Introduction

With the increased importance of satellite and remote sensing information on the global economy and scientific landscape, access to space has never been more important. That being said, risks from the current debris, future collisions, and increased pressure on countries to invest in ASAT technology threaten safe access to space. The following is not only a proposal for sensible international legislation on ASAT development, but also a plea for action before it is too late.

Part I: Description of Tech Policy Problem

Before one discusses the policy or the ethical weight of the problem, it is important to understand some definitions, mechanics, and history. David Wright (2007) defines orbital debris as any unused and man-made object that exists in orbit around the Earth. This includes decommissioned satellites, small or large pieces of hardware, or any other fragments of materials sent into space. They can be smaller than one tenth of a penny, or larger than a car. They can remain in orbit for decades if not centuries. Furthermore, when they are in orbit, they pose a risk to our access to space.

Orbital debris is produced from two primary and one secondary source. Firstly, in the course of routine space activity, small pieces of machinery will break and float off. Secondly, the use of Anti-Satellite (ASAT) technology creates huge debris clouds. Because of the relative infrequency of ASAT launches and the small amount of debris caused by routine operations, we wouldn't expect to have the whopping 128 million pieces of space trash (Klinkrad) that we are currently facing. The urgency of this problem comes from the secondary source of space debris.

A piece of debris just one centimeter in diameter seems innocuous. However, when traveling at speeds upwards of twenty eight thousand kilometers per hour, it becomes deadly. According to Wright (2007), any debris greater than one centimeter in diameter has the potential to "destroy a satellite in collision." This is the secondary effect. As debris grows, it enters into a positive feedback loop. An increase in orbital debris causes a direct increase in collisions (both between pieces of debris and between debris and active satellites). In turn, these collisions create more debris.

This secondary effect compounds ASAT events immensely. Alone, ASAT events are bad. However, when one analyzes a single ASAT event over the time span of years, it is apparent that they are the main source of debris. For example, in 2009, two years after China launched a ballistic missile at one of their own deactivated satellites, NASA determined that one quarter of all orbital debris at that time was a result of the single ASAT event (ODQN 2009). Hence, the policy proposed in this paper will focus on ASAT prevention.

There are several key pieces of legislation that are relevant when considering ASAT policy (Johnson-Freese 2000). The first is the Outer Space Treaty (OST) of 1967. This international treaty provided an initial framework, but is fraught with linguistic ambiguities that allowed the Reagan Administration to significantly increase funding and focus on ASATs with the well known Space Defense Initiative (SDI). However, most of the technologies proposed in the SDI were not feasible, which meant that the primary satellite "kill" technologies were mostly kinetic missile systems. The current legal consensus regarding the OST and ASATs is that non-nuclear ASAT weaponry is legal, because ASATs are not weapons of mass-destruction. With an argument analogous to MAD, we argue that the global, ethical, and societal implications of a Kessler-esque cascading process are too big to continue development of kinetic kill ASATs.

The next relevant treaty is the 1972 Anti-Ballistic Missile Treaty (ABM). This treaty provides that anti ballistic missiles based on laser or particle beam techniques are intended as a defense system, so they are non-aggressive. The ABM includes some language that is controversial with regard to the development of new technologies. Proponents of ASATs can exploit the ambiguity with regard to the development of new technologies to argue that technologies not described in the ABM are not limited by its restrictions, as Reagan did with SDI systems.

Another piece of relevant legislation was made by the US in 2006, when they added a provision to the National Space Policy that categorically rejects any arms control proposals that would restrict military space operations (Grego 2012). This severely limits the US by preemptively disallowing the US firm ground in restricting military space capabilities of other countries, which significantly increases the range of threats to US space interests.

In 2008, China and Russia presented a joint draft treaty that placed necessary but insufficient conditions on ASAT development and capabilities. The US offered a critique, but no counter-proposal. This shows that Russia and China are interested in limiting the risks of military space operations, and that the US has not taken leading steps towards risk reduction. There is significant opportunity for the US to lead the international community towards a lower risk situation.

There have been several informal non-binding voluntary proposals that have had some positive impact, but they are not strong enough to hold weight.

Part II: Discussion of Research on Benefits and Potential Risks Posed by Emerging Technology

The following section focuses on three topics. We will explore the enormous benefits afforded to the human race by space access, followed by a discussion on the risks that orbital debris displays to our future abilities. This will then be applied in a discourse on the ethics of regulating ASAT operations internationally.

In the past half century, satellites have become incredibly important to the global community. Although people are mostly uneducated and unaware of the topic, in 2014 satellite revenue across the planet was 195 billion dollars (Salter 2015), and the number increases every year. Our ability to study long range communications (such as cellular service), navigation, astrophysics, meteorology, climatology, geology, geodesy, and military reconnaissance are all highly dependent on satellites.

There does not exist a figure to the lives impacted by our access to space. Our ability to predict hurricanes and other natural disasters, days in advance, allows people to safely evacuate areas that would soon become untenable. Farmers use satellite imagery to monitor their crops and learn information about droughts and soil conditions. Companies such as Facebook and Google are currently researching technology to ensure global access to the internet via satellites. None of this mentions the long term benefits of research that could not be done with remote sensing data. Listing every example would be redundant; satellites are astoundingly important right now, and they are only growing in capability.

Clearly, humanity needs to prioritize the sustainability of satellite practices. However, we are reaching a dangerous point. Scholars have accepted the theory put forward by Kessler (1991) that because of the positive feedback loop, there exists a point where the rate of creation of debris will overcome the rate that debris falls out of orbit. Kessler syndrome, as it is caused, needs to be avoided at all costs. As we stand now, it is unclear when exactly the point of Kessler syndrome will be reached. However, Kessler thought it was imperative in 1991 to slow our space missions in order to prevent the syndrome. Now, many models and scientists predict that we have already hit the point of no return. As stated before, the threat from ASAT events is particularly noteworthy. Models and scientists agree that if we have not reached the syndrome, we are incredibly close. Although we don't yet know the long term ramifications of India's March 27th ASAT collision, if it is anything like China's in 2007, we will be in dangerous territory.

This puts the world in an ethical inquiry. There are real human lives at stake, and it is in everyone's best interest to protect space from orbital debris. However, countries like the U.S. are more frequently using satellites for military reconnaissance. This puts countries like India and China is a unique position. Consider country X, who is not necessarily as advanced technologically as the United States. Country X has some minor weather satellites that are operational, but no military satellites. Furthermore, country X is worried about a vast number of countries discreetly monitoring and spying on their military bases via satellites. At this moment, the only technologically and economically viable way country X can defend itself from spying is an ASAT.

Any policy limiting country X from developing its own ASAT technology is practically forcing it to succumb to unwanted imaging of secret locations. Normally, spying is internationally frowned upon and deterred against by threat of war. Understandably, war is the least ideal way to handle the situation. Furthermore, it is assumed that as long as countries have the capabilities to discreetly spy on each other, they will. Is country X not supposed to launch an ASAT? On the one hand, it would create a cascading effect of debris that would later harm the greater international community. But, country X couldn't possibly be happy with just sitting around. We intend to address this concern in our policy.

Part III: Proposal of Proposed Regulation/Law/Tech Policy Solution

Our proposal is focused on kinetic hit-to-kill ASAT technology. Specifically, we propose a total ban on all ASAT technology that would break up satellites into many fragments. There is a strong joint international interest in preserving orbital space from debris, and this interest is even more important for smaller countries with fewer satellite and space-faring capabilities. The United States is currently in a position to lead by example in regard to this policy, so we propose revisions and additions to the U.S National Space Policy that ban both current and future technologies from use as ASAT weapons. One important provision of our policy is a reduction in military orbital reconnaissance. The reduction in risk of a Kessler effect is worth the reduced

U.S. intelligence capability. We focus on kinetic hit-to-kill weapons because they have the highest potential for increasing space debris significantly, leading to a Kessler syndrome.

This proposal has several nice properties. First, it drastically reduces the chances of the Kessler syndrome being realized. Second, it has decent grounds for international acceptance. Between the 2007 Chinese ASAT test and the 2018 Indian test, the risks of kinetic hit-to-kill ASATs is becoming clear to the international community, and there is growing international support for policy banning these high-risk weapons. Additionally, the 2008 joint draft treaty between Russia and China is promising. We can see that there is international interest in this area. However, it is unlikely that another country will take the lead in the effort to reduce this risk, so the U.S. has the ability to effect significant change. Third, this proposal does not include forms of ASAT systems that do not pose significant risk of drastically increasing space debris. This exclusion is purposeful, as it grants the military and defense utility of some ASAT systems. This increases the likelihood of the proposal's broad bipartisan and international acceptance. Finally, this proposal respects the prior domestic and international legislation regarding ASATs, and respects individual countries' general rights to space.

However, there are challenges with the implementation of this proposal. The first and perhaps most important issue arises when defining a kinetic hit-to-kill weapon. We define a kinetic hit-to-kill weapon as a missile launched at a satellite or object in orbit with intent to destroy or disable the object. This is the current highest-risk type of weapon, and focusing on this area would be a good first step towards deproliferation of high-risk ASAT technology. Similarly to other international policies, standard sanctions can be applied to countries that break their commitment, however a detailed description of specific sanctions is out of the scope of this proposal. There are historical military arguments against restrictions on ASAT technology, however, the current global reliance on satellite technology is too high to justifiably consider these viable.

Conclusion

The point that satellite use is infeasible due to the concentration or orbital debris is imminent. The wide reaching effects of this would be catastrophic and far reaching. For this reason, this paper argues that it is important and necessary to install ASAT regulation immediately. The policy proposed in this paper is preliminary, but a necessary step towards a global sustainable future in space and in our home.

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