3), 436–463.
<https://doi.org/10.1080/13523260.2022.2090070>

Treaty on principles governing the activities of states in the exploration and use of outer space,
including the moon and other celestial bodies, April 25, 1967,

https://www.unoosa.org/pdf/gares/ARES_21_2222E.pdf

United Nations Office for Outer Space Affairs. (n.d.). *The Outer Space Treaty*. Retrieved March
31, 2023, from

<https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>

Zannoni, D. (2022). Out of sight, out of mind? The proliferation of space debris and international
law. *Leiden Journal of International Law*, 35(2), 295–314.

<https://doi.org/10.1017/S0922156522000152>