The Rationale Behind the Continuance of Anti-Satellite Weapons Testing

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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

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I ntroduction:

There is a prominent and growing issue that might imperil all of humanity: trash. I'm not referring to the trash that fills our landfills and, more alarmingly, oceans. I'm not even referring to trash here on earth at all but rather trash in space, more commonly referred to as space debris. Since the first satellite reached space in 1957, those responsible for these missions have been careless about leaving rocket and satellite remnants in space. Even the first satellite, Sputnik 1, was left in orbit after its battery died and ceased transmitting (*Sputnik 1*). Although leaving a satellite in space without a plan to remove it is inherently problematic, it's the small pieces of junk that are the real concern, as they are just as lethal and harder to avoid.

In 1968, the Soviet Union performed the first anti-satellite (ASAT) weapons test, intentionally blowing up a satellite and creating a large cloud of debris. Since then, China, India, and the United States have followed suit, each government blowing up its own satellites in a show of force, creating much more debris (*Space Debris from Anti-Satellite Weapons* 2008). When a debris hits a satellite, it can cause the satellite to explode, sending more debris going in all directions. In fact, this has already happened multiple times, but most notably in 2009 when an old Soviet satellite collided with an operational communication satellite, blowing it up (Pultarova, 2023).

The growing international concern for the safety of space has been evident in recent decades, leading to a shifting attitude toward ASAT testing. Understanding why countries continue to perform ASAT tests and how it links to ongoing political conflict is the first step in determining the best approach that can be taken to protect space. If space assets are destroyed, all space technology from weather reporting to GPS will be gravely effected. This has inspired my

STS research question: Why are China and Russia opposed to a ban on destructive ASAT testing?

Background:

Most people don't think about space often, and if they do it is probably in the context of NASA and science fiction; they might wonder "who cares if we can't go to space anymore?" The fact of the matter, though, is that nearly everybody is impacted by space technology far more than they might realize. Yes, one of the allures of space is the great beyond. Recently, many governments have been considering colonizing the moon even Mars (Kamin, 2023). NASA spent $10 billion on the James Webb Space Telescope alone to help us understand the history of the universe (USAFacts, 2023). Pursuing questions about the nature of the universe doesn't immediately benefit the economy or livelihood of most people, so this may seem like a ludicrous investment; however, beyond the scientific and explorational allure of space, its utility in everyday life for most people is often underappreciated. Without satellites, we would not have cellphones, GPS, accurate weather predictions, and so much more. Inaccurate weather predictions alone would lead to thousands of deaths each year and billions of dollars in damages (Shrader et al., 2023). The terrifying part of space debris is that, if it gets out of control, not only will it cut us off from further exploring space, but it will also destroy the technology that many people have become accustomed to. This critical threshold is known as Kessler Syndrome, and it is the point at which space debris snowballs out of control by hitting all satellites in orbit and cutting off our access to space.

Currently, there are millions of pieces of debris in space, and by some estimates over half of it is a direct result of ASAT testing. The 22,000 pieces of debris larger than a softball are currently being tracked by the Department of Defense, but the estimated 150 million pieces

smaller than 10 centimeters are not (*Space Debris from Anti-Satellite Weapons* 2008). To date, there have been four satellite collisions with space debris (*Space Environment Statistics* 2023). Thousands more have been narrowly avoided with evasive maneuvers (Alamalhodaei, 2023). The snowballing effect of this debris is worrying, especially as more and more satellites are launched, increasing the risk of collisions which would lead to more debris and so on. Efforts to clean space debris are ongoing, but the size of and speed at which these pieces are moving make it an incredibly difficult feat. So far, the most successful efforts in remedying this problem have been about prevention more than solution, as most responsible companies now dispose of their satellites after they stop working. Additionally, on-orbit servicing is a very promising emerging technology, and it has been able to increase the lifespan of satellites on-orbit, again decreasing the amount of space debris (*Adras-J - Astroscale, securing Space Sustainability* 2024). With that said, some active debris removal services have been attempted, with varying levels of success, such as physically grabbing the debris or even using lasers to incinerate it (Houser, 2023). While these efforts are important, relying on technology that is largely underdeveloped and untested is not an acceptable solution to such a large problem.

The first time humans reached space, both physically and with satellites, was during the Cold War, a battle between Russia and the United States over which country would be the greatest power in the world. It was a war fought with technological innovation and the stockpiling of weaponry rather than overt killing. Space exploration was born in conflict, and, though space is now used extensively for commercial purposes, military satellites make up around a fifth of all satellites today (Abbany, 2020). Most military satellites are used to provide navigation, communications, surveillance, and early warnings for missile launches (Fox et al., 2013). This is one reason why countries focus so heavily on ASAT arsenals, as disabling enemy

satellites could prove crucial in a war. Countries also focus on ASAT technology because of what it represents: at a political level, the country with control of space is still in many ways viewed as the global superpower. Currently, the United States dominates space, owning 63% of all satellites.

With growing international concern over space debris, some countries have changed their perspective on the allowance of ASAT testing. Most notably, championed by the United States to curb the arms race in space, the United Nations addressed the issue in 2022. This resolution encouraged countries to halt destructive ASAT testing, though it was non-binding, meaning refraining from ASAT testing is voluntary for the countries that sign the treaty. Among the nine countries to vote against this motion were Russia and China: two of the countries that have performed successful ASAT testing and the biggest adversaries of the United States (Foye & Hernandez, 2022). Following this vote, the United States was the first to commit to stop destructive ASAT tests in space (Foust, 2023). Since then, 12 more countries have joined this commitment, bringing the total to 13. During this same time period, Russia conducted a destructive ASAT test, creating a cloud of debris, and have recently admitted to developing a nuclear ASAT weapon (Starling & Massa, 2024).

Methods:

To understand this issue, I first sought to gain a better understanding of space debris, the problems it poses, and the causes of it. I found countless articles on collisions, avoidance maneuvers and the overwhelming concern in the aerospace community over this problem. This is how I learned more about the impact of ASAT testing on space debris and found United Nations proceedings from November of 2022 in which the United States proposed halting all ASAT

weapons testing. These proceedings included the arguments from the representatives of the countries that were opposed to the motion, leading me to many more sources discussing the matter. Additionally, these proceedings gave me some of the important background and keywords to search on Google Scholar for to find many more scholarly articles on the matter.

I approached my next stretch of research in three ways: searching for background on ASAT testing, in-depth analysis on the history of space being used as a frontier and battlefield, and the history of the relations between Russia, China and the United States and how they have intensified in recent years. To learn more about the background of ASAT testing, I mainly searched for scholarly articles that included the keywords "ASAT testing," "space debris," and each country I was researching: Russia, China, and the United States. To learn more about the history of space as a battlefield and the relations between the aforementioned countries, I searched mainly using keywords such as "Cold War," "weapons in space," "history of international tensions between the United States and Russia and China," and variations on those searches. Ultimately, I was able to find many sources covering these topics, which was incredibly valuable information for my research, and analyze them using methods learned in my STS courses.

Results:

What They Say:

Most scholarly articles agree that space debris is a concerning issue that could have some very impactful repercussions if it is not properly addressed, and that ASAT testing is a major contributor to this issue. It is also very widely known which countries support the continued use of ASAT testing, and which countries do not, as well as the strained relationship between the

countries that disagree. What few sources address, however, is the argument for ASAT testing to be continued, though it has deep ties to both the history of space as it related to the military and global relations between the countries at play.

In 2007, China conducted a very destructive ASAT test, creating 2867 pieces of trackable space debris that are still in orbit today, travelling incredibly fast near satellites and the ISS (Bartholomew & Cleveland, 2019). Many experts believe that this test was conducted to send a message to the United States, to let us know that intervention in the Taiwan affair would be even more risky and costly than previously thought, as our satellites could be at risk (Milowicki & Johnson-Freese, 2008). The global response to this test was outrage.

One of the main reasons for such a harsh global response was the altitude at which China conducted their ASAT testing in 2007. Low earth orbit, where all direct ascent ASAT tests have been performed, includes all orbits below 2000 kilometers. Within this area, satellites' orbits vary drastically, some as low as 160 kilometers, only slightly above the Earth's atmosphere. When objects are in a low orbit like that, they encounter a force called atmospheric drag. Essentially, the atmosphere is thin but still exists at these altitudes, so it creates drag, slowing projectile in orbit. The slowed velocity causes the object to orbit lower, where the atmosphere is thicker, slowing it further and eventually pulling it back down to Earth, where it typically burns up upon reentry. The lower the initial orbit, the faster the object burns up (*Leo Economy Frequently asked questions* 2023). When the United States performed a destructive ASAT test in 1985, all the debris burned up in a time span of 18.7 years. In 2008, the United States chose a lower satellite to perform the test on, and all the debris was burned up in 1.7 years (Weeden, 2024). In 2021, Russia performed the most recent ASAT test, creating a cloud of debris that should be burned up entirely by 2033, a total duration of 12 years (Foust, 2023). Much of this

debris has already reentered the atmosphere, but 67 pieces still remain in orbit (Specktor, 2021). This test was met with international disapproval, though nothing compared to the 2007 Chinese ASAT test. The 2007 Chinese ASAT test targeted a satellite in a much higher orbit than the Russia and the United States, creating a cloud of debris with 3536 traceable pieces, only 850 of which have reentered the atmosphere to date. This means 2686 pieces of trackable debris remain in orbit today, 79% of which are expected to remain in orbit until the year 2108 (Weeden, 2012).

It is widely believed that China had not expected such an aggressive response to this incredibly destructive test, and China remained silent on the issue in the wake of it. Neither remorse nor further combativeness were shown, and it is unclear if China will try to mitigate space debris caused by further testing (Saunders & Lutes, 2007). One thing is certain, though: China has made no public plans to cease their ASAT testing and has continued to develop and stockpile more aggressive ASAT weapons since 2007 (Blatt, 2020).

The Great Power:

From Egypt and the Roman empire to Britain and the Ottomans, many countries and empires have been considered to be the "great power" of their era. Since the Revolutionary War, the Unites States has been viewed as a global power, though many have considered it to be the world's greatest power since 1898 (Trask et al., 2016). This was when the United States began to meddle in foreign affairs, deciding to aid Cuban resistance to Spanish colonialism. From this point forward, the United States began participating in many international conflicts, primarily to spread democratic and republic ideologies and crush other power structures, whether for better or for worse (Blatt, 2020).

What it means: (Russia)

The United States' place as the great power has been threatened many times since the 19th century. Both World Wars caused massive upheaval, but the first major threat to the United States' status was the Nazi Party. The United States allied with many countries to defeat them, including the Soviet Union.

The Soviet Union formed in 1922, as communism began to take hold across the world. Although the United States and the Soviets had allied during the war against the Nazis their relationship was highly strained (*The United States, the Soviet Union, and the End of World War II* 2005). In 1945, World War 2 ended in German and Japanese surrenders, and just two years later in 1947, a different type of war began: The Cold War. There was no overt conflict between the Soviet Union and the United States during this time, but there was a massive increase in weapons manufacturing. The first rockets had been created during World War 2 to be used as missiles, but with the influx of funding toward technology during the Cold War, the resources needed to utilize rockets in a less combative way became available. The Cold War was a battle for power. The rivalry inferred that the greatest power would have the greatest technological abilities. This led to the Space Race, where the United States and Soviet Union had a great battle of intellect as both raced to the moon (Brittanica, 2023). The moon landing was a pivotal point in the Cold War, and though it did not end the war, it proved that the United States was superior in technology and engineering, and their status of the great power was secured. Since then, the United States has continued funding space at exorbitant rates, spending over $73 billion last year alone on it. For reference, the next highest spender is China, with an investment of just $14.15 billion in the same year (Statista Research Department, 2023).

Though the Soviet Union fell in 1991, a relationship between Russia and the United States remains strained. Recently, the war in Ukraine has increased these tensions, as the United States is financially backing Ukraine against Russia. Big picture, the war in Ukraine is the culmination of building tensions between NATO and Russia. Russia views part of Ukraine as Russian territory, despite Ukraine being recognized as a nation by most of the world (Nato, 2024). The United States claims to be backing Ukraine based on the same moral principles of self-governance that the United States was founded on, along with their history with NATO. It should be noted, though, that many speculate that the United States is backing Ukraine for the more politically selfish reason of weakening Russia (Sonnenfield & Tian, 2024).

Recently, American financial support of Ukraine has become a heated issue in United States politics. While many people do not support this continued military funding, the politicians who do have worked to vilify Russia once more in the media, creating a story of good versus evil, implying that to cease funding will allow the bad guys to win. One such attack came from a United States senator who announced that Russia is developing ASAT weapons with nuclear capabilities (Barnes et al., 2024). This was clearly an effort to garner support for the Ukrainian war, addressing the important issue of ASAT testing and space debris in a highly political and grossly ineffective way.

What this means: (China)

More recently, another power has been growing to rival the United States' title as the great power. Since the communist party took control over China after a long and brutal revolution in 1949, its fundamental differences from the United States have led to a myriad of disagreements, most notably over Taiwan (*The Chinese Revolution of 1949* 2016). Taiwan is a

small island off the coast of China that retains its status as a republic in the eyes of the western world, though China claims sovereignty over it. Although the United States officially cut ties with Taiwan in 1979 to establish diplomatic relations with the People's Republic of China (PRC), the mainland communist-run Chinese government, the United States and Taiwan share more similar values. This, in addition with Taiwan's advantageous location and tradable goods, links the United States much more closely with Taiwan than with the PRC. As a result, the United States has created strategic ambiguity over whether they would militarily defend Taiwan should the PRC physically move against it to reclaim the territory, something the PRC has threatened to do numerous times. This has been referred to as the most sensitive and important issue in Chinese-United States relations and has become more heated in recent years as the United States is increasingly reliant on Taiwan's microchip production and China gains enough power to begin working toward long-term goals like repossessing Taiwan (*Taiwan: Background and U.S. Relations* 2024).

The vague threat of war between China and the United States over Taiwan has greatly increased tensions, especially in recent years. Lately, China has been growing at incredible rates as a global power. China's GDP has been creeping up on that of the United States for the past decade: The United States' GDP is $7.5 trillion greater than that of China, but China's GDP has been growing at a rate of 3% as opposed to the United States' 2.1% (*People's Republic of China*). Beyond economic power, technological power is historically a major indicator of who the great power is. In the arena of space, the United States still dominates, but China is rapidly closing the gap (Kube & De Luce, 2023). Militaristically, China and the United States are somewhat even. While the Chinese military has nearly twice as many troops, the United States still retains superior military technology in most areas. With that being said, China has been

investing heavily in their arsenal (Heginbotham et al., 2015). It should also be noted that a large portion of this technological superiority over the Chinese military comes from the United States' space assets, which would be seriously threatened by Chinese ASAT technology. This is one of the main reasons that the United States has been pushing so hard to eliminate ASAT testing, as they have much more to lose should it go awry than any other nation.

Putting It Together:

The United States has been the great global power for decades, though China and Russia are seriously challenging this as of late. Since China and Russia both have rocky relations with the United States and both have a history closely tied to communism, they have struck up an alliance. Though the extent of this alliance is debated, these nations have been working together to threaten the power of the United States in many ways including coordinating economic and diplomatic moves like backing each other on ASAT testing (Nikoladze & Bhusari, 2023).

The United States has significantly more valuable and powerful assets in orbit, so while Russia and China are both working to catch up on this front, they recognize how powerful this asset is from both a literal and metaphorical standpoint. Since the space race, people look to space for clear evidence of which country is the great power, as it reveals which country has the technology and means to conquer the greatest frontier and use it to their advantage.

The war in Ukraine and tensions over Taiwan are friction points between the great powers of the world. If there were another great war, it would likely be fought between nearly every nation on the planet. Hopefully we can avoid World War 3, but this will not happen if these great nations continue to point fingers, vilify each other, and stockpile weapons. The United States calling for an ASAT ban during the United Nations summit was a highly political

way to address a very serious issue. The large majority of people in the world benefit from satellite technology every day and losing this technology would equate to many lives and billions, even trillions of dollars lost. At the end of the day, if global superpowers cannot put aside their political motivations to create a stable, agreed-upon way to ensure the safety of space, we will all lose space as an asset. Access to space was born in conflict, through the Cold War, and if we do not make serious efforts to work together to find a more responsible, less political way to protect it, this access will be lost in the same way.

Conclusion:

Anti-satellite weaponry and space debris is clearly a nuanced issue when put into a geopolitical context. The United States and its allies have reasons to be opposed, and, like all history, it is inaccurate to describe the situation as having a protagonist and antagonist, or "good guys" and "bad guys," though this is a common narrative. Blanket condemnation of ASAT testing is a highly political play for the United States. The United States has a significantly larger investment in space than any other country and uses this fleet to bolster its role as the global superpower. This is why at the United States' request, China and Russia will not cease testing and are even increasing their weaponry in recent years. In a perfect world, ASAT testing would not exist, but for the time being, countries need to work together to find a way to limit the impact of ASAT testing on the space environment.

Space debris is a very real and very scary issue. There are certain problems that threaten everybody on earth, and this is certainly one of them. This should be—*has to* be—bigger than countries fighting for world dominance. The only way to solve certain problems is to work together, but this will not happen if countries continue to point fingers and maneuver around

these issues based on their own political agendas. If the countries that are conducting ASAT tests refuse to stop, they must find a way to do it in a more responsible way. At the same time, countries that are calling for this practice to stop must be willing to work in a more respectful, collaborative way with others. If space debris is not mitigated and controlled, people run the risk of losing access to space entirely. We must ensure that future generations are able to look to the sky and see endless possibilities rather than prison bars.

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