**1NC**

**SPEC**

**Interpretation – the aff must specify what type of private actor appropriation they affect.**

**Appropriation is extremely vague – no legal precedent means no normal means**

Pershing 19, Abigail D. "Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today." Yale J. Int'l L. 44 (2019): 149. (Robina Fellow at European Court of Human Rights. European Court of Human Rights Yale Law School)//Elmer

Though the Outer Space Treaty **flatly prohibits national appropriation of space,**150 it leaves unanswered many questions as to what actually counts as appropriation. As far back as 1969, scholars wondered about the implications of this article.151 **While it is clear that a nation may not claim ownership of the moon, other questions are not so** clear. Does the prohibition extend to collecting scientific samples?152 Does creating space debris count as appropriation by occupation? While **the answers to these questions are most likely no, simply because of the difficulties that would be caused** otherwise, there are some questions that are more difficult to answer, and more pressing. As commercial space flight becomes more and more prevalent,153 the question of whether private entities can appropriate property in space becomes very important. Whereas once it took a nation to get into space, it will soon take only a corporation, and scholars have pondered whether these entities will be able to claim property in space.154 Though this seems allowable, since the treaty only prohibits “national appropriation,”155 allowing such appropriation would lead to an absurd result. This is because the only value that lies in recognition of a claim is the ability to have that claim enforced.156 If a nation recognized and enforced such a claim, this enforcement would constitute state action.157 It would serve to exclude members of other nations and would thus serve as a form of national appropriation, even though the nation never attempted to directly appropriate the property.158 Furthermore, the Outer Space Treaty also requires that non-governmental entities must be authorized and monitored by the entities’ home countries to operate in space.159 Since a nation cannot authorize its citizens to act in contradiction to international law, a nation would not be allowed to license a private entity to appropriate property in space.160 While this nonappropriation principle is great for allowing free access to space, thereby encouraging research and development in the field, it makes it difficult to create or police a solution to the space debris problem. A viable solution will have to work without becoming an appropriation. There is, however, very little substantive law on what actually counts as appropriation in the context of space.161 So, the best way to see what is and is not allowed is to look both at the general international law regarding appropriations and to look at the past actions of space actors to see what has been allowed (or at least tolerated) and what has been prohibited or rejected.

**Violation: they don’t**

**Standards:**

**a] Shiftiness – vague plan wording wrecks Neg Ground since it’s impossible to know which DAs link or which CPs are competitive since different types of appropriation like Space Mining, Space Col, and Satellites – the 1AR can squirrel out of links by saying they don’t affect a certain type of appropriation, or they don’t reduce private appropriation enough to trigger the link.**

**b] Topic Ed – nuanced debates about private property in Outer Space requires spec since each form of appropriation has specific issues related to it so generalization disincentivizes in-depth research – o/w since we only debate the topic for two months.**

**dtd deterrence and implicated 1nc, ci, no rvis chilling effect baiting topic ed**

**DA**

**The space-for-space economy is beginning to develop now because of private enterprise in space**

**Weinzierl and Sarang 21** (Matt, PhD in Economics Harvard University, Joseph and Jacqueline Elbling Professor of Business Administration at HBS and a Research Associate at the National Bureau of Economic Research, and Mehak, Research Associate at Harvard Business School and the Lunar Exploration Projects Lead for the MIT Space Exploration Initiative, Harvard Business Review, "The Commercial Space Age is Here," 2/12, <https://hbr.org/2021/02/the-commercial-space-age-is-here>)

In 2019, 95% of the estimated $366 billion in revenue earned in the space sector was from the space-for-earth economy: that is, goods or services produced in space for use on earth. The space-for-earth economy includes telecommunications and internet infrastructure, earth observation capabilities, national security satellites, and more. This economy is booming, and though research shows that it faces the challenges of overcrowding and monopolization that tend to arise whenever companies compete for a scarce natural resource, projections for its future are optimistic. Decreasing costs for launch and space hardware in general have enticed new entrants into this market, and companies in a variety of industries have already begun leveraging satellite technology and access to space to drive innovation and efficiency in their earthbound products and services. In contrast, the space-for-space economy — that is, goods and services produced in space for use in space, such as mining the Moon or asteroids for material with which to construct in-space habitats or supply refueling depots — has struggled to get off the ground. As far back as the 1970s, research commissioned by NASA predicted the rise of a space-based economy that would supply the demands of hundreds, thousands, even millions of humans living in space, dwarfing the space-for-earth economy (and, eventually, the entire terrestrial economy as well). The realization of such a vision would change how all of us do business, live our lives, and govern our societies — but to date, we’ve never even had more than 13 people in space at one time, leaving that dream as little more than science fiction. Today, however, **there is reason to think that we may finally be reaching the first stages of a true space-for-space economy**. SpaceX’s recent achievements (in cooperation with NASA), as well as upcoming efforts by Boeing, Blue Origin, and Virgin Galactic to put people in space sustainably and at scale, mark the opening of a new chapter of spaceflight led by private firms. These firms have both the **intention** and **capability** to bring private citizens to space as passengers, tourists, and — eventually — settlers, opening the door for businesses to start meeting the demand those people create over the next several decades with an array of space-for-space goods and services.

**That’s key to satellite monitoring, resource management, agriculture, climate change monitoring, and space-based solar power development**

**Sommariva 20** (Andrea, Italian Institute for International Political Studies, "The Evolution of Space Economy: The Role of the Private Sector and the Challenges for Europe," 12/11, <https://www.ispionline.it/en/pubblicazione/evolution-space-economy-role-private-sector-and-challenges-europe-28604>)

The second factor focuses on spacecraft and space-access costs. NASA has moved from a government-run International Space Station access system to one where the transportation of goods and people relies on private companies, obviously under contract and control of NASA, thus eliminating the monopoly of Lockheed Martin and Boeing. As a result, significant progress has been made in the design and development of cost-effective launch vehicles. Currently, SpaceX has developed a system to reuse the first stage of rockets, which serves to give the initial thrust necessary to overcome Earth's atmosphere. Normally, after doing its job, the first stage came off and fell into the ocean as waste. SpaceX has successfully developed the recovery and reuse of the first stages of rockets, reducing the cost per kilogram of payload by more than 50 percent. These developments provide access to space for many small and medium-sized companies, **as well as educational and research institutions**. In the near future, the development of the satellite Internet will allow people and companies to connect wherever they are - an effective alternative when terrestrial networks are absent or of poor quality. In addition, satellite technology gives rise to a growing stream of uses, including transportation and logistics efficiency, natural resource management, precision agriculture, environment and climate change monitoring, and makes it a potential source of economic growth, social well-being, and sustainable development. As for the exploration programs, the return to the Moon is now days on the agendas of the major space agencies, such as NASA and ESA. Over the next ten to fifteen years, the use of space resources will be crucial for the success of expeditions to the Moon and other planets. The Moon's resources provide propellant for the in-orbit refueling of spacecraft, reducing their costs[1], and oxygen and water for support systems of the future space station around the Moon (the Gateway project). A new form of public-private partnership is rising, a partnership in which governments will provide initial support in the exploration and the advancement of critical technologies (telecommunications and Moon-Earth navigation), and in the construction of space infrastructure. NASA plans a first exploration mission at the South Pole of the Moon in 2024. The private sector would then take the lead in creating new markets and expanding the presence of humanity in space. SpaceX is developing a vehicle, Starship, for missions to the Moon and beyond. The Starship is a fully reusable launch vehicle. It consists of two stages, the booster and the spacecraft, which in November 2018 Elon Musk renamed Super Heavy and Starship respectively. The overall vehicle architecture includes both the launcher and the vehicle, as well as the infrastructure for the first and subsequent launches, and zero-gravity propellant transfer’s technology. The spacecraft alone is designed to be used, in a first phase, without a booster for both freight and passenger transport. In April 2020, NASA selected a modified version of the Starship as one of three landing systems for the Artemis Program. Moon mining will present also an opportunity to make space based solar power (SBSP) economically feasible. SBSP has been studied for decades. However, the costs of launching such large infrastructure from Earth to geosynchronous orbit (GEO) make these projects economically not feasible. At the SEE Lab-SDA Bocconi, we have initiated a study where the basic idea is to build the SBSP satellite with material from the Moon and to transfer the components to GEO where they would be assembled. Its costs are comparable to a large-scale nuclear power plant. If preliminary results are confirmed by the completion of the study, space based solar power can transform the energy markets of Earth[2], and can give an important contribution to the climate change’s mitigation.

**SBSP is necessary to reduce emissions and solve climate change**

**Shtivelman 12** - J.D., Boston University School of Law [Aleksey, 2012, *B. U. J. SCI. & TECH. L. Vol. 18:435*, “SOLAR POWER SATELLITES: THE RIGHT TO A SPOT IN THE WORLD'S HIGHEST PARKING LOT”, Hein Online]

Rather than spending millions on land-based solar power projects, it would be much more profitable if these nations invested in SBSP satellites for two reasons. First, although SBSP satellites are much more expensive at the outset, the cost of initial investment is returned in a period of time comparable to what it would take to recoup the investment cost of a land-based solar farm. 113 Second, SBSP satellites generate about **eight to ten times** as much power as land-based solar farms."l 4 This means that after one and a half years, SBSP satellites would generate **eight to ten times the revenue** of a land-based solar farm. As a result, countries that currently rely on coal, nuclear or other types of non-clean, non-renewable energy **may look to SBSP** for their energy needs, and consequently generate a **significant spike in demand** for orbital locations on the GSO. This increased demand will raise two issues: (1) whether a GSO orbital **slot can be owned**, and, (2) if not, whether there is a way to allocate the right to access GSO orbital slots for a period of time. A viable legal framework could address both of these issues in a clear and precise manner. The ITU currently allocates slots for telecommunications satellites, but the increased demand for slots in GSO for SBSP satellites may force countries to reevaluate ITU's authority to regulate SBSP satellites.

1. An unsuccessful attempt to appropriate GSO slots

The ITU allocation is one way to solve the problem, but given the physical limitations of the GSO, there is an underlying conflict between the goals of fair and equitable access on one side and the GSO's efficient use on the other.' 5 The conflict arises when developed countries receive priority to access the GSO because they have the demand, infrastructure, and funding to put satellites into orbit, while developing countries without viable satellites also want access the GSO. 116 This a posteriori approach to GSO property rights favors those who are first to apply for frequency and orbital slots and protects those applicants from interference by later users."17 At the same time, developing countries do not favor such a "free-market-approach" to GSO access; on the contrary, they **would like a multilateral approach** that distributes access to the GSO equitably among all nations. 118 "As feared by the developing States, this a posteriori system [has] provided a few industrialized and rich States with the opportunity of temporarily unlimited use of registered frequencies and orbit positions."' "19 Developing countries feel that they should have equal access to these frequencies and orbital slots. 120 These countries have tried to gain leverage over the GSO resource by advocating for the creation of an administrative agency that would allocate a part of the GSO to each country. In 1976, eight developing countries above the equator claimed sovereign right over the parts of the GSO lying over their territories and called for the administration of the rest of the GSO. 12 ' The Declaration of the First Meeting of Equatorial Countries (**the "Bogota Declaration**") asserted that these countries had the right to parts of the GSO because the orbit should be considered part of the earth and not outer space. 22 These countries argued that the gravitational force that produces the GSO was defived from their land.' 23 Both developed **and developing** countries rejected the Bogota Declaration's arguments because its claims were weak: the gravity that produces the orbit (1) is **produced by the entire earth**, not just these eight nations, and (2) produces all orbits, not just the GSO.124 Another of the arguments in the Bogota Declaration was that there is no legally defined boundary as to **where an atmosphere ends and space begins**. 125 Furthermore, the Bogota Declaration declared that even the Outer Space Treaty, which provides the basic outline for the peaceful exploration and use of outer space, does not address the issue. 126 While there is no definition that all countries in the world accept regarding the boundary of space, the International Aeronautic Federation recognizes the Karman Line as the edge of the atmosphere and the beginning of space.' 27 The International Aeronautic Federation is a non-governmental organization founded in 1905, for the purpose of encouraging aeronautical and astronautical activities worldwide. 28 It has 100 member countries, including the United States, United Kingdom, Spain, Sweden, South Africa, Mongolia, Korea, Israel, Iran, as well as many others.1 29 For the preceding reasons, the International Aeronautic Federation portrays a widely held view concerning the definition of space. The Karman line is one hundred kilometers above sea level, and that is where the atmosphere becomes so thin that an airplane cannot fly and a spaceship is needed for flight.' 30 The GSO lies more than 35,000 kilometers above sea level, which is approximately 34,900 kilometers higher than the Karman line. Therefore, GSO is well above the demarcation of space that is internationally recognized. For this reason and others, most countries did not accept the Bogota Declaration. Accordingly, the Bogota Declaration was an unsuccessful attempt to appropriate GSO slots.

1. Space law must allow appropriation of space for the good of everyone

The Bogota Declaration was ultimately a failure because it **violated** internationally accepted principles. According to the Outer Space Treaty of 1967, GSO orbital positions and frequencies cannot be appropriated because no country can appropriate or own space. 31 **Ninety-one states have signed this treaty, including the United States, the United Kingdom, Ukraine, Japan, Greece, Denmark, Spain, Uganda, Afghanistan, Iraq and many others**. 32 The treaty specifies that outer space is the "province of mankind" and that all activity should be done for the benefit of all of humanity. 133 It would then seem that no country could have exclusive ownership over an orbital position in the GSO or any orbit. 134 Even if the Outer Space Treaty of 1967 prohibits countries from **owning orbital slots** in the GSO, the slots should still be allocated to countries that will use them, on a first-come, first-served basis. SBSP has so much potential to benefit all of mankind that if even a single country uses a GSO slot to gather power, the advantage of developing the technology of SBSP **may outweigh** the argument that all nations should have equal access to space.'3 5 Countries like Tonga that have no capability of sending satellites into orbit should not be able to claim GSO slots because this would prohibit developed countries from **placing satellites into orbit that can benefit the whole world.**136 The Outer Space Treaty of 1967 likely permits the allocation of GSO slots to individual countries **on the condition** that the slots are used for SBSP satellites that **benefit all mankind**. Countries with orbiting SBSP satellites could meet such conditional requirements in three ways. First, they **could be required to provide power** to less developed countries. Second, launching countries can help decrease global warming because SBSP satellites provide clean energy. Third, launching countries can lower the cost of solar power systems as they become **cheaper and more affordable** with time so that many less developed countries around the world will be able to access solar power from space. By satisfying any of these conditions, deployment of SBSP satellites would qualify under the treaty as "use of outer space ... carried out for the benefit and in the interests of all countries."'137 The universal benefits provided by SBSP satellites would therefore **be consistent** with the treaty's requirement that the use of outer space "shall be the province of all mankind." 138 Thus, while the **Outer Space Treaty** of 1967 may prohibit ownership of GSO slots, the temporary allocation of GSO slots for the use of SBSP satellites would be compatible with the goals of the treaty. ." As a result of the need to allow SBSP to have access to the GSO, there will need to be some sort of regulatory structure to GSO slot allocation. If a regulatory organization, such as the ITU, allows licensees to use a particular GSO position and microwave frequency, for a limited period of time, this would appear to satisfy the current international regime under the Outer Space Treaty of 1967. In order to comply with the treaty, countries would not have to surrender their slot or frequency, as they could simply allow other countries to lease the power satellites from them for a period of time. SBSP satellites in GSO would fall within the "province of mankind" requirement of the Outer Space Treaty of 1967 because SBSP can **decrease global warming** and help less developed countries by **providing them with electricity in areas lacking infrastructure**. Furthermore, SBSP satellites in GSO would satisfy the "peaceful purposes" requirement of the Outer Space Treaty of 1967 because the satellites are used for commercial power production and **cannot be converted into weapons**. 139

**Warming causes extinction – a confluence of nonlinear and unpredictable effects will make human and natural systems inhospitable while increasing escalatory conflicts – even if the impacts are far off, only drastic action soon solves**

**Melton 19** [Michelle Melton is a 3L at Harvard Law School. Before law school, she was an associate fellow in the Energy and National Security Program at the Center for Strategic and International Studies, where she focused on climate policy. Climate Change and National Security, Part II: How Big a Threat is the Climate? January 7, 2019. https://www.lawfareblog.com/climate-change-and-national-security-part-ii-how-big-threat-climate]

At least until 2050, and possibly for decades after, climate change will remain a **creeping threat** that will **exacerbate and amplify** existing, **structural** global **inequalities**. While the developed world will be negatively affected by climate change through 2050, the consequences of climate change will be felt most acutely in the developing world. The national security threats posed by climate change to 2050 are likely to differ in degree, not kind, from the kinds of threats already posed by climate change. For the next few decades, climate change will **exacerbate humanitarian crises**—some of which will result in the deployment of **military personnel**, as well as material and financial assistance. It will also **aggravate** natural **resource constraints**, potentially contributing to political and economic **conflict** over **water**, **food** and **energy**. The question for the next 30 years is not “can humanity survive as a species with 1.5°C or 2°C of warming,” but, “how much will the existing disparities between the developed and developing world widen, and how long (and how successfully) can these widening political/economic disparities be sustained?” The urgency of the climate threat in the next few decades will depend, to a large degree, on whether and how much the U.S. government perceives a widening of these global inequities as a threat to U.S. national security. By contrast, if emissions continue to **creep upward** (or if they do not decline rapidly), by 2100 climate-related national security threats could be **existential**. The question for the next hundred years is not, “are disparities politically and economically manageable?” but, “can the **global order**, premised on the **nation-state system**, itself based on territorial sovereignty, **survive** in a world in which **substantial swathes of territory** are potentially **uninhabitable**?” National Security Consequences of Climate Change to 2050 Scientists can predict the consequences of climate change to 2050 with some measure of certainty. (Beyond that date, the pace and magnitude of climate change—and therefore, the national security threat posed by it—depend heavily on the level of emissions in the coming years, as I have explained.) There is relative agreement across modeled climate scenarios that the world will likely warm, on average, at least 1.5°C above pre-industrial levels by about 2050—but perhaps as soon as 2030. This level of warming is likely to occur even if the world succeeds in dramatically reducing greenhouse gas emissions, as even the recent Intergovernmental Panel on Climate Change (IPCC) report implicitly admits. In other words, a certain amount of additional warming—at least 1.5°C, and probably more than that—is presumptively unavoidable. Looking ahead to 2050, it can be said with relative confidence that the national security consequences of climate change will vary in degree, not in kind, from the national security threats already facing the United States. This is hardly good news. Even **small differences** in global average **temperatures** result in **significant environmental changes**, with attendant **social**, **economic** and **political consequences**. By 2050, climate change will **wreak increasing havoc** on **human** and **natural systems**—predominantly, but not exclusively, in the developing world—with attenuated but **profound consequences** for **national security**. In particular, changes in **temperature**, the **hydrological cycle** and the **ranges of insects** will impact **food availability** and food access in much of the world, increasing food insecurity. **Storms**, **flooding**, **changes in ocean pH** and other climate-linked changes will damage **infrastructure** and negatively impact **labor productivity** and economic **growth** in much of the world. Vector-borne **diseases** will also become **more prevalent**, as climate change will expand the geographic **range** and **intensity** of **transmission** of diseases like malaria, West Nile, Zika and dengue fever, and cholera. Rising **public health challenges**, **economic devastation** and **food insecurity** will translate into an increased **demand** for **humanitarian assistance** provided by the **military**, increased **migration**—especially from tropical and subtropical regions—and **geopolitical conflict**. Long-term trends such as declining food security, coupled with short-term events like hurricanes, could sustain unprecedented levels of migration. The 2015 refugee crisis in Europe portends the kinds of population movements that will only accelerate in the coming decades: people from Africa, Southwest and South Asia and elsewhere crossing land and water to reach Europe. For the United States, this likely means greater numbers of people seeking entry from both Central America and the Caribbean. Such influxes are not unprecedented, but they are unlikely to abate and could increase in volume over the next few decades, driven in part by climate change-related food insecurity, climate change-related storms and also by economic and political instability. Food insecurity, economic losses and loss of human life are also likely to exacerbate existing political tensions in the developing world, especially in regions with poor governance and/or where the climate is particularly vulnerable to warming (e.g., the Mediterranean basin). While the Arab Spring had many underlying causes, it also coincided with a period of high food prices, which arguably contributed to the protests. In some situations, **food insecurity**, **economic losses** and **public health crises**, combined with **weak** and ineffectual **governance**, could **precipitate future conflicts** of this kind—although it will be difficult to know where and when without more precise local studies of both underlying political dynamics and the regionally-specific impacts of climate change. 2100 and Beyond While the national security impacts of climate change to 2050 are likely to be costly and disruptive for the U.S. military—and devastating for many people around the world—at some point after 2050, if warming continues at its current pace, changes to the climate could **fundamentally reshape geopolitics** and possibly even the current nation-state basis of the current global order. To be clear, both the ultimate level of warming and its attendant political consequences is highly speculative, for the reasons I explained in my last post. Nonetheless, we do know that the planet is currently on track for at least 3-4°C of warming by 2100. The “known knowns” of higher levels of warming—say, 3°C—are frightening. At that 3°C of warming, for example, scientists project that there will be a nearly **70 percent decline** in **wheat** production in **Central America** and the Caribbean, **75 percent** of the **land area** in the **Mid**dle **East** and more than 50 percent in South Asia will be affected by highly unusual heat, and **sea level rise** could **displace** and imperil the lives **hundreds of millions** of people, among other consequences. But even higher levels of warming are physically possible within this century. At these levels of warming, some **regions of the world** would be **literally uninhabitable**, likely resulting in the depopulation of the tropics, to say nothing of the consequences of **sea-level rise** for **economically important cities** such as Amsterdam and New York. Even if newly warmed regions of the far north could **theoretically accommodate** the resulting **migrants**, this **presumes** that the **political response** to this unprecedented **global displacement** would be **orderly** and **conflict-free** **borders on fantasy**. The geopolitical consequences of significant levels of warming are severe, but if these changes occur in a linear way, at least there will be time for human systems to adjust. Perhaps more challenging for national security is the possibility that the until-now **linear changes give way** to **abrupt** and **irreversible ones**. Scientists forecast that, at higher levels of warming—precisely what level is speculative—humanity could trigger **catastrophic**, **abrupt** and **unavoidable consequences** to the **ecosystem**. The IPCC has considered **nine** such abrupt changes; one example is the potential **shutting down** of the **Indian summer monsoon**. Over a **billion** people are **dependent** upon the Indian monsoon, which provides parts of South Asia with about 80 percent of its annual rainfall; relatively minor changes in the monsoon in either direction can cause disasters. In 2010, a wetter monsoon led to the catastrophic flooding in Pakistan, which directly affected 20 million people; a drier monsoon in 2002 led to devastating drought. Studies suggest that the Indian summer monsoon has two stable states: wet (i.e., the current state) and dry (characterized by low precipitation over the subcontinent). At some point, if warming continues, the monsoon could abruptly shift into the second, “dry” state, with catastrophic consequences for over a billion people dependent on monsoon-fed agriculture. The IPCC suggests that such a state-shift is “unlikely”—that is, there is a 10 to 33 percent chance that a state-shift will happen in the 21st century—but scientists also have relatively low confidence in their understanding of the underlying mechanisms in this and other large-scale natural systems. The consequences of abrupt, severe warming for national security are obvious in general, if unclear in the specifics. In 2003, the Defense Department asked a contractor to explore such a scenario. The resulting report outlined the offensive and defensive national security strategies countries may adopt if faced with abrupt climate change, and highlighted the **increased risk** of inter- and intra-state **conflict** over natural **resources** and **immigration**. Although the report may be off in its imagined timeframe (positing abrupt climate change by 2020), the world it conjures is improbable but not outlandish. If the Indian monsoon were to switch to dry state, and a billion people were suddenly without reliable food sources, for example, it is not clear how the Indian government would react, assuming it would survive in its current form. Major wars or low-intensity proxy conflicts seem likely, if not inevitable, in such a scenario. This is not to say that a parade of climate horribles is certain—or even likely—to come to pass. Scientific understanding of the sensitivities in the climate system are far from perfect. It is also possible that emissions will decline more rapidly than anticipated, averting the worst consequences of climate change. But this outcome is far from guaranteed. And even if global emissions decline precipitously, humanity cannot be sure when or whether the planet has crossed a climate tipping point beyond which the incremental nature of the current changes shifts from the current linear, gradual progression to a non-linear and abrupt process. Within the next few decades, the most likely scenario involves manageable, but costly, consequences on infrastructure, food security and natural disasters, which will be borne primarily by the world’s most impoverished citizens and the members of the military who provide them with humanitarian assistance and disaster relief. But **while** the head-turning national security **impacts** of climate change are **probably** several **decades away**, the **nature of the threat** is such that **waiting until** these **changes manifest** is **not a viable option**. By the time the climate consequences are severe enough to compel action, there is likely to be little that can be done on human timescales to undo the changes to **environmental systems** and the **human societies dependent upon them**.

**CP**

**The use of propellants other than liquid hydrogen and liquid oxygen to fuel rocket launches is unjust.**

**That solves ozone because solid fuel rockets are the ones that burn the ozone layer – liquid hydrogen/oxygen are safe**

**Mortillaro 21** [Nicole Mortillaro, CBC News Senior Reporter, editor of the Journal of the Royal Astronomical Society of Canada, author of several books. "Rocket launches could be affecting our ozone layer, say experts." CBC, 4-22-2021, accessed 1-22-2022, https://www.cbc.ca/news/science/rocket-launches-environment-1.5995252] HWIC

There are different types of rocket propellants. Some, like liquid oxygen and liquid hydrogen, produce mainly water vapour and have little environmental impact. These were used in past shuttle launches and even in the Apollo-era Saturn V vehicles.

Then there are those that produce alumina particles in the stratosphere, such as those in solid rocket boosters, which were also used in past shuttle launches, and are still being used today by some launch companies.

Finally, there are those that deposit black soot in the stratosphere, such as kerosene used in SpaceX's Falcon 9 and Russia's Soyuz rockets.

It's the alumina and black soot that is most concerning to experts.

**Case**

**Neolib**

**Exploitation on earth will continue – ev isnt reverse causal**

**Neoliberal globalization reduce the frequency and severity of wars by a factor of ten.**

**Mooney 14** – Loren, Stanford Graduate School of Business, summarizing Matthew O. Jackson, the William D. Eberle Professor of Economics at Stanford, and earned his PhD in economics from Stanford GSB in 1988. (“Matthew O. Jackson: Can Trade Prevent War?” May 28, 2014https://www.gsb.stanford.edu/insights/matthew-o-jackson-can-trade-prevent-war)

While there is considerable existing research on the effects of trade and war, much of it has looked at bilateral relationships. This model focuses on **multilateral interactions** and considers various incentives for countries to attack, form alliances with, and trade with one another. In an attempt to understand what's necessary to achieve a stable network with no incentive for war, Jackson and Nei first explored an alliance scenario based solely on military defense considerations, excluding trade. "The fundamental difficulty we find is that **alliances are costly to maintain if there's no economic incentive**," says Jackson. So networks remain relatively sparse, a condition in which even a few shifting allegiances leaves some countries vulnerable to attack. "**Stability is not just a little bit elusive; it's very elusive**."

Economic trade, however, makes a **significant difference**. "Once you bring in trade, you see network structures densify," he says. Nations form a web of trading alliances, which creates **financial incentive** not only to **keep peace** with trading partners, but also to **protect them** from being attacked so as not to disrupt trade. "In the context of the alliances we have analyzed, trade motives are essential to **avoiding wars and sustaining stable networks**," the authors wrote in their paper, Networks of Military Alliances, Wars, and International Trade.

Their findings coincide with two major global trends since World War II: From 1950 to 2000, the incidence of interstate war has **decreased nearly tenfold** compared with the period from 1850 to 1949. At the same time, since 1950 international trade networks have increased nearly fourfold, becoming significantly more dense. "In the period before World War II, it was hard to find a stable set of alliances," says Jackson. The probability of a lasting alliance was about 60%. "You have almost a coin-flip chance that the alliance won't still be there in five years," he says. In Europe in the 1870s, for example, German chancellor Otto von Bismarck sought peace with "balance of power" diplomacy, which crumbled leading up to World War I. "Then in the past 50 years or so, there's been a surprising global stability." The impact of economic interdependence is especially apparent in Europe, Jackson says, where the Eurozone has promoted not only peace and increased trade among nations, but also labor mobility.

Very costly wars still occur, of course, but Jackson notes that **the most war-torn places** in recent history have tended to be those with **fewer global trade alliances**. For example, the Second Congo War from 1998 to 2003 and beyond, which killed more than **four million people** and is the deadliest war since World War II, involved eight African nations with relatively **few trade ties**. "Then look at the Kuwait situation," says Jackson, referring to U.S. intervention in the first Gulf War to protect oil supplies. "Economic interest drives a lot of what goes on in terms of where nations are willing to exercise military strength."

There are other real-world factors that have no doubt influenced war and trade trends since World War II, among them the proliferation of nuclear weapons — "Changing military technology can help maintain stable arrangements," says Jackson — the Cold War, an increase in worldwide wealth levels, and the introduction of container shipping in the 1960s, which has helped facilitate low-cost, long-range trade.

Still, Jackson and Nei's theoretical model suggests that **trade alliances play a critical role.** And in fact **economic allies** may be the most worth striving for in developing areas. "Maybe wars like the Second Congo War **won't be occurring in the future if there's more trade** with African nations," says Jackson. "Economic interests can really help us have a more peaceful world than we already have."

**Economic decline causes nuclear war.**

**Tønnesson 15**—Research Professor at the Peace Research Institute Oslo; Leader of East Asia Peace program, Uppsala University [Stein, “Deterrence, interdependence and Sino–US peace,” International Area Studies Review, 2015, Vol. 18, No. 3, p. 297-311]

Several recent works on China and Sino–US relations have made substantial contributions to the current understanding of how and under what circumstances a combination of nuclear deterrence and economic interdependence may reduce the risk of war between major powers. At least four conclusions can be drawn from the review above: first, those who say that interdependence may **both inhibit and drive conflict** are right. Interdependence raises the cost of conflict for all sides but asymmetrical or unbalanced dependencies and **negative trade expectations** may generate tensions leading to **trade wars** among interdependent states that in turn **increase** the **risk of military conflict** (Copeland, 2015: 1, 14, 437; Roach, 2014). The risk may increase if one of the interdependent countries is governed by an inward-looking socio-economic coalition (Solingen, 2015); second, the risk of war between China and the US should not just be analysed bilaterally but include their allies and partners. Third party countries could drag China or the US into confrontation; third, in this context it is of some comfort that the three main economic powers in Northeast Asia (China, Japan and South Korea) are all deeply integrated economically through production networks within a global system of trade and finance (Ravenhill, 2014; Yoshimatsu, 2014: 576); and fourth, decisions for war and peace are taken by very few people, who act on the basis of their future expectations. International relations theory must be supplemented by foreign policy analysis in order to assess the value attributed by national decision-makers to economic development and their assessments of risks and opportunities. If leaders on either side of the Atlantic begin to seriously **fear or anticipate their own nation’s decline** then they may blame this on **external dependence**, appeal to **anti-foreign sentiments**, contemplate the use of **force** to gain respect or credibility, adopt protectionist policies, and ultimately **refuse to be deterred by** either **nuclear arms** or prospects of socioeconomic calamities. Such a dangerous shift could happen **abruptly**, i.e. under the instigation of actions by a third party – or against a third party.

Yet as long as there is both nuclear deterrence and interdependence, the tensions **in East Asia** are unlikely to escalate to war. As Chan (2013) says, all states in the region are aware that they cannot count on support from either China or the US if they make provocative moves. The greatest risk is **not** that **a territorial dispute** leads to war under present circumstances but that **changes in the world economy** alter those circumstances in ways that render **inter-state peace** more **precarious**. If China and the US fail to rebalance their financial and trading relations (Roach, 2014) then a trade war could result, **interrupting transnational production networks**, **provoking social distress**, and **exacerbating nationalist emotions**. This could have unforeseen consequences in the field of security, with nuclear deterrence remaining the only factor to **protect the world from Armageddon**, and **unreliably so**. Deterrence could **lose its credibility**: one of the two great powers might **gamble** that the other yield in a cyber-war or conventional limited war, or third party countries might engage in conflict with each other, with a view to obliging Washington or Beijing to intervene.

**No limits to growth---their models ignore key feedback effects.**

**Lynch 16**—President of Strategic Energy and Economic Consulting, Director of Asian Energy and Security at the Center for International Studies at MIT, and a Lecturer at Tufts and Vienna University [Michael, *The “peak oil” scare and the coming oil flood*, p. 63-74]

More recently, there has been a clamor about "peak everything" based on the idea that, well, everything is finite and we 're using it up, so it is "running out." Or at least, production must peak. Or, as one physicist [END OF PAGE 63] points out, eventually human energy production will generate as much heat as the sun does-eventually being 1400 years.

Flat Earth

Colin Campbell, in the famed (well, famous in the IEA's offices) debate at the IEA in 1997, compared resource optimists to the conservative Spanish court that opposed the visionary, Columbus, and has since referred to those, like Adelman and me, who disagreed with him as "flat-earth economists." Albert Bartlett later explained that the term actually meant that economists thought the earth had two dimensions and thus was infinite, containing equivalently infinite resources.

But this description **ignores** two important variables: **capital and knowledge**. Additional investment can often increase the production of renewables like agricultural products and nonrenewables like minerals and oil in the same amount of space, as can **better tech**nology. Neo-Malthusians tend to **ignore this factor** and argue that the rate of technological advance (and greater scientific knowledge) has diminished or disappeared, as described in Chapter 7.

The argument is somewhat specious and relies in part the question of the finiteness of resources, discussed earlier-or a static measure of resources and dynamic view of consumption, as in The Limits to Growth.

HOW LONG?

Perhaps the most important factor that raises skepticism is the fact that at least some exponential alarmists fear the distant future. Any number of pundits have looked at long-term forecasts of economic and/or technological development and characterized them as foolish. We have no flying cars, nuclear power is not too cheap to meter, and no one is eating Soylent Green. On the other hand, most of these **were not serious forecasting efforts**, but rather **off-the-cuff remarks** (or the equivalent), and those making them were not particularly serious about achieving them within a specific time frame. And we do eat Soylent Green already; only we call it tofu and vegemite. (Read the book, it wasn't people.)

NEWTON'S FIRST LAW

The biggest mistakes have come from an apparent source: **extrapolation** of a trend **endlessly**, as if there were no feedback or other variables [END PAGE 64] involved. Jay Forrester, the inventor of Systems Dynamics, which was used in The Limits to Growth model (and which I have used), reportedly once said that **feedback effects** tend to **overwhelm** the initial stimuli, which is probably true in many cases. Yet, many neo-Malthusians and especially peak oil advocates tend to extrapolate a given trend endlessly, assuming no feedback effect whatsoever.

Indeed, the first wave of peak oil advocates explicitly argued that no feedback effect would occur: prices didn't affect production or consumption levels. Technological advances were either unimportant or had ceased and so could not increase the resource base.

An **important element** of the fear of exponential growth is the analysts' choice of **particularly high** growth rates. As Figure 4.1 showed, Ehrlich chose the **highest observed** growth in the 20th century for his calculations, even though it represented the post-World War II **baby boom** and should have been considered **an exception**, not the norm. Similarly, Bartlett, writing in 1998, talks about the growth in oil demand from the 1950s and 1960s at 7 [percent] a year, which causes a doubling of use every decade, 25 which sounds alarming, given the arguments about the difficulty of making a speedy energy transition, until you realize that consumption growth dropped to 3% per year in the 1970s (a doubling time of 24 years), and under **1 [percent] per year** in the 1980s (a doubling period of 75 years), before recovering to 1.5% in the seven years before his talk (48 years).

This emphasizes the lack of feedback mechanism used in these simplistic models and how important they are in the real world.

REAL SCARCITY

Indeed, the subtext of the fear of resource scarcity is that renewable resources have repeatedly been the source of problems. In **Tainter**'s The Collapse of Complex Societies, he talks about resources as causing the fall of a number of (mostly) ancient civilizations; **nearly all** suffered from problems like **lengthy droughts** and **salt buildup** in irrigated farmland. 26

And similar problems continue today, especially if you consider endangered species, from rhinos to tuna. In all cases, these are renewable resources, the very ones that are NOT finite, that are sustainable, that we can rely on for all eternity-in theory. **No lasting shortage** of nonrenewable resources minerals and energy-has occurred **since the advent of the global economy**.

**Commercial space manufacturing solves --- microgravity environments accelerate disease research**

**Giulianotti et. al 21** [Marc A. Giulianotti1\*, Arun Sharma2,3, Rachel A. Clemens4 , Orquidea Garcia5 , D. Lancing Taylor6, Nicole L. Wagner7 , Kelly A. Shepard8 , Anjali Gupta4, Siobhan Malany9 , Alan J. Grodzinsky10, Mary Kearns‐Jonker11, Devin B. Mair12, Deok‐Ho Kim12,13, Michael S. Roberts1, Jeanne F. Loring14, Jianying Hu15, Lara E. Warren1 , Sven Eenmaa1, Joe Bozada16, Eric Paljug16, Mark Roth17, Donald P. Taylor18, Gary Rodrigue1, Patrick Cantini19, Amelia W. Smith1, William R. Wagner19,20\* 1 Center for the Advancement of Science in Space, Melbourne, FL, USA 2 Board of Governors Regenerative Medicine Institute, Cedars‐Sinai Medical Center, Los Angeles, CA, USA 3 Smidt Heart Institute, Cedars‐Sinai Medical Center, Los Angeles, CA, USA 4 Axiom Space, Inc., Houston, TX, USA 5 Johnson & Johnson 3D Printing Innovation & Customer Solutions, Johnson & Johnson Services, Inc., Irvine, CA , USA. 6 University of Pittsburgh Drug Discovery Institute and Department of Computational and Systems Biology, University of Pittsburgh, Pittsburgh, PA, USA 7 LambdaVision Inc., Farmington, CT, USA 8 California Institute for Regenerative Medicine, Oakland, California, USA 9 Department of Pharmacodynamics, College of Pharmacy, University of Florida, Gainesville, FL USA 10 Departments of Biological Engineering, Mechanical Engineering and Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, USA 11 Department of Pathology and Human Anatomy, Loma Linda University School of Medicine, Loma Linda, CA, USA 12 Department of Biomedical Engineering, Johns Hopkins University School of Medicine, Baltimore, MD, USA 13 Department of Medicine, Johns Hopkins University School of Medicine, Baltimore, MD, USA 14 Scripps Research Institute, San Diego, CA, USA 15 Center for Computational Health IBM Research, Yorktown Heights, NY, USA 16 Joseph M. Katz Graduate School of Business, University of Pittsburgh, Pittsburgh, PA, USA 17 Pittsburgh, PA, USA 18 The Ohio State University, Columbus, OH, USA 19 McGowan Institute for Regenerative Medicine, Pittsburgh, PA, USA 20 Departments of Surgery, Bioengineering, Chemical Engineering, University of Pittsburgh, Pittsburgh, PA, USA. “Opportunities for Biomanufacturing in Low Earth Orbit: Current Status and Future Directions.” August 2, 2021. https://www.preprints.org/manuscript/202108.0044/v1/download]

The use of LEO by governments and commercial enterprises is a complex ecosystem for providing opportunities and financing. In the last two decades, governments around the world, led by the U.S. and China, have heavily supported private space companies (2019 Report). These investments have focused on launch technologies, as high launch costs are perceived to be the greatest limiting factor to expanded space exploration and utilization (Werzt et al., 1996) and have led to recent reductions in the cost of transporting cargo to LEO by a factor of more than 20. Between 1970 and 2020, the average cost to launch a kilogram of payload into LEO on the space shuttle remained constant at about $54,500. Now, the cost per kilogram is $2,720 on a SpaceX Falcon 9 rocket (Figure 1) (Jones, H. W. et al., 2020). Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 August 2021 doi:10.20944/preprints202108.0044.v1 4 Figure 1: The cost of launching payloads to LEO has dropped considerably over the last 50 years. Note: Data is not to scale. Additionally, several private companies are now pursuing commercial space stations. Axiom Space, headquartered in Houston, is currently developing what promises to be the first‐ever privately operated space station, with the initial module scheduled to launch to the ISS in 2024. Axiom plans to dock multiple modules to the ISS that will eventually detach to become a standalone station. As the cost of transport to LEO has decreased—and is expected to decrease further—and plans for new platforms in LEO continue to advance (Dinkin S., 2019), opportunities in areas such as satellite deployment, **biomedical research**, in‐space manufacturing, and space tourism increase. Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 2 August 2021 doi:10.20944/preprints202108.0044.v1 5 As the past half century has witnessed the opening of space for exploration and commercial opportunities, in this same period, we have experienced exponential growth in our understanding of biology and physiology. This knowledge has been translated and commercialized for the benefit of human health and continues to accelerate as new technologies create additional tools to explore and cure. One aspect of this biomedical revolution is in the field of **regenerative medicine**, built upon advances in **stem cell biology**, **biomaterials**, and **bioengineering**. Remarkable advancements have been made in the design of MPS, also called tissue chips or organs‐on‐chips, and organoids that can mimic complex organ systems outside of the body for drug development or potential implantation to restore function. Stem cell isolation, characterization, and manipulation is advancing, with target applications broadly spread across tissues impacted by disease, trauma, and congenital conditions. Biomaterials and bioengineering advances have created new medical devices, targeted drug delivery platforms, biosensors and new imaging modalities, and the bioprinting of tissue constructs. To take advantage of these significant advances—more frequent and more affordable access to LEO and exponential progress in biomedical technology—the question is: How do these intersect, and what new opportunities arise as both advance? How can the unique LEO environment be leveraged to further advance biomanufacturing? Compelling answers to these questions will introduce economic drivers for investment in space‐based R&D that extend beyond the initial focus on pure discovery and into the expansion of commercial development in LEO. Over the past decade, the ISS National Lab has supported important space‐based research in the areas of tissue engineering and regenerative medicine that lays the groundwork for more complex studies and future investment. This critical research addressed fundamental questions such as: How does the LEO environment affect the organ function mimicked by tissue chips, and how do these changes relate to human disease? How does microgravity affect stem cell proliferation and differentiation? And how might 3D bioprinting benefit from the absence of gravity? Continued access to LEO through the ISS National Lab provides a unique opportunity for R&D that enables the jump from this initial work to the development of a sustainable market for biomanufacturing in space. The ISS is a powerful platform with a limited lifetime and thus limited time left for utilization; therefore, now is the time to leverage this invaluable orbiting laboratory to conduct R&D that demonstrates the value of biomanufacturing in space. This work will set the stage for increased private investment and the transition to larger and more numerous platforms in LEO that can support further discovery and development in the coming decades

**Co-op**

**Ukraine is a *massive* alt cause that the plan can’t overcome**

**Fisher 1-28-22**

[Kristin Fisher](https://www.cnn.com/profiles/kristin-fisher) (Space and Defense Correspondent); “Tensions with Russia worry former US astronauts about the partnership in space”; *Daily Mail*; January 28, 2022; <https://www.cnn.com/2022/01/28/business/us-russia-ukraine-iss-space-scn/index.html>; // HW-EMJ

(CNN Business) The International Space Station has transcended terrestrial political troubles between the United States and Russia for more than two decades. But some former NASA astronauts who spent months floating alongside Russian cosmonauts are worried the current crisis in Ukraine could end the US-Russian partnership in space. The ISS, which is a collaboration between the US, Russia, Japan, Canada, and the European Space Agency, has so far remained insulated from the geopolitical battle brewing on Ukraine's border, though the head of Russian space agency Roscosmos, Dmitry Rogozin, recently alluded to "cold winds that are now blowing from Washington and Brussels," according to Russian state-owned media TASS. "It scares me that if this becomes a shooting war, I think it would be hard for the ISS to survive," former NASA astronaut Garrett Reisman told CNN. NASA Administrator Bill Nelson is confident that the International Space Station will remain insulated from global politics, especially after the Biden administration announced in December that it is committed to extending its operations through 2030. Russia, however, still has not committed to the Biden administration's six-year extension of the International Space Station. "The talks with NASA on extending the operation of the ISS until 2030 are underway," Rogozin told TASS in January. "There may be political problems," Nelson said in an interview with CNN. "But when it comes to our civilian space program and our cooperation, there has never been a problem and I expect that to continue." When Russia occupied and subsequently annexed Crimea (a move unrecognized by the United States) in 2014, NASA Astronauts Rick Mastracchio and Steve Swanson were on board the International Space Station. They say no one in Houston's Mission Control ever even mentioned the ongoing tensions. "Nobody talked about it. It was completely like it's not happening," Swanson told CNN. "We were just going about our normal business and not worrying about it." But Mastracchio says they did discuss the political turmoil taking place roughly 250 miles below with their cosmonaut crewmates. "There was no finger pointing or accusations or who's right or who's wrong. It was just talking through the different points of view," he said. But even if it were to come to a space station split, breaking up in space is easier said than done. Astronauts and cosmonauts depend on each other and their equipment while living and working in the dangerous vacuum of outer space. "The Russian segment can't function without the electricity on the American side, and the American side can't function without the propulsion systems that are on the Russian side," Reisman said. "So you can't do an amicable divorce. You can't do a conscious uncoupling." The complex interdependency even extends to the station's water supply. "We actually recycle the cosmonauts' urine to get more water for our side to drink," Swanson said. "Now that's transcending politics. It's survival." "That was always troublesome, to go ask somebody if you could borrow a tank of their urine," Mastracchio said. It's a type of bond that's difficult to duplicate on Earth, and it's part of the reason the NASA administrator describes the station as a "beacon of peaceful international scientific collaboration." "Whenever we've had political trouble with the government of Russia in the past, the astronauts and the cosmonauts do not miss a beat," Nelson said. But **Russian politicians have threatened to use the station as a bargaining chip during previous geopolitical crises**. When the United States imposed sanctions on Russia after the 2014 annexation of Crimea, it was entirely reliant on Russian Soyuz rockets to launch NASA astronauts to the space station and return them safely home. "After analyzing the sanctions against our space industry, **I suggest the US delivers its astronauts to the ISS with a trampoline**," Rogozin, then Russia's Deputy Prime Minister of Defense, said in a tweet at the time. Mastracchio, who was on board the station when Rogozin made those remarks, says he was "not concerned personally," but that his family was worried "he was going to get stranded in space, because the Russians are not going to bring him home."

**Weir 21 card is not uq for them -- just confirms that cooperation is impossible – does not mention space**

**China and Russia are making their own exclusive space tea-party and keeping the US out — the ILRS is already set in stone**

**Druker 1-22-22**

[Simon Druker](https://www.linkedin.com/in/simon-druker/?originalSubdomain=ca) (broadcast journalist at CKWX News in Vancouver); “China, Russia to start building lunar research station by 2026”; *United Press International*; January 28, 2022; <https://www.upi.com/Science_News/2022/01/28/world-china-russia-build-joint-lunar-research-base/6501643387198/>; // HW-EMJ

Jan. 28 (UPI) -- China said Friday that it expects to sign a space agreement with Russia by the end of this year that will include construction of a joint lunar research facility. "We are **intensively engaged in negotiations** and have basically reached a **consensus**. The agreement is quite possible to be signed **as soon as possible** this year," China National Space Administration Vice Administrator Wu Yanhua told a Friday news conference, the Eurasian Times said. The countries aim to begin construction of the International Lunar Research Station by 2026 and have basic infrastructure finished by 2035. It will be capable of conducting multidisciplinary research activities. The construction area will be chosen before 2025. This comes on the same day the China National Space Administration released a white paper outlining the immediate future of the country's space program, as well as its recent accomplishments. "The space industry is a critical element of the overall national strategy, and China upholds the principle of exploration and utilization of outer space for peaceful purposes," the paper states. A future base also could include a reserve spacecraft capable of taking off from the moon's surface, Russia's Sputnik News Agency reported Tuesday. It also reported member states of the European Space Agency have been invited to participate in the facility's development. The agency said it has not yet reached a decision. In September, **China and Russia jointly hosted a closed-door workshop on the lunar station**. Experts from France, Italy, the Netherlands, Germany, Malaysia, Thailand also were invited.

**Debris**

states/squo – russia hit their own satellite and caused a bunch of debris

**Non-state actors in space are conflict dampeners – they avoid geopolitical tension and have financial incentives to keep conflict low**

**Frankowski 17** (Pawel, Assistant Professor at the Faculty of National Security. His current research interests include space policy, labour standards in free trade agreements, and theories of international relations, Jagiellonian University in Kakow, “OUTER SPACE AND PRIVATE COMPANIES CONSEQUENCES FOR GLOBAL SECURITY”, <https://doi.org/10.12797/Politeja.14.2017.50.06>)

In the terms of privatization and space security, space remains relatively untapped, but commercial and military benefits from space exploration/exploitation could even lead to ‘privatization of space’. Such privatization will result from growing pressure on spacefaring countries to defect from cooperation, since is less viable with good number of multiple actors who entered the space.36 However, space policy and space research are characterized by very high costs, which are rather impossible to bear by private companies, limited by economic calculation. As pointed out earlier, under-investment in technological development by private companies it is related to the fact that these actors are not focused on profits of a social nature, such as improving the quality of life of the recipient of the product.37 This makes some technology, potentially beneficial to society, not developed or introduced into use, because the profit margin is too small to make this viable for commercial players. To conclude, privatization of space security can develop in unexpected ways, but in today’s space environment private actors would rather play the role of security regulators than security providers. When investment in space technologies is less profitable than other areas of economy, private actors would focus on soft law and conflict prevention in space, and new private initiatives will appear. For example, apart from important space companies, as SpaceX or Blue Origin active in outer space, other private actors as Secure World Foundation (SWF), who focus on space sustainability, will play more important role in crafting international guidelines for space activities.38 This path the way for future solutions and projects, **as cleaning the space debris, extracting resources from asteroids and planetoids, refuelling satellites, providing payload capabilities for governmental entities on market-based logic**, will be based on activity non-state actors, providing soft law and regulatory solutions, where space faring states are unable to find any compromise. Therefore private companies will be in fact global (or space) regulators, as part of UNCOPUS, being involved in space activities.39 The last argument for private involvement in space security comes from an approach based on common good and resilience of space assets, emphasized by the Project Ploughshares, as an important part of space security. As of 2017 there are more than 700,000 man-made objects on the Earth’s orbit bigger than 1 cm, while 17,000 of them are bigger than 10 cm.40 Some of them are traced by SSA systems, both American and European, but these systems are public-military owned, and private operators are not granted any access to this data. Any collision of space object with space debris, even with small particles, might result in a chain reaction, called Kessler’s syndrome, and not only private but public, and military assets will be destroyed or impaired. In such conditions, a reluctant cooperation between the public and private sector, and unwillingness to share vulnerable data by public actors seem to confirm that private space activity is more than necessary. This is an apparent case when logic of mistrust between state powers must be overcome by private actors, perhaps by suggesting common preferences for debris mitigation, and space situational awareness. In the case of space debris, Space Data Association, an initiative supported by private sector, with its main aim to enhance data sharing between commercial satellite operators, could be an example of nascent public good provided by private actors for the sake of global security.

**Doesn't escalate – vulnerability leads to restraint.**

**Pavur 19** [James, DPhil Researcher at the Cybersecurity Centre for Doctoral Training at Oxford University, and Ivan Martinovic, Professor of Computer Science in the Department of Computer Science at Oxford University, “The Cyber-ASAT: On the Impact of Cyber Weapons in Outer Space”, 2019 11th International Conference on Cyber Conflict: Silent Battle, <https://ccdcoe.org/uploads/2019/06/Art_12_The-Cyber-ASAT.pdf>]

A. Limited Accessibility Space is difficult. Over 60 years have passed since the first Sputnik launch and only nine countries (ten including the EU) have orbital launch capabilities. Moreover, a launch programme alone does not guarantee the **resources** and **precision required** to **operate a meaningful ASAT capability**. Given this, one possible reason why **space wars have not broken out** is simply because only the US has ever had the ability to fight one [21, p. 402], [22, pp. 419–420]. Although launch technology may become cheaper and easier, it is unclear to what extent these advances will be distributed among presently non-spacefaring nations. **Limited access to orbit** necessarily reduces the scenarios which could plausibly escalate to ASAT usage. Only major conflicts between the handful of states with ‘space club’ membership could be considered possible flashpoints. Even then, the **fragility of an attacker’s own space assets** creates **de-escalatory pressures** due to the **deterrent effect of retaliation**. Since the earliest days of the space race, dominant powers have recognized this dynamic and demonstrated an inclination **towards de-escalatory space strategies** [23]. B. Attributable Norms There also exists a **long-standing normative framework** favouring the **peaceful use of space**. The effectiveness of this regime, centred around the Outer Space Treaty (**OST**), is highly contentious and many have pointed out its serious legal and political shortcomings [24]–[26]. Nevertheless, this status quo framework has somehow supported over **six decades of relative peace** in orbit. Over these six decades, **norms have become deeply ingrained** into the way states describe and perceive space weaponization. This de facto codification was dramatically demonstrated in 2005 when the US found itself on the short end of a 160-1 UN vote after opposing a non-binding resolution on space weaponization. Although states have occasionally pushed the boundaries of these norms, this has typically occurred through incremental legal re-interpretation rather than outright opposition [27]. Even the most notable incidents, such as the 2007-2008 US and Chinese ASAT demonstrations, were couched in rhetoric from both the norm violators and defenders, depicting space as a peaceful global commons [27, p. 56]. Altogether, this suggests that **states perceive real costs** to breaking this normative tradition and may even **moderate their behaviours** accordingly. One further factor supporting this norms regime is the **high degree of attributability** surrounding ASAT weapons. For kinetic ASAT technology, **plausible deniability** and **stealth** are essentially **impossible**. The literally explosive act of launching a rocket cannot evade detection and, if used offensively, retaliation. This imposes **high diplomatic costs** on ASAT usage and testing, particularly during peacetime. C. Environmental Interdependence A third stabilizing force relates to the **orbital debris consequences** of ASATs. China’s 2007 ASAT demonstration was the largest debris-generating event in history, as the targeted satellite dissipated into thousands of dangerous debris particles [28, p. 4]. Since debris particles are indiscriminate and unpredictable, they often threaten the attacker’s own space assets [22, p. 420]. This is compounded by Kessler syndrome, a phenomenon whereby orbital debris ‘breeds’ as large pieces of debris collide and disintegrate. As space debris remains in orbit for hundreds of years, the **cascade effect** of an ASAT attack can constrain the attacker’s long-term use of space [29, pp. 295– 296]. Any state with kinetic ASAT capabilities will likely also operate satellites of its own, and they are necessarily exposed to this collateral damage threat. Space debris thus acts as a strong strategic deterrent to ASAT usage.

**Kessler syndrome is media hype – no risk**

**Von Fange 17**

Daniel von Fange (systems engineer. Fond of charts), 5-21-2017, "Kessler Syndrome is Over Hyped," braino, http://braino.org/essays/kessler\_syndrome\_is\_over\_hyped/, // HW AW

Kessler Syndrome is overhyped. A chorus of online commenters greet any news of upcoming low earth orbit satellites with worry that humanity will to lose access to space. I now think they are wrong. What is Kessler Syndrome? Here’s the popular view on Kessler Syndrome. Every once in a while, a piece of junk in space hits a satellite. This single impact destroys the satellite, and breaks off several thousand additional pieces. These new pieces now fly around space looking for other satellites to hit, and so exponentially multiply themselves over time, like a nuclear reaction, until a sphere of man-made debris surrounds the earth, and humanity no longer has access to space nor the benefits of satellites. It is a dark picture. Is Kessler Syndrome likely to happen? I had to stop everything and spend an afternoon doing back-of-the-napkin math to know how big the threat is. To estimate, we need to know where the stuff in space is, how much mass is there, and how long it would take to deorbit. The orbital area around earth can be broken down into four regions. Low LEO - Up to about 400km. Things that orbit here burn up in the earth’s atmosphere quickly - between a few months to two years. The space station operates at the high end of this range. It loses about a kilometer of altitude a month and if not pushed higher every few months, would soon burn up. For all practical purposes, Low LEO doesn’t matter for Kessler Syndrome. If Low LEO was ever full of space junk, we’d just wait a year and a half, and the problem would be over. High LEO - 400km to 2000km. This where most heavy satellites and most space junk orbits. The air is thin enough here that satellites only go down slowly, and they have a much farther distance to fall. It can take 50 years for stuff here to get down. This is where Kessler Syndrome could be an issue. Mid Orbit - GPS satellites and other navigation satellites travel here in lonely, long lives. The volume of space is so huge, and the number of satellites so few, that we don’t need to worry about Kessler here. GEO - If you put a satellite far enough out from earth, the speed that the satellite travels around the earth will match the speed of the surface of the earth rotating under it. From the ground, the satellite will appear to hang motionless. Usually the geostationary orbit is used by big weather satellites and big TV broadcasting satellites. (This apparent motionlessness is why satellite TV dishes can be mounted pointing in a fixed direction. You can find approximate south just by looking around at the dishes in your northern hemisphere neighborhood.) For Kessler purposes, GEO orbit is roughly a ring 384,400 km around. However, all the satellites here are moving the same direction at the same speed - debris doesn’t get free velocity from the speed of the satellites

. Also, it’s quite expensive to get a satellite here, and so there aren’t many, only about one satellite per 1000km of the ring. Kessler is not a problem here. How bad could Kessler Syndrome in High LEO be? Let’s imagine a worst case scenario. **An evil alien intelligence chops up everything in High LEO, turning it into 1cm cubes of death orbiting at 1000km, spread as evenly across the surface of this sphere as orbital mechanics would allow. Is humanity cut off from space? I’m guessing the world has launched about 10,000 tons of satellites total.** For guessing purposes, I’ll assume 2,500 tons of satellites and junk currently in High LEO. If satellites are made of aluminum, with a density of 2.70 g/cm3, then that’s 839,985,870 1cm cubes. A sphere for an orbit of 1,000km has a surface area of 682,752,000 square KM. So there would be one cube of junk per .81 square KM. If a rocket traveled through that, **its odds of hitting that cube are tiny - less than 1 in 10,000**. **So even in the worst case, we don’t lose access to space.** Now though you can travel through the debris, you couldn’t keep a satellite alive for long in this orbit of death. Kessler Syndrome at its worst just prevents us from putting satellites in certain orbits. In real life, there’s a lot of factors that make Kessler syndrome even less of a problem than our worst case though experiment. Debris would be spread over a volume of space, not a single orbital surface, making collisions orders of magnitudes less likely. Most impact debris will have a slower orbital velocity than either of its original pieces - this makes it deorbit much sooner. Any collision will create large and small objects. **Small objects are much more affected by atmospheric drag and deorbit faster**, even in a few months from high LEO. Larger objects can be tracked by earth based radar and avoided. The planned big new constellations are not in High LEO, but in Low LEO for faster communications with the earth. They aren’t an issue for Kessler. Most importantly, all new satellite launches since the 1990’s are required to include a plan to get rid of the satellite at the end of its useful life (usually by deorbiting) So the realistic worst case is that insurance premiums on satellites go up a bit. Given the current trend toward much smaller, cheaper micro satellites, this wouldn’t even have a huge effect. **I’m removing Kessler Syndrome from my list of things to worry about.**