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Preventing Future Conflicts in Outer Space

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Mankind's dependence on space-based services has grown exponentially in the last few decades. As early as 1994, the UN noted that "*space has become an important factor in the social and economic well-being and development of many States*". Today, a growing number of experts argue that sustaining modern life in an increasingly interconnected world will not be possible without ensuring the sustainable use of outer space. From instant communication and the use of global positioning systems, to weather forecasting and environmental monitoring, space technologies bring us irreplaceable and far-reaching benefits, which must be protected responsibly.

Yet with growing dependence comes increased vulnerability, a notion which is perfectly true for space matters, where any accidental interruption or deliberate severance of space-based services would cause immense financial losses and other disruptions. Indeed, a single day without access to space would have disastrous consequences worldwide. Approximately $1.5 trillion worth of financial market transactions per day would be stifled, throwing global markets into disarray. According to statistics provided by the International Air Transport Association, over 100,000 commercial flights crisscross the planet daily. Evidently such flights would be interrupted by communication disruptions, and deliveries of emergency health services would be severely hampered. Additionally, coordinating effective responses to crises would become nearly impossible. Due to the fundamentally transnational nature of almost all outer space activities, any conflict in outer space – even a limited one – would have disastrous consequences for the large amount of civilians globally who depend on the provision of outer space services.

Contemporary strategists warn that command and control structures of modern militaries are also becoming critically dependent on space-based assets for communication, coordination,

reconnaissance, surveillance, high-precision targeting and other critical military activities. This increasing indispensability of space for modern military activities makes satellites ideal targets in future conflicts. This issue is particularly relevant for the United States, which is not only heavily dependent on space but also *unequally*dependent on space, meaning its dominance in space could "give adversaries incentive to attack its infrastructure in orbit". In fact, any conflict on Earth would inherently need to begin "with some sort of conflict in space". For the US military, the threat of a massive cyber attack is a "nightmare scenario" and understandably so: the US could lose early warnings of nuclear attacks, pilots could lose contact with drones, and its "smart bombs would become dumb".

There are many ways in which satellites can be targeted, including the temporary disablement of a satellite achieved by jamming its signal, providing false military coordinates. Experts have also warned that cyber-attackers could feasibly take physical control of satellites, from which point it would be possible to deliberately cause collisions with other space assets, re-enter a satellite into the Earth's atmosphere or over-expose its solar panels to radiation, thus destroying it. Significantly, China has launched the world's first 'quantum satellite', constituting a major technological achievement with great implications for outer space security, as the satellite plans to transmit hack-proof keys from space and therefore relay targeting data without risk of interception through cyberattacks. Other tactics include causing the physical degradation of a satellite or its destruction by various terrestrial or space-based anti-satellite weapons (ASATs), such as kinetic-kill interceptor missiles, high-powered laser beams or nuclear-tipped missiles exploding in the vicinity of the targeted satellite.

The growing sense of concern surrounding space weaponization and space warfare re-emerged in 2007, when China tested a kinetic-kill ASAT weapon against its own satellite, the most disruptive ASAT test to date, creating tens of thousands of debris pieces. In the United States, the event was described as "the first real escalation in the weaponization of space that we've seen in 20 years". The incident also raised other fears, such as that China could use its counterspace capabilities to destroy critical space assets belonging to the US, including its early warning systems. Certainly, the real proportions of these dangers should not be overstated either because available evidence suggests it is unlikely that China will employ anti-satellite weapons to disable nuclear surveillance sites. The 2007 test was not enough to fundamentally *erode* the US' dominance in space. In the US, however, the very fact that China seems capable of *challenging* that dominance is enough to trigger concern.

After the landmark moment in 2007, a period of relative calm ensued until 2013, when China launched a rocket, which was ostensibly launched for a science mission but some feared it was "a practice run for future anti-satellite weapons".

Additionally, there have also been less high-profile instances of ASAT proliferation and testing. For example: a US missile downed a low-orbit defunct spy satellite in 2008; in 2012 Indian officials announced they had the building blocks in place to use ASAT weapons to strike satellites; China carried out tests on secretive missiles – called Dong Neng 2 and 3 – in 2013 and 2015, which are capable of destroying US satellites; and in 2016 Russia successfully tested its A-235 Nudol direct ascent anti-satellite missile.

These instances may not yet amount to an imminent danger of a war in space, but they are not inconsequential either. US Navy Vice Admiral, Charles Richard, summarized this when he stated

"while we're not at war in space, I don't think we can say we're exactly at peace either". More caution and weariness certainly dictates the mood today, and with it increasing calls for more preparedness, including at the institutional level. In a conference in April 2017, a Republican Congressman from Alabama proposed that the US Air Force should create a specialized and independent group to deal with military operations in orbit.

A disturbing fact is that it is very difficult to distinguish anti-ballistic weapons (kinetic energy or direct energy systems) based on the ground or on naval or aerial platforms, from anti-satellite weapons, since satellites in Low Earth Orbit (LEO) can be attacked by the same systems that are officially designed to attack ballistic missiles warheads, since a long-range (IRBM or ICBM) ballistic missile warhead goes through space at a speed of the same order of magnitude as the velocity of a satellite of LEO. Military space systems in LEO and anti-ballistic systems based on the ground or on naval or aerial platforms can be considered as belonging to the same broad category of defense systems, making it very difficult to separate discussions on anti-satellite (ASAT) weapons from discussions on anti-ballistic missiles (ABM) weapons, which are nevertheless addressed very differently in the international sphere.

The trend of proliferation demonstrates the capability of major military powers to swiftly down satellites, suggesting that emerging powers may be sucked into a weaponization race. Experts have also cited the possible proliferation of explosive cylindrical kinetic energy weapons – dubbed the "rod from God" – which can destroy targets simply by firing non-explosive tungsten rods at a speed high enough to generate a force equivalent to a small nuclear explosion.

Furthermore, as we saw in 2007, the physical destruction of a single space object can pollute orbits with tens of thousands of chunks of space debris and indiscriminately threaten all space-based assets for years or even decades to come. As I argued in my book, *Meta-Geopolitics of Outer Space*, the interconnectedness and fragile nature of the space environment importantly means that once certain orbits become contaminated with enough debris, they are rendered unusable for all. In September 2016, Chinese authorities announced that they had lost control of their first space laboratory – Tiangong 1. It was initially expected to renter the Earth's atmosphere in late 2017, although the time and location are unknown, and more recently, it was reported that the expected date for reentry would be at some point in March 2018. Although unlikely to cause damage on Earth, the lack of control of such a large object signals a wider issue of possible geopolitical tensions arising from the destruction of space assets, particularly when they are unidentifiable.

Although defensive strategies can greatly benefit parties in future space conflicts, they are also important in conflict prevention. For example, improving space situational awareness systems (SSA), which can allow a single party to better understand the movements of an adversary's space assets, could also serve to elucidate congested orbits, if cooperative systems are established. Non-aggressive defense mechanisms, such as increasing a satellite's maneuverability or hardening spacecraft, clearly have strategic benefits for a single party. Yet equipping space assets with such technology also has the potential to reduce the possible adverse effects of unintentional incidents, which can harm space assets, by avoiding collisions or using more robust materials. Improving other defense mechanisms, such as diversifying space assets and using further-afield orbits, could also reduce the incentives for adversaries to attack space assets, as the consequences of a single attack would be less crippling. Moreover, overly offensive strategies which aim to increase a single state's control of the space

domain are likely to provoke a negative reaction in the wider international community, as states rely on access to space services. Such aggression would increase tensions between space actors.

Alarming gaps in international space law

The high stakes of space power make it all the more worrisome that the current body of international space law remains minimal concerning the prospect of researching, developing, testing and deploying terrestrial ASATs and space-based weapons. The preamble of the Outer Space Treaty of 1967 speaks of the desire of states to use outer space for peaceful purposes. This reference leads some lawyers to believe that the treaty in fact establishes a general prohibition on military activities in this domain, implying that the deployment of space weapons or ASATs is illegal.

In reality, the treaty does not include any legally binding provisions concerning the peaceful use of outer space. In fact, the reference to the peaceful use of space is not even included in the operational part of the treaty. Instead, it simply appears in the preamble as an objective. The treaty was drafted by the two Cold War superpowers, during a highly tense period in which both nations had already made extensive use of outer space for military purposes through the deployment of reconnaissance or early-warning satellites. Consequently, neither state was willing to place legal restrictions on such activities.

The Outer Space Treaty only explicitly prohibits the militarization of the Moon and other celestial bodies, as well as the placement of weapons of mass destruction (WMD) in outer space. However, the prohibition of WMDs only applies to 'placed' and 'stationed' objects, or objects 'installed' on celestial bodies, meaning that transits carrying weapons would be allowed. Non-stationed objects armed with WMDs such as intercontinental ballistic missiles equipped with a nuclear warhead or a nuclear-armed spacecraft moving through space are, strictly speaking, legal under the treaty. The previously-mentioned tungsten-based "rod for God" weapons could also be considered legal, as international legal definitions of WMDs typically encompass only nuclear, biological and chemical weapons.

Even more worrying than its limited restrictions on militarization in outer space is the treaty's silence on the issue of developing and testing terrestrial or space-based ASAT weapon systems. Since the withdrawal of the United States from the Anti-Ballistic Missile Treaty in 2002, the current body of space law has remained unable to prevent states from creating space debris by testing ASAT weapons. Given the critical importance of satellites for a wide variety of civilian, commercial and military activities, the continued testing of such weapons is inherently escalatory and destabilizing. By polluting orbits around the Earth with space debris, ASAT testing not only threatens the safety, security and sustainability of the space environment, but also fosters an international atmosphere of distrust and fear among the major spacefaring nations. Since all states benefit when one state takes on the cost of cleaning up space debris, the incentive for any state to do so remains low. However, in 2014 Lockheed Martin and Electro Optic Systems Pty Ltd began tracking space debris. This network, called Optical Space Services, provides data on space debris orbits to improve the maneuvering of satellites around the junk. This will serve as a compliment to the US Air Force's radar-based Space Fence, to be completed this year, which aims to simultaneously detect, track and characterize objects within a much wider field of view than was possible before. Moreover, the European Space Agency (ESA) is launching its CleanSat initiative, which aims at cleaning space debris and safeguarding

both terrestrial and space environments from increasingly clogged orbits. This development represents an example of the cooperative use of space with a vision towards sustainability.

Preventing a future arms race in outer space

In order to preserve the many benefits of outer-space use it is necessary to urgently address the existing lacunas in international space law, in spite of the current geopolitical climate which increasingly fosters suspicion, rivalry and fear among the major global players. As I have argued previously, a state's actions are guided not only by their rational self-interest but also by their inherent emotional amoral egoism. If states receive credible assurances through positive transparency and confidence building measures in outer space, they will be more likely to commit to legally binding instruments. In contrast, if states are excluded from the benefits of cooperation in space, or see that other states are secretive about their space programs, they will be more likely to pursue unilateral approaches to strengthen their own security, including the development and testing of new weapons.

Any serious effort to close the existing gaps in international space law must include measures to build confidence and transparency among states. All relevant stakeholders should publicize unilateral moratoria on the development of certain types of weapons, as well as announcing national pledges of no-first-use and non-placement of such weapons in orbit. Cooperative initiatives of all kinds, such as the International Space Station (ISS) or NASA-ESA cooperation should be strengthened and expanded to include other actors. States must exchange information about their satellites' orbital positions to promote transparency and minimize risks, especially as the increasing amount of satellites in space raises the likelihood of collisions. Similarly, UN member states could coordinate an international code of conduct in outer space, as has been proposed by EU states, aiming to establish universal consensus on what constitutes legitimate and dangerous activities in space. Such non-binding guidelines could eventually be transposed into binding national legislation, demonstrating a state's commitment to preserving the sustainability and safety of outer space. So far, hopes for a space rulebook that would be applicable today still remain unfulfilled – something that reflects the persistent mistrust between global players: in 2008, Russia and China proposed norms of behavior but the United States was reluctant to sign on; in 2014, when the US supported an EU proposal on how to govern the use of conventional weapons in orbit, Russia and China did not agree to the terms.

However, there are also signs of progress. Despite high tensions between the US and China regarding outer space security, the two nations met to discuss military operationsin space in May 2016, and a second meeting occurred in late 2016. In 2013, the UN held a governmental expert meeting for confidence-building and transparency in outer space, including representatives from all permanent members of the Security Council. In 2014, a UN compendium of space debris mitigation standards was adopted by states and IOs in Vienna. The 50th anniversary of the Outer Space Treaty was heralded as an opportunity to foster a multi-stakeholder response to the challenges of cybersecurity and sustainable outer space, as well as the much-need expansion of the international legal base for these issues. One step in the right direction was taken in February 2018, when a UN committee of COPOUS agreed on nine guidelines for "space sustainability", which emphasize the need for more transparency, information-sharing and more precaution in the use of sources of laser beams in space. These guidelines are voluntary – they are not legally-binding under international law;

nevertheless, they represent a much-needed step forward for fostering more cooperation and trust-building in outer space matters.

Only after achieving a greater degree of transparency, confidence and trust among the major space-faring players will it be possible to pursue the legally binding measures necessary to address the existing gaps in current space law more definitively. In the absence of these factors, the future weaponization of space seems inevitable. Given the centrality of space-based services in our globalized society, such an outcome would translate into global insecurity and a vulnerable and uncertain future for humanity. Aside from weaponization, more responsible behavior in space is anyway critical because the risk of collateral damage is high: in space, debris moves at 17,000 mph and can cause havoc. Indeed, even something the size of a marble can be detrimental to a satellite.

One may add that with the expansion of economical space activities farther from the Earth, in cislunar space and beyond, which will be the trend in the 2020s and 2030s, the risk of extending also the weaponization of space to the Moon region and beyond is becoming very real. Under these circumstances – and before the available options start narrowing even more – the global community must act in the spirit of collaboration and be bound by a fundamental principle: if space becomes critically unsafe, it will not be selectively unsafe, but rather unsafe for all.

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