# 1NC

## Offs

### 1 – Vagueness

#### Interp - If the Affirmative specifies “Appropriation that produces Debris” – they must clearly de-lineate a clear parameter and definition for what “produces Debris” constitutes.

#### Violation – they don’t. They will outline particular examples BUT that doesn’t meet since they haven’t produced a metric or brightline for determining what type of appropriation is banned by the Plan.

#### Three Implications:

#### 1] The term “debris” itself is meaningless in international agreements – impossible to come to consensus – independently means you Vote Negative on Presumption since the Plan does nothing since everyone will deny they produce “Debris”.

Munters 16 Ward Munters 2016 "Space debris conundrum for international law makers" <https://room.eu.com/article/space-debris-conundrum-for-international-law-makers> (Leuven Centre for Global Governance Studies, Belgium)//Elmer

A fundamental and abstract legal matter in this regard, that appears almost too simple and too basic to present an obstacle, is the question: what is space debris? Technical definitions used by scientists and engineers, as well as in the technical and non-binding Space Debris Mitigation Guidelines [3] of the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) focus unvaryingly on the non-functional nature of debris: space debris are all man-made objects, including fragments or elements thereof, in Earth orbit or re-entering into Earth’s atmosphere that are non-functional. However, this definition, intuitive as it may be, cannot easily be construed into an international legal definition. The existing space law treaties simply do not mention ‘space debris’ anywhere. The closest related, applicable and rather vague term in the treaties is that of ‘space object’. The treaties apply this term to any object launched into space to determine important legal consequences such as which State has sole jurisdiction and control over the object, which State can register the object or which States are liable for damage caused by the object in space or on Earth. Nevertheless, the treaties do not define what exactly is a ‘space object’ and, more importantly, they do not consider the functional or non-functional nature of the space object in applying these important legal consequences to it. Therefore, international space law does not contain any provisions that could form the basis for a legal distinction between valuable spacecraft and supposedly worthless space debris. Faced with this legal uncertainty, the majority of legal experts appear to agree that even if a satellite were to become non-functional or to catastrophically break up into separate fragments, these will still constitute a ‘space object’ for the purposes of the treaties and carry with them all legal ramifications thereof. The Outer Space Treaty declares that any State that has registered a space object shall retain legal and de facto jurisdiction and control over that object. As a piece of space debris is considered a ‘space object’ for legal purposes, even if the State were to lose de facto control over the space object when it becomes non-functional or uncontrollable, it retains sole legal jurisdiction and control as per the treaty. Therefore, it is uncertain whether space objects, their component parts or fragments thereof can legally be abandoned or considered abandoned, irrespective of their non-functional status. This notion is reinforced by the fact that space faring States have hitherto not expressed a right to abandon their non-functional satellites in space. This sheds severe doubt on the possibility of introducing a legal regime of ‘salvage’, similar to maritime law, whereby actors other than the State of registry could freely remove pieces of debris that pose a threat in Earth orbit.

#### 2] Neg Ground – without anything de-lineated in the 1AC – it can become as limiting or under-limiting as they deem strategic given the 1NC which makes Negative prep impossible since they will always shift the ground of “what produces debris”. Fairness is a voter since its necessary for Debate to continue to occur.

#### 3] At worst – auto-grant us competition for Links since they haven’t grounded a definition of the Plan which means any No Link is arbitrary – best remedy for vague and un-predictable Plan Texts.

#### CX checks is arbitrary and unlimiting – allows them to change from round-to-round which ruins pre-round prep since we can’t predict it.

#### [Competing Interps] – Reasonability is arbitrary and causes a race to the bottom of questionable argumentation.

#### [No RVI’s] – 1] Forces the 1NC to go all-in on Theory which kills substance education, 2] Encourages Baiting since the 1AC will purposely be abusive, and 3] Illogical – you shouldn’t win for not being abusive.

### 2 – Ev ethics

#### Interpretation: Debaters must not omit parts of evidence.

#### Violation: They omitted two paragraphs – ss in the doc

Boley and Byers 21. Aaron Boley is at the Department of Physics and Astronomy, The University of British Columbia, Vancouver, Canada and Michael Byers is at the Department of Physics and Astronomy, The University of British Columbia, Vancouver, Canada. 5/20/21. [Nature, “Satellite mega-constellations create risks in Low Earth Orbit, the atmosphere and on Earth,” <https://www.nature.com/articles/s41598-021-89909-7>] Justin

Companies are placing satellites into orbit at an unprecedented frequency to build ‘mega-constellations’ of communications satellites in Low Earth Orbit (LEO). In two years, the number of active and defunct satellites in LEO has increased by over 50%, to about 5000 (as of 30 March 2021). SpaceX alone is on track to add 11,000 more as it builds its Starlink mega-constellation and has already fled for permission for another 30,000 satellites with the Federal Communications Commission (FCC)1 . Others have similar plans, including OneWeb, Amazon, Telesat, and GW, which is a Chinese state-owned company2 . Te current governance system for LEO, while slowly changing, is ill-equipped to handle large satellite systems. Here, we outline how applying the consumer electronic model to satellites could lead to multiple tragedies of the commons. Some of these are well known, such as impediments to astronomy and an increased risk of space debris, while others have received insufcient attention, including changes to the chemistry of Earth’s upper atmosphere and increased dangers on Earth’s surface from re-entered debris. Te heavy use of certain orbital regions might also result in a de facto exclusion of other actors from them, violating the 1967 Outer Space Treaty. All of these challenges could be addressed in a coordinated manner through multilateral law-making, whether in the United Nations, the Inter-Agency Debris Committee (IADC), or an ad hoc process, rather than in an uncoordinated manner through diferent national laws. Regardless of the law-making forum, mega-constellations require a shif in perspectives and policies: from looking at single satellites, to evaluating systems of thousands of satellites, and doing so within an understanding of the limitations of Earth’s environment, including its orbits.

Tousands of satellites and 1500 rocket bodies provide considerable mass in LEO, which can break into debris upon collisions, explosions, or degradation in the harsh space environment. Fragmentations increase the cross-section of orbiting material, and with it, the collision probability per time. Eventually, collisions could dominate on-orbit evolution, a situation called the Kessler Syndrome3 . Tere are already over 12,000 trackable debris pieces in LEO, with these being typically 10 cm in diameter or larger. Including sizes down to 1 cm, there are about a million inferred debris pieces, all of which threaten satellites, spacecraf and astronauts due to their orbits crisscrossing at high relative speeds. Simulations of the long-term evolution of debris suggest that LEO is already in the protracted initial stages of the Kessler Syndrome, but that this could be managed through active debris removal4 . Te addition of satellite mega-constellations and the general proliferation of low-cost satellites in LEO stresses the environment further5–8 .

[Omitted Figures 1 and 2]

Results

The overall setting. Te rapid development of the space environment through mega-constellations, predominately by the ongoing construction of Starlink, is shown by the cumulative payload distribution function (Fig. 1). From an environmental perspective, the slope change in the distribution function defnes NewSpace, an era of dominance by commercial actors. Before 2015, changes in the total on-orbit objects came principally from fragmentations, with efects of the 2007 Chinese anti-satellite test and the 2009 Kosmos-2251/Iridium-33 collisions being evident on the graph.

Although the volume of space is large, individual satellites and satellite systems have specifc functions, with associated altitudes and inclinations (Fig. 2). Tis increases congestion and requires active management for station keeping and collision avoidance9 , with automatic collision-avoidance technology still under development. Improved space situational awareness is required, with data from operators as well as ground- and space-based sensors being widely and freely shared10. Improved communications between satellite operators are also necessary: in 2019, the European Space Agency moved an Earth observation satellite to avoid colliding with a Starlink satellite, afer failing to reach SpaceX by e-mail. Internationally adopted ‘right of way’ rules are needed10 to prevent games of ‘chicken’, as companies seek to preserve thruster fuel and avoid service interruptions. SpaceX and NASA recently announced11 a cooperative agreement to help reduce the risk of collisions, but this is only one operator and one agency

When completed, Starlink will include about as many satellites as there are trackable debris pieces today, while its total mass will equal all the mass currently in LEO—over 3000 tonnes. Te satellites will be placed in narrow orbital shells, creating unprecedented congestion, with 1258 already in orbit (as of 30 March 2021). OneWeb has already placed an initial 146 satellites, and Amazon, Telesat, GW and other companies, operating under diferent national regulatory regimes, are soon likely to follow.

Enhanced collision risk. Mega-constellations are composed of mass-produced satellites with few backup systems. Tis consumer electronic model allows for short upgrade cycles and rapid expansions of capabilities, but also considerable discarded equipment. SpaceX will actively de-orbit its satellites at the end of their 5–6-year operational lives. However, this process takes 6 months, so roughly 10% will be de-orbiting at any time. If other companies do likewise, thousands of de-orbiting satellites will be slowly passing through the same congested space, posing collision risks. Failures will increase these numbers, although the long-term failure rate is difcult to project. Figure 3 is similar to the righthand portion of Fig. 2 but includes the Starlink and OneWeb megaconstellations as fled (and amended) with the FCC (see “Methods”). Te large density spikes show that some shells will have satellite number densities in excess of n = 10−6 km−3 .

Deorbiting satellites will be tracked and operational satellites can manoeuvre to avoid close conjunctions. However, this depends on ongoing communication and cooperation between operators, which at present is ad hoc and voluntary. A recent letter12 to the FCC from SpaceX suggests that some companies might be less-thanfully transparent about events13 in LEO.

Despite the congestion and trafc management challenges, FCC flings by SpaceX suggest that collision avoidance manoeuvres can in fact maintain collision-free operations in orbital shells and that the probability of a collision between a non-responsive satellite and tracked debris is negligible. However, the flings do not account for untracked debris6 , including untracked debris decaying through the shells used by Starlink. Using simple estimates (see “Methods”), the probability that a single piece of untracked debris will hit any satellite in the Starlink 550 km shell is about 0.003 afer one year. Tus, if at any time there are 230 pieces of untracked debris decaying through the 550 km orbital shell, there is a 50% chance that there will be one or more collisions between satellites in the shell and the debris. As discussed further in “Methods”, such a situation is plausible. Depending on the balance between the de-orbit and the collision rates, if subsequent fragmentation events lead to similar amounts of debris within that orbital shell, a runaway cascade of collisions could occur.

Fragmentation events are not confned to their local orbits, either. Te India 2019 ASAT test was conducted at an altitude below 300 km in an efort to minimize long-lived debris. Nevertheless, debris was placed on orbits with apogees in excess of 1000 km. As of 30 March 2021, three tracked debris pieces remain in orbit14. Such long-lived debris has high eccentricities, and thus can cross multiple orbital shells twice per orbit. A major fragmentation event from a single satellite could afect all operators in LEO.

[Strake omits this]

Even if debris collisions were avoidable, meteoroids are always a threat. The cumulative meteoroid flux15 for masses m > 10–2 g is about 1.2 × 10–4 meteoroids m−2 year−1 (see “Methods”). Such masses could cause non-negligible damage to satellites16. Assuming a Starlink constellation of 12,000 satellites (i.e. the initial phase), there is about a 50% chance of 15 or more meteoroid impacts per year at m > 10–2 g. Satellites will have shielding, but events that might be rare to a single satellite could become common across the constellation.

One partial response to these congestion and collision concerns is for operators to construct mega-constellations out of a smaller number of satellites. But this does not, individually or collectively, eliminate the need for an all-of-LEO approach to evaluating the effects of the construction and maintenance of any one constellation.

[Stake card continues]

Surface impacts and atmospheric efects. Although failures do occur, frst stages of SpaceX rockets are usually landed and re-used, while second stages are usually controlled through re-entry and deposited in remote areas of ocean. Tis best practice might not be followed by others. For example, the frst stages of the Soyuz rockets employed by OneWeb are not reusable, nor are the second stage re-entries controllable. Te Long March rockets that will likely be employed by GW are similar. Uncontrolled re-entries do not always meet safety standards17, a situation that may be exacerbated by mega-constellations. Moreover, the cumulative impact of thousands of rocket stages on the ocean environment could be signifcant should those stages contain hazardous materials, such as unspent hydrazine fuels17–19. In the 1990s, Pacifc island countries opposed the Sea Launch project because of environmental concerns, including from discarded rocket stages20. In 2016, Inuit in the Canadian Arctic protested the Russian practice of disposing rocket stages in the North Water Polynya, a biologically rich area of year-round open water21.

Te frst Starlink satellites contained some components that survive re-entry, with the highest human casualty risk for a single satellite calculated to be 1:17,40022, below NASA’s recommended 1:10,000 threshold. However, the initial approval process did not account for the cumulative casualty risk, and if all the then-planned 12,000 satellites had contained the same components, a continuous 5-year replacement cycle would have seen a 45% probability of one or more casualties per cycle. When the subsequent FCC petition process identifed the problem, SpaceX reportedly replaced some materials with a view to having all of the satellite components now demise in the atmosphere23. Other companies, based in other countries, might not follow this best practice or be required to do so.

Te demise of satellite components during re-entry introduces a diferent problem, since none of that material actually disappears. Starlink satellites have a dry mass of about 260 kg; 12,000 satellites will total 3100 tonnes. A 5-year cycle would see on average almost 2 tonnes re-entering Earth’s atmosphere daily. While small compared to the 54 daily tonnes of meteoroid mass24, the satellites are mostly aluminum; most meteoroids, in contrast, contain less than 1% Al by mass25. Tus, depending on the atmospheric residence time of material from reentered satellites, each mega-constellation will produce fne particulates that could greatly exceed natural forms of high-altitude atmospheric aluminum deposition, particularly if the full numbers of envisaged satellites are launched. Anthropogenic deposition of aluminum in the atmosphere has long been proposed in the context of geoengineering as a way to alter Earth’s albedo26. Tese proposals have been scientifcally controversial and controlled experiments encountered substantial opposition27. Mega-constellations will begin this process as an uncontrolled experiment28.

Rocket launches themselves afect the atmosphere. While cumulative CO2 emissions are small compared to other sources, CO2 is not the relevant metric. Black carbon produced by kerosene-fueled rockets such as SpaceX’s Falcon 9 and alumina particles produced by solid-fueled rockets lead to instantaneous radiative forcing. Modelling of the cumulative efect of emissions from 1000 annual launches of hydrocarbon-fuelled rockets found that, afer one decade, the black carbon would result in radiative forcing comparable to that resulting from sub-sonic aviation29. Although 1000 launches annually is 10 times the current rate, the construction and renewal of multiple mega-constellations will require dramatic increases in launches. Current launches likely cause non-negligible radiative forcing already30.

**Text, letter

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#### Voter for fairness and academic honesty – justifies debaters infinitely changing or modifying evidence to fit the affirmative in a way that’s hard to check means u should err neg even if it doesn’t change the meaning bc it shoudnt be on us to verify and real world ows bc ud get expelled for plagiarism or misciting irl

#### Cx voters from other shell

### 3 – Space Elevators PIC

#### Text – Private Appropriation of Outer Space except for painted Space Elevators is Unjust. Private entities ought to invest and develop Space Elevators. We will defend an Orbital Use Fee per the 1AC’s Normal Means Mechanism.

#### It Competes – that’s cx they n amed space elvators we. Get new 2nr anseres

#### Private Companies are pursuing Space Elevators.

Alfano 15 Andrea Alfano 8-18-2015 “All Of These Companies Are Working On A Space Elevator” <https://www.techtimes.com/articles/77612/20150818/companies-working-space-elevator.htm> (Writer at the Tech Times)//Elmer

Space elevators are solid proof that any mundane object sounds way cooler if you stick the word "space" in front of it. But there's much more than coolness at stake when building a space elevator – this technology has the potential to revolutionize space transportation, and the Canadian private space company Thoth Technology that was recently awarded a patent for its space elevator design isn't the only company in the game. One of the other major players is a U.S.-based company called LiftPort Group, founded by space entrepreneur Michael Laine in 2003. Its plan for a space elevator is vastly different from the one for which Thoth received a patent, however. Whereas Thoth's plans entail tethering a 12-mile-high inflatable space elevator to the Earth, LiftPort is shooting for the moon. Originally, LiftPort had planned to build an Earth elevator, too, but it abandoned the idea in 2007 in favor of building a lunar elevator. The basic design for a lunar elevator is an anchor in the moon that is attached to a cable that extends to a space station situated at a very special point. Known as a Lagrange Point, this is the gravitational tipping point between the Earth and the moon, where their gravitational pulls essentially cancel one another out. A robot could then travel up and down the tether, ferrying cargo between the moon and the station. Out farther in space, a counterweight would balance out the system. Both types of space elevator are intended to increase space access, but in very different ways. Thoth's Earth elevator aims to make launches easier by starting off 12 miles above the Earth's surface. LiftPort's space elevator aims to increase access to the moon in particular, because it is much easier to launch a rocket to the Lagrange Point and dock it at a space station than it is to get to the moon directly. There's a third major company based in Japan called Obayashi Corp. whose plans look like a hybrid of Thoth's and LiftPort's. Obayashi is not a space company, however – it's actually a construction company. Like Thoth, Obayashi plans to build an Earth elevator. But its Earth elevator would consist of a cable tethered to the blue planet, a robotic cargo-carrier, a space station, and a counterweight. It essentially looks like LiftPort's plans, but stuck to the Earth instead of to the moon.

#### Regardless of completion, Elevators spur investment in Nanotechnology

Liam O’Brien 16. University of Wollongong. 07/2016. “Nanotechnology in Space.” Young Scientists Journal; Canterbury, no. 19, p. 22.

Nanotechnology is at the forefront of scientific development, continuing to astound and innovate. Likewise, the space industry is rapidly increasing in sophistication and competition, with companies such as SpaceX, Blue Origin and Virgin Galactic becoming increasingly prevalent in what could become a new commercial space race. The various space programs over the past 60 years have led to a multitude of beneficial impacts for everyday society. Nanotechnology, through research and development in space has the potential to do the same. Potential applications of nanotechnology in space are numerous, many of them have the potential to capture and inspire generations to come. One of these applications is the space elevator. By using carbon nanotubes, a super light yet strong material, this concept would be an actual physical structure from the surface of the Earth to an altitude of approximately 36 000 km. The tallest building in the world would fit into this elevator over 42 000 times. The counterweight, used to keep the elevator taught, is proposed to be an asteroid. This would need to be at a distance of 100 000 km, a quarter of the distance to the moon. The benefits of such a structure would be enormous. 95% of a space shuttle's weight at take-off is fuel, costing US$ 20 000 per kilogram to send something into space. However, with a space elevator the cost per kilogram can be reduced to as little as US$ 200. Exploration to other planets can begin at the tower, and travel to and from the moon could become as simple as a morning commute to work. Solar sails provide the means to travel large distances and incredible speeds. Much like sails on a boat use wind, the solar sail uses light as a source of propulsion. Ideally these sails would be kilometres in length and only a few micrometres in thickness. This provides us with the ability to travel at speeds previously unheard of. Using carbon nanotubes once again, a solar sail has the capability to travel at 39 756 km/s which is 13% of the speed of light! This sail could reach Pluto in an astonishing 1.7 days, and Alpha Centauri in just 32 years. Space travel to other planets, other stars, could be possible with solar sails. The Planetary Society is funding for a space sail of itself, and has successfully launched one into orbit. NASA has also sent a sail into orbit, allowing it to burn up in the atmosphere after 240 days. Investing time and resources into nanotechnology for space exploration has benefits for society today. Materials such as graphene are being used in modern manufacturing at an increasing rate as the applications become utilised. Carbon nanotubes will change the way we think about materials and their strength. These nanotubes have a tensile strength one hundred times that of steel, yet are only a sixth of the weight. Imagine light weight vehicles using less petrol and energy as well as being just as strong as regular vehicles. With potentials to revolutionize the way we think about space travel, nanotechnology has a bright future. As a new field of science, it has the capability to push the human race to the outer reaches of our galaxy and hopefully one day to other stars. It will inspire generations of explorers and dreamers to challenge themselves and advance the human race into the next era. As Richard Feynman said in his 1959 talk 'There's Plenty of Room at the Bottom' "A field in which little has been done, but in which an enormous amount can be done. There is still plenty more to achieve.

#### Nano tech solves warming

Bhavya Khullar. September 4, 2017. Nanomaterials Could Combat Climate Change and Reduce Pollution. https://www.scientificamerican.com/article/nanomaterials-could-combat-climate-change-and-reduce-pollution/

The list of environmental problems that the world faces may be huge, but some strategies for solving them are remarkably small. First explored for applications in microscopy and computing, nanomaterials—materials made up of units that are each thousands of times smaller than the thickness of a human hair—are emerging as useful for tackling threats to our planet’s well-being. Scientists across the globe are developing nanomaterials that can efficiently use carbon dioxide from the air, capture toxic pollutants from water and degrade solid waste into useful products. “Nanomaterials could help us mitigate pollution. They are efficient catalysts and mostly recyclable. Now, they have to become economical for commercialization and better to replace present-day technologies completely,” says [Arun Chattopadhyay](http://www.iitg.ac.in/arun/), a member of the chemistry faculty at the Center for Nanotechnology, Indian Institute of Technology Guwahati. To help slow the climate-changing rise in atmospheric CO2levels, researchers have developed nanoCO2 harvesters that can suck atmospheric carbon dioxide and deploy it for industrial purposes. “Nanomaterials can convert carbon dioxide into useful products like alcohol. The materials could be simple chemical catalysts or photochemical in nature that work in the presence of sunlight,” says Chattopadhyay, who has been working with nanomaterials to tackle environmental pollutants for more than a decade. Many research groups are working to address a problem that, if solved, could be a holy grail in combating climate change: how to pull CO2 out of the atmosphere and convert it into useful products. Chattopadhyay isn’t alone. Many research groups are working to address a problem that, if solved, could be a holy grail in combating climate change: how to pull CO2 out of the atmosphere and convert it into useful products. Nanoparticles offer a promising approach to this because they have a large surface-area-to-volume ratio for interacting with CO2 and properties that allow them to facilitate the conversion of CO2into other things. The challenge is to make them economically viable. Researchers have tried everything from metallic to carbon-based nanoparticles to reduce the cost, but so far they haven’t become efficient enough for industrial-scale application. One of the most recent points of progress in this area is work by scientists at the CSIR-Indian Institute of Petroleum and the Lille University of Science and Technology in France. The researchers developed a nanoCO2 harvester that uses water and sunlight to convert atmospheric CO2 into methanol, which can be employed as an engine fuel, a solvent, an antifreeze agent and a diluent of ethanol. Made by wrapping a layer of modified graphene oxide around spheres of copper zinc oxide and magnetite, the material looks like a miniature golf ball, captures CO2 more efficiently than conventional catalysts and can be readily reused, according to Suman Jain, senior scientist of the Indian Institute of Petroleum, Dehradun in India, who developed the nanoCO2harvester. Jain says that the nanoCO2 harvester has a large molecular surface area and captures more CO2 than a conventional catalyst with similar surface area would, which makes the conversion more efficient. But due to their small size, the nanoparticles have a tendency to clump up, making them inactive with prolonged use. Jain adds that synthesizing useful nanoparticle-based materials is also challenging because it’s hard to make the particles a consistent size. Chattopadhyay says the efficiency of such materials can be improved further, providing hope for useful application in the future. CLEANSING WATER Most toxic dyes used in textile and leather industries can be captured with nanoparticles. “Water pollutants such as dyes from human-created waste like those from tanneries could get to natural sources of water like deep tube wells or groundwater if wastewater from these industries is left untreated,” says Chattopadhyay. “This problem is rather difficult to solve.” An international group of researchers led by professor Elzbieta Megiel of the University of Warsaw in Poland reports that nanomaterials have been widely studied for removing heavy metals and dyes from wastewater. According to the research team, adsorption processes using materials containing magnetic nanoparticles are highly effective and can be easily performed because such nanoparticles have a large number of sites on their surface that can capture pollutants and don’t readily degrade in water. Chattopadhyay adds that appropriately designed magnetic nanomaterials can be used to separate pollutants such as arsenic, lead, chromium and mercury from water. However, the nanotech-based approach has to be more efficient than conventional water purification technology to make it worthwhile. In addition to removing dyes and metals, nanomaterials can also be used to clean up oil spills. Researchers led by Pulickel Ajayan at Rice University in Houston, Texas, have developed a reusable nanosponge that can remove oil from contaminated seawater.

#### Nano weapons solve every existential threat

**Miller 17,** Gina Miller, She has written articles and provided interviews on the subject of nanotechnology and created digital artwork, videos and animations to illustrate future applications. Her work has been featured in various media including the History Channel, Japanese television, international documentaries, Wired, PC Magazine, Fast Company, and various books such as “Nanofuture” by J. Storrs Hall, the inventor of the “utility fog” concept. Miller has collaborated with other nanotechnology pioneers such as Robert A. Freitas Jr., author of “Nanomedicine,” and is a frequent collaborator of the Foresight Institute co-founded by K. Eric Drexler the “founding father of nanotechnology”.. 2-26-2017, accessed on 1-28-2021, Nanotechnology Industries, "Nanotechnology, the real science of miracles, the end of disease, aging, poverty and pollution - Nanotechnology Industries", http://nanoindustries.com/nanotechnology\_science\_of\_miracles/ //Adam

The current status of disease and death is staggering. We do know that in the documented world 56 million people die every year. Dissecting the statistics of disease provided by the World Health Organization is overwhelming to weed through. There is a solution. Or there may be in the future. One day there could be a cure for all disease, and you may be able to live forever, in a healthy youthful state. One day it may be possible that scientists will be able to create nanorobots using nanotechnology. Nanotechnology is the ability to see and move atoms around. Everything is made of atoms, the chair you are sitting in, your food, your body, the air we breathe, everything. Atoms are so small they cannot be seen by the human eye. Atoms are on the nanoscale, that's a teeny, tiny size. There are 25,400,000 nanometers in an inch, a sheet of newspaper is 100,000 nanometers thick, human hair is about 80,000 nanometers in diameter. Atoms are the building blocks. Different atoms, arranged in different ways, make molecules that make the different things you see and experience. In the human body atoms come together to make many things, for example water, fats, hair, bones, and DNA. DNA and other molecules build cells; sometimes cells malfunction and cause disease. Where does nanotechnology fit in? That's a self realizing question, that's how, it fits in! Think of it this way, if you were King Kong, could you grab one grain of sand easily? Your hands would be too big. That's how medicine is currently treating disease. Nanotechnology is on the same size and scale as disease. A nanorobot can grab a cell and repair it. This will allow us to cure diseases that have never been cured before. Nanorobots could be released into the blood stream via pill or injection to find and repair damage and then break down and disintegrate. Or nanorobots could remain in the body at all times, perpetually monitoring, identifying and repairing problems immediately, without any external treatment. Nanorobots would cure the aliment so early on that you would never even know you were going to get sick. Chemotherapy releases toxic chemicals throughout the entire body rather than just the affected area, such as a tumor. This process destroys the cancer but also the immune system. Chemotherapy makes patients very sick, and there is risk of permanent damage or death from the treatment itself. There is also a risk of the cancer returning. A nanorobot could have radiation inside of it, locate the tumor, inject it and destroy it directly. Molecular nanorobots wouldn't leave one cancerous cell behind. That's one of the benefits of getting down to the molecular level. Doctors cannot see on the molecular level and could easily miss some cancer cells, which is often the case and the cancer returns. A nanotech gene therapy has successfully killed ovarian cancer in mice; if successful in human clinical trials it could save the lives of 15000 women a year. But it doesn't stop with cancer. Every disease is made out of the same atoms that everything else is. All medical conditions are a result of atoms being out of place; a nanorobot could put them back where they belong, thus immediately alleviating the problem without the side effects that current day medication and treatments cause. What else can be repaired in the human body? EVERYTHING. From cancer to the common cold. There is nothing that nanotechnology could not repair. The injuries or illnesses you have right now will have the capability to be repaired or cured by nanotechnology. Nanotechnology could eliminate diseases, disabilities, and illnesses such as diabetes, malaria, HIV, cardiovascular disease, damage from injuries and accidents, heal wounds, reduce child mortality, regenerate limbs and organs, eliminate inflammatory/infectious diseases, and so on and so forth. Nanotechnology offers hope to people suffering from Alzheimer’s, Parkinson's, brain injuries, tumors and neurological disorders. Nanoconstructs could deliver neuroprotective molecules directly to the brain to recover or protect nerve cells from damage or degeneration. Nanotechnology has been emerging in this field in the form of nanoengineered scaffolds that could one day result in a tool for rewiring the intricate neuronal network. Research by Dr. Samuel I. Stupp designed molecules using nanomaterials and injected them into mice who were paralyzed due to spinal cord injury. After 6 weeks the mice regained the ability to walk. Research like this could one day evolve into real cures for people. 65 billion dollars is wasted every year due to low bioavailability. Meaning that the drug or treatment used is not absorbed into or accessed by the body properly due to a multitude of reasons. For example drug interactions, different molecular arrangements and manufacturing processes by different brands. Drugs with more moisture may form lumps in the stomach which decreases absorption, and a highly compressed pill will slow absorption. Different level changes in the body at any given time may cause drug toxicity. Metabolism, age, activity, stress, previous surgery and syndromes are also factors. These are huge challenges that can be alleviated by using nanotechnology to target the specific areas. Nanorobots can take their cues from mother nature; she is the first nanotechnologist. She is an expert at creating molecular machines. Geneticists have been taking advantage of viruses for use in gene therapy for some time. They modify a virus by removing the viral gene so it doesn't cause disease. They replace it with healthy genes to transport to the faulty cell and cure diseases. This strategy of hacking viruses could be exploited by nanotech. Viruses are biological molecular machines that could be modified into becoming nanorobots or they could become transportation for a nanorobot. Another means is a nanorobot could attach itself to a traveling white blood cell and ride shotgun to assist in the tissue repair of injured tissue. Nanotechnology could even be involved in tissue engineering, creating scaffolds for artificial organs and implants. Tissue from your own body could be used to make new tissue, which assures that your body doesn't reject it. The surgeries of today are painful, costly, can leave scars and can even be life threatening. Repairing nanorobots would eliminate the need for surgeries, incisions, side effects and recovery time. According to the American Academy of Periodontology there are links to poor dental health and stroke, heart disease, respiratory disease, osteoporosis, some cancers and diabetes. Nanorobots as nanodentistry could repair damage without large needles or drills. Nanorobots could also constantly and invisibly maintain and clean your teeth to avoid any dental problems. Hygiene is important for good health; your skin and hair could be cleaned by nanorobots eliminating the need for showers. Spider bites and ticks carrying lyme disease would be detected by nanorobots, blocking penetration. Other skin problems such as eczema would be repaired by dermal nanorobots. Is aging a disease? Could aging be cured? Yes. Since nanorobots would be able to repair single cells on the molecular level they would be able to repair damages created by aging. It's all the same to a nanorobot. Nanotechnology could repair damaged cells. Dead cells are the primary reason for aging and death; nanorobots could replace senescent (old) cells with non-senescent cells, or reprogram cells so they do not senescensce, which would keep the body from aging. Not only would the inside of your body never get sick or age, but neither will the outside. Your skin will be young, elastic, dewy and wrinkle-free. Your hair will be thick, without gray, and intact. Your hearing, your eyesight and memory will be in perfect shape. You wouldn't get arthritis, turkey neck, or saggy parts. You could go out dancing when you are 93 and not worry about sore feet, low energy or suffering any consequences. Unless you party too hard, but that's on you, not the nano. So if you never get sick and never get old could you live forever? Yes. nanorobots could be programmed to rebuild older cells into younger copies on a regular basis thereby the human body could become immortal. You could live a disease-free youthful life, forever. Of course immortality isn't for everyone and everyone should have the right to decide what they want or don't want for their own body. Death will be a choice rather than a requirement. There are well funded countries that have access to researchers and high tech equipment that would love to figure out how to create the nanotechnology that will repair bodies and end disease. In the US despite having a lot of financial resources it's not always easy to get funding. If you are at a university, you need to write a grant, go through a lot of red tape, and there are a lot more near-term projects that seem to get prioritized when it comes to funding. For companies looking for investors, unfortunately not all investors can foresee the amazing future that nano will have because they are used to funding things they can see. For example a company that makes desks seeking an investor can show the investor the money they need for each piece of wood, bolt, and the quantity of desks that will be manufactured within a specific time frame. Nanotechnology is in development and isn't readily available like a piece of wood, the piece of wood has to be built. And the individual processes of each emerging development will have their own variables. Once the recipe has been figured out and formulated, the investment we have made will then be very inexpensive and easy to reproduce. Third world countries would have easy access to nanomedicine. Mother nature puts atoms together all the time and it doesn't cost her anything. The raw materials for making nanorobots would be essentially cost-free because they will be made mostly of carbon. Because nanotechnology would be created on the very small atomic level, traveling to provide treatment would not require large equipment. The size and portability would make treatment easily accessible across the world. The environment and living conditions also impact health. Since nanotechnology is on the atomic level and atoms are everywhere, it can be beneficial to the world all around us, as well as our bodies. Nanotechnology could enrich depleted soil in places like Africa, which is currently facing a food crisis. Vitamins, nutrients and minerals could be delivered to rebuild soil to a fertile state and thus have the ability to grow food. Hunger could one day be a solvable problem. Nanotechnology would make it possible to provide meat and animal products inexpensively without killing animals. E.coli and other pathogens could be detected in soil and eliminated so that food is not harmful. Currently nanomaterials are in development to release fertilizers for plants and nutrients for livestock, nano sensors for monitoring the health of crops and farm animals, and magnetic nanoparticles to remove soil contaminants. According to water.org 750 million people around the world lack access to safe water; approximately one in nine people. 840,000 people die each year from water-related disease. A portable non-chemical nano-filtration water purification device has been developed by Micheal Pritchard. It creates safe and sterile water out of dirty water and would make the cost of water per household an estimated 3 dollars a year. His company has provided clean water to countries who have gone through natural disasters, such as Haiti and the Philippines. In the future nanotechnology particles could destroy bacteria that often cause fatal disease. Pollution in general, global warming, nuclear waste, oil spills, smog, and acid rain, could be remedied and prevented by nanotechnological advances. Large quantities of nanorobots could come together to remove pollutant atoms from the atmosphere, earth and water. These groups of nanorobots could swim in contaminated waters and be released into the polluted atmosphere to destroy or remove contaminating molecules. Nanorobots could pull apart the bad molecules and reassemble the atoms into good molecules for other positive purposes. As a first indicator of the possibility, Brian Mercer created a new pollution control technology using nanofibres that greatly reduce industrial pollution by trapping and removing the pollutants. Currently nanotech is being used to reduce emissions from car fuels. Since nanotechnology builds atom by atom; the process is pollution free. Nanotechnology will not be manufactured in the way we use manufacturing plants today. There will be no chemical by product, no emission, hazardous waste and no pollution.

#### Counterplan solves the Case - Space Elevators net reduce Space Debris – reduces overall Rocket Launches

Forgan 19, Duncan H. Solving Fermi's Paradox. Vol. 10. Cambridge University Press, 2019. (Associate Lecturer at the Centre for Exoplanet Science at the University of St Andrews, Scotland, founding member of the UK Search for Extra-terrestrial Intelligence (SETI) research network and leads UK research efforts into the search)//Elmer

All objects in HEO reside beyond the geostationary orbit (GEO). The orbital period at GEO (w'hich is aligned with the Earth's equator) is equal to the Earth’s rotational period. As a result, from a ground observer’s perspective the satellite resides at a fixed point in the sky, with clear advantages for uses such as global communication. Activities at HEO are considerably less than at LEO and MEO. Earth's orbital environment does contain a natural component - the meteoroids. These pose little to no threat to space operations - the true threat is self-derived. The current limitations of spacefaring technology ensure that every launch is accompanied by substantial amounts of space debris. This debris ranges in size from dust grains to paint flecks to large derelict spacecraft and satellites. According to NASA’s Orbital Debris Program Office, some 21.000 objects greater than 10 cm in size are currently being tracked in LEO. with the population below 10 cm substantially higher. Most debris produced at launch tends to be deposited with no supplemental velocity - hence these objects tend to follow the initial launch trajectory, which often orbits with high eccentricity and inclination. However, these orbits do intersect with the orbits of Earth’s artificial satellite population, resulting in impacts w'hich tend to produce further debris. The vast majority of the low-size debris population is so-called fragmentation debris. This is produced during spacecraft deterioration, and in the most abun- dance during spacecraft break-up and impacts. The first satellite-satellite collision occurred in 1961. resulting in a 400% increase in fragmentation debris (Johnson et al.. 2008). Most notably, a substantial source of fragmentation debris was the deliberate destruction of the Fengyun 1C satellite by the People’s Republic of China, which created approximately 2.000 debris fragments. As with collisions of ‘natural debris’, debris-debris collisions tend to result in an increased count of debris fragments. Since the late 1970s, it has been understood that man-made debris could pose an existential risk to space operations. Kessler and Cour-Palais (1978) worked from the then-population of satellites to extrapolate the debris production rate over the next 30 years. Impact rates on spacecraft at any location. /, can be calculated if one knows the local density of debris p, the mean relative velocity vrei\* and the cross-sectional area ct: [[EQUATION 13.5 OMITTED]] Each impact increases p without substantially altering vrel or o. We should there- fore expect the impact rate (and hence the density of objects) to continue growing at an exponential rate: [[EQUATION 13.6 OMITTED]] Kessler and Cour-Palais (1978) predicted that by the year 2000, p would have increased beyond the critical value for generating a collisional cascade. As new collisions occur, these begin to increase ^jjp, which in turn increases resulting in a rapid positive feedback, with p and I reaching such large values that LEO is rendered completely unnavigable. This has not come to pass - LEO remains navigable, partially due to a slight overprediction of debris produced by individual launches. The spectre of a collisional cascade (often referred to as Kessler syndrome) still looms over human space exploration, as debris counts continue to rise. Without a corresponding dedicated effort to reduce these counts, either through mitigating strategies to reduce the production of debris during launches, or through removal of debris fragments from LEO. we cannot guarantee the protection of the current flotilla of satellites, leaving our highly satellite-dependent society at deep risk. What strategies can be deployed to remove space debris? Almost all debris removal techniques rely on using the Earth’s atmosphere as a waste disposal sys- tem. Most debris is sufficiently small that atmospheric entry would result in its complete destruction, with no appreciable polluting effects. Atmospheric entry requires the debris fragments to be decelerated so that their orbits begin to intersect with lower atmospheric altitudes. Once a critical altitude is reached, atmospheric drag is sufficiently strong that the debris undergoes runaway deceleration and ultimately destruction. There are multiple proposed techniques for decelerating debris. Some mechani- cal methods include capturing the debris using either a net or harpoon, and applying a modest level of reverse thrust. These are most effective for larger fragments, and especially intact satellites (Forshaw et al., 2015). Attaching sails to the debris is also a possibility if the orbit is sufficiently low for weak atmospheric drag. The Japanese space agency JAXA’s Kounotori Integrated Tether Experiment (KITE) will trail a long conductive cable. As a current is passed through the cable, and the cable traverses the Earth’s magnetic field, the cable experiences a magnetic drag force that will de-orbit the spacecraft. Orbiting and ground-based lasers can decelerate the debris through a variety of means. For small debris fragments, the radiation pressure produced by the laser can provide drag. A more powerful laser can act on larger debris fragments through ablation. As the laser ablates the debris, the resulting recoil generated by the escaping material produces drag and encourages de-orbit. A more lateral solution is to ensure that launches and general space-based activity no longer generate debris. These approaches advocate lower-energy launch mechanisms that do not rely on powerful combustion. The most famous is the space elevator (see Aravind. 2007). Originally conceived by Tsiolkovsky, the ele- vator consists of an extremely durable cable extended from a point near the Earth’s equator, up to an anchor point located at GEO (most conceptions of the anchor point envision an asteroid parked in GEO). ‘Climber’ cars can then be attached to the cable and lifted to LEO, MEO and even GEO by a variety of propulsion methods. Most notably, the cars can be driven to GEO without the need for chemical rockets or nuclear explosions - indeed, a great deal of energy can be saved by having coupled cars, one ascending and one descending. Space elevators would solve a great number of problems relating to entering (and leaving) Earth orbit, substantially reducing the cost of delivering payload out of the Earth's atmosphere. The technical challenges involved in deploying a cable tens of thousands of kilometres long are enormous, not to mention the material science required to produce a cable of sufficient tensile strength and flexibility in the first place. The gravitational force (and centrifugal force) felt by the cable will vary significantly along its length. As cars climb the cable, the Coriolis force will move the car (and cable) horizontally also, providing further strain on the cable material. The relatively slow traversal of the biologically hazardous Van Allen Belt on the route to GEO is also a potential concern for crewed space travel. Whatever the means, a spacefaring civilisation (or at least, a civilisation that utilises its local orbital environment as we do) must develop a non-polluting solution to space travel, whether that is via the construction of a space elevator, a maglev launch loop, rail gun, or some other form of non-rocket acceleration. If it cannot perform pollution-free spacecraft launches (or fully clean up its pollution), then it will eventually succumb to Kessler syndrome, with potentially drastic consequences for future space use, with likely civilisation-ending effects (Solution C.13).

### 4 – Orbital Use Fee PIC

#### CP Text – We affirm that the appropriation of outer space through the production of space debris by private entities is unjust but do not endorse the usage of an Orbital Use Fee. To clarify – this is a blanket ban and should be enforced by the United Nations Committee on the Peaceful Uses of Outer Space, enforced by scaling fines for each violation.

#### CP solves the Aff – an OUF isn’t an enforcement mechanism, it’s a regulatory solution which is irrelevant to the CP saying private entities are simply banned and heavily fines them if they violate.

#### The 1AC Runnels Normal Means Card about Orbital Use Fees says it would be used to fund ADR – here’s a re-cutting. Hold them to it – it was highlighted in their evidence as what an OUF would be – anything else encourages poor 1AC construction.

Runnels 22. Michael is a professor and writer for the American Bar Association. 1/13/22. [American Bar Association “On Clearing Earth’s Orbital Debris & Enforcing the Outer Space Treaty in the U.S.” <https://www.americanbar.org/groups/business_law/publications/blt/2022/01/orbital-debris/>] Justin //re-cut by Elmer \*\*OUF: Proportional fee for amount of debris put into Space

A number of technological and regulatory solutions, such as active debris removal[119] and voluntary orbital debris mitigation guidelines,[120] are currently being explored by regulatory authorities.[121] While these efforts are important in ensuring the sustainable use of LEO orbits, they do not address the underlying incentive problem for satellite operators. Namely, they are incentivized to view both their orbital debris and the costs that it imposes on others as externalities.[122] As such, without the internalization of these externalities, efforts to fully address the orbital debris problem will likely be ineffective.[123] Notably, a National Academy of Sciences study found that orbital debris removal may worsen the economic damages from congestion by increasing incentives to launch.[124] As satellite operators are prohibited from securing exclusive property rights to orbital shells under the OST,[125] and are unlikely to recover economic damages resulting from orbital debris collisions under the Liability Convention,[126] prospective operators “face a choice between launching profitable satellites, thereby imposing current and future collision risk on others, or not launching and leaving those profits to competitors.”[127] This dynamic represents a classic tragedy of the commons problem.[128] However, under Article VI of the OST,[129] this problem can be partially solved through an OUF[130] levied by the FCC. The monies received from this fee would then be used to fund private orbital debris clearing projects[131] and research related to orbital debris removal.

Though such an OUF may be seen as an unreasonable growth restraint on the nascent space industry,[132] a Pew study found that in the case of nearly a dozen industries, the costs of implementing new regulations were less than estimated while the economic benefits were greater than estimated.[133] Moreover, these regulations did not significantly impede the economic competitiveness of the industry.[134] An OUF consistent with what this article proposes would even the playing field for commercial-satellite operators in a manner consistent with OST principles[135] and, as OneWeb’s founder argued, while “thoughtful, common-sense rules” likely increase operating costs for commercial-satellite operators, they protect the environment and ensure that the U.S. commercial satellite industry continues to grow.[136] While the U.S. cannot address the issue of reducing orbital debris on its own, it can make a substantial contribution through demonstrating responsible orbital debris mitigation measures, such as those advocated in this article. In support of the aforementioned OST language,[137] this article’s second proposed amendment to Title 51 of United States Code would read: Title 51, of the United States Code, is further amended by adding at the end the following: CHAPTER 802—ADMINISTRATIVE PROVISIONS RELATED TO CERTIFICATION AND PERMITTING § 802XX. Orbital use fee purpose The Administrator, in conjunction with the heads of other Federal agencies, shall take steps to fund orbital debris removal projects, technologies, and research that will enable the Administration to decrease the risks associated with orbital debris. § 802XX. Administrative authority In order to carry out the responsibilities specified in this subtitle, the Secretary may impose an orbital use fee for the placement of objects in low Earth orbits on a nongovernmental entity holder of, or applicant for: (1) a certification under chapter 801; or (2) a permit under chapter 802. V. Conclusion The OST establishes space as the “province of all mankind”[138] and promotes its peaceful use and exploration for the “benefit and in the interests of all mankind.”[139] The OST further requires that “Parties to the Treaty … bear international responsibility for national activities in outer space … whether such activities are carried on by governmental agencies or by non-governmental entities,”[140] and requires that each “Party to the treaty … [be] internationally liable” for damages caused by an object launched into outer space.[141] Finally, the OST prohibits claims of “national appropriation” of both outer space and celestial bodies “by claim of sovereignty, by means of use or occupation, or by other means.”[142] The Space Act “facilitate[s] commercial exploration for and commercial recovery of space resources by [U.S.] citizens … ”[143] and exempts companies from regulatory oversight until 2023.[144] However, the FCC’s laissez-faire enforcement of satellite mega-constellation projects is arguably in violation of the OST[145] due to the saturation of these mega-constellations in LEO and their likely resulting orbital debris.[146]

#### Orbital use fees fail

Stilwell 20, Ruth [Dr. Ruth Stilwell is a Senior Non-Resident Scholar at the Space Policy Institute of George Washington University and Adjunct Professor at Norwich University.] Orbital use fees won’t solve the space debris problem. Jun 22, 2020, <https://www.thespacereview.com/article/3971/1> TG

State, commercial, and non-government users of space have a shared interest in creating the long-term sustainability of space operations, and global progress requires international agreement. Proposers for an orbital use tax mention that it would need to be globally harmonized but fail to recognize the difficulty in reaching such an agreement—if such an agreement is even possible. The recent collapse of the OPEC pact and the subsequent oil price war illustrates the fragility of international economic collaboration. By contrast, international agreements on standards and regulation for international operators, as we see in the maritime and aviation industries, tend to endure. It is important to recognize that diplomatic resources are limited and efforts to reach international agreement should focus on areas that can provide the most benefit and have the greatest chance for success. For the long-term sustainability of space, the answer is not to make space more expensive to use, but rather to ask the users, both civilian and military, to be responsible to the goal of sustainable use. This requires a focus in three critical areas: collision avoidance, limiting debris-generating behaviors, and debris removal. As we ask the space community to be more responsible, it is important to define what that means. As illustrated by recent anti-satellite missile tests, the community can be alarmed, but we are functionally unable to hold each other to standards of behavior if those standards do not exist. Efforts at international agreement should be focused on reaching agreement in these areas if we are to have a sustainable and accountable orbital domain. The space debris problem is complex and will not be solved by targeting one section of the industry. It is important to look at primary contributors to the problem. Leaving non-maneuverable objects in orbit creates an unresolvable collision risk as illustrated in January, when two intact satellites that had been in orbit for decades came within meters of colliding (see [“Will we hit the snooze button on an orbital debris wakeup call?”](https://www.thespacereview.com/article/3885/1), The Space Review, February 17, 2020). By contrast, days before the potential collision, a damaged DirecTV satellite at risk of exploding was maneuvered to a graveyard orbit where it did not pose a debris hazard to other operators. An orbital use tax would put an additional financial penalty on the user that is able to prevent the collision risk but do nothing to change the behavior that created the collision risk. The orbital fees not only don’t solve the problem but, by and large, they are asking the commercial sector to pay for the pollution that was created by legacy users who were largely governments.

#### ADR cause “grey zones” of military ambiguity

Seidel, 19 (Jamie Seidel, cites Todd Harrison, Centre for Strategic and International Studies Aerospace Security Project head “Space junk or sabotage? Space clean-up drones could have military implications” accessed online 8/15/19 <https://www.news.com.au/technology/science/space/space-junk-or-sabotage-space-cleanup-drones-could-have-military-implications/news-story/e2cbbb479ea620a64a43ddc0d860c30c>)

China calls them scavengers, Russia calls them inspectors and the US calls them threats. The race is on to clean up the space junk orbiting above our heads. But fears are these trash collectors are really killer “gremlins”. Touted as space-junk clean-up drones, they also have the potential to grab vital GPS, communications and surveillance satellites — and send them hurtling towards the ground. And strange things are already happening in orbit. Analysts are asking: is it space junk, or sabotage? Several critical geostationary orbit satellites have been reporting anomalies. Most recently, Intelsat 29e — which provided communication and navigation services to the Caribbean and North Atlantic — “experienced damage that caused a leak of the propellant on board the satellite”. Nobody is yet suggesting sabotage. Space junk remains the number one suspect. But as the satellite was only three-years-old, and joins five other major satellite malfunctions in the past two years, the incident has started analysts talking. Is space junk already getting out of control? Or is something more sinister at play? According to the Massachusetts Institute of Technology (MIT), attacks against satellites may have already happened. COLLISION COURSE Last year, fears Moscow was developing a secret satellite saboteur were renewed when what was initially believed to be a piece of space junk left over from a rocket launch began to behave abnormally. It was changing course and speed under its own power. And it was doing so just days after US Vice-President Mike Pence formally announced plans to create a new Space Force. Why would it do this? Why the secrecy? Was it some sort of message? Now, Beijing has declassified tantalising details of what it calls an artificial-intelligence controlled space clean-up project. The so-called scavenger program was confirmed in state-controlled media by Luo Jianjun, deputy director of the National Laboratory of Space Flight Dynamics Technology at Northwestern Polytechnical University in Xian. “We prefer not to talk about it publicly,” he said. But talk about it he did. ORBITAL PICK-UP Referring to the uncontrolled crash of the Tiangong-1 experimental space station last year, Mr Luo said the use of newly developed technology could guide such craft to burn up in the Earth’s atmosphere safely. According to the South China Morning Post, he said the project was still experimental and that there had been no large-scale deployment of such orbital robots. The project involves small satellites — some weighing less than 10kg — with robotic arms and small thrusters. Their sensors and thrusters enable them to approach within 20cm of an object before reaching out and grabbing it. This could be a cast-off rocket casing. An old satellite with a dead power source. Or a fully-functional military or commercial device. Once attached, the scavenger can then set about pushing it towards the Earth’s atmosphere — and a fiery fate. “Most details remain secret because of the technology’s potential military applications,” Mr Luo states. WEAPONISED GARBAGE TRUCKS? The Morning Post also quoted a recently declassified Communist Party document as saying the concept of orbital drones had been under development since 2008. “The project has not only found applications in more than 10 satellite models … but also drones, smart weapons and robots,” the document reads. The Centre for Strategic and International Studies (CSIS) states in its 2019 Space Threat Assessment that a Chinese experimental satellite, designated SJ-17, circled a Chinese communications satellite several times in 2017 and 2018. Any military objective could be similar to that of Russia. The small robotic devices hide among space junk — or even attached to a bigger object. Here they remain, powered down until awoken by a coded call. This is because every rocket launch is carefully observed by competing governments and corporations. Whatever ends up in orbit is accurately tracked and recorded — not least to determine if it could end up hitting some high-value target, such as the International Space Station. But only the most sensitive and comprehensive space junk tracking systems would be capable of detecting the strange appearance or shift in the course of an object so small. These grapple-equipped gremlins can then pass close to a satellite of interest, photographing and scanning its make-up, or even intercepting its signals. They can also tear away at its surface, damaging sensitive equipment and rendering the satellite useless. Or, they could grab a dead satellite and propel the junk out of orbit. BATTLESPACE In March last year, India launched a missile that successfully destroyed a satellite already in orbit. It is only the fourth nation to do so. But there was fallout: a great cloud of metallic debris cannoning through space. Some pieces are just millimetres across. Others, tens of centimetres. All can rip holes in propellant tanks, depressurise a spacecraft — or smash another satellite, causing yet another cloud of debris to erupt It joins a hail of some 3000 high-velocity fragments — all of which are being tracked — caused when China conducted a similar ‘kinetic-kill’ test in 2007. It’s estimated a total of more than 600,000 pieces are cannoning about up there. The risk is, such debris could initiate a runaway chain reaction. It’s called the Kessler Syndrome, after the researcher who first predicted it. And, some academics are warning it could soon close access to high orbit within as little as 20 years. “If the useful orbits around Earth become too full of rubbish, and our satellites can’t operate safely, it will have serious implications,” the Australian Academy of Science warns. And space agencies around the world, including Australia, are racing to find ways to mitigate the problem. Some, such as the space nets being tested by Britain and repair robots proposed by the US, could also be construed as weapons. ‘SOFT’ OPTIONS There’s no point winning an orbital war if nobody could ever leave the surface of the Earth again for several thousand years. Which is why the militaries of such nations such as China, Russia and the United States are looking for less destructive ways to dominate space — including gremlin satellites. Militaries are exploring other options, such as Russia’s recent controversial jamming of GPS satellites operating above Norway and Sweden. And then there are lasers. While not yet capable of shooting an object out of space, they can damage or blind the sensors they carry. “It’s happening all the time at this low level,” Centre for Strategic and International Studies Aerospace Security Project head Todd Harrison told MIT Technology Review. “It’s more grey-zone aggression. Countries are pushing the limits of accepted behaviour and challenging norms. They’re staying below the threshold of conflict.”

#### Dual-use ambiguity guarantees miscalculation that escalates

Bragg et. al, 18 —- Dr. Allison Astorino-Courtois (NSI’s Chief Analytics Officer (CAO) and Executive Vice President, PhD in IR @ NYU); Dr. Robert Elder (PhD @ Emory, BA @ Clemson, Assistant prof of History @ Baylor); Dr. Belinda Bragg (principle research scientist at NSI, Inc. Lecturer in political science @ Texas A&M); July 2018, “Contested Space Operations, Space Defense, Deterrence, and Warfighting: Summary Findings and Integration Report,” NSI, https://nsiteam.com/social/wp-content/uploads/2018/11/Space-SMA-Integration-Report-Space-FINAL.pdf

Space is the ultimate gray zone

The nature of the space environment itself—and how humans tend to relate to it—can pose risks to stable governance and crisis management in the space domain (Wright; ViTTa Q16; Q19/23). Specifically, cognitive science tells us that ambiguous and high-stakes environments create significant potential for misperception and miscommunication (Wright). Physical and technical limitations on direct observation of events in space limit space situational awareness and increase the difficulty of distinguishing between intentional acts, unintentional events, and natural events. As a result, actors rely on other methods for understanding the nature and causes of events in space. Misperception, mistakes, and/or miscommunication can lead to incorrect inferences and either unintended escalation or unaddressed security threats. Managing escalation requires manipulating an adversary’s perception of the risks inherent in that escalation. However, the inherent ambiguity of the space domain makes effective communication of that risk more complicated (Wright). The “grayness” of the space domain is intensified by the increase in dual-use (military/civilian) technologies (Wright). For example, as a number of contributors pointed out, the same rocket engines used to boost satellites into orbit can be used to deliver conventional or nuclear warheads (ViTTa Q8; Q9: Q19/23). Partly in response to increasingly unstable regional security environments, more and more actors are starting to think about the national security applications of dual-use aspects of space technologies. Unlike the US, where there has traditionally been a clear division between civil, military, and commercial space industries, in most countries active in space, there is a more permeable division between government and commercial space. This creates fewer institutional barriers to military use of civil capabilities. In many non-Western states, commercial space enterprises are partially or even wholly state-owned (ViTTa Q2).

#### 1AR theory is skewed towards the aff – a) the 2NR must cover substance and over-cover theory, since they get the collapse and persuasive spin advantage of the 3min 2AR, b) their responses to my counter interp will be new, which means 1AR theory necessitates intervention. Implications – a) reject 1AR theory since it can’t be a legitimate check for abuse, b) drop the arg to minimize the chance the round is decided unfairly, c) use reasonability with a bar of defense or the aff always wins since the 2AR can line by line the whole 2NR without winning real abuse

## Case

### Debris

#### D/B – in order to solve the Aff – the mechanism for determining “producing Space Debris” must happen through Space Situational Awareness Data – otherwise they have no solvency since companies can just deny they produce debris.

Kennewell and Vo 13 Kennewell, John A., and Ba-Ngu Vo. "An overview of space situational awareness." Proceedings of the 16th International Conference on Information Fusion. IEEE, 2013. (Department of Electrical and Computing Engineering)//Elmer

1 DEFINITIONS In the broadest sense, Space Situational Awareness (SSA) may be defined as a knowledge of the energy and particle fluxes in near-Earth space, natural and artificial objects passing through or orbiting within this space, including the past, present and future state of these components. The realm of near-Earth space may be left rather vague at this stage. It is definitely within cis-lunar space, but extends to an Earthradius of at least 100,000 km to include nearly all man-made objects currently in orbit. Not everyone agrees with this definition. Some reserve the term only for macroscopic objects in near-Earth space. The Space Foundation states that “Space Situational Awareness (SSA) refers to the ability to view, understand and predict the physical location of natural and manmade objects in orbit around the Earth, with the objective of avoiding collisions”[1]. Not only is this very restrictive, but it is not very useful, as most natural objects do not orbit the Earth, but rather transit through near-Earth space. The European Space Agency (ESA), however, uses the fuller definition, and specifically lists three segments of knowledge in SSA: “SST - Space surveillance and tracking of objects in Earth orbit (Watching for active and inactive satellites, discarded launch stages and fragmentation debris that orbit the Earth). SWE - Space weather (Monitoring conditions at the Sun and in the solar wind, and in Earth's magnetosphere, ionosphere and thermosphere, that can affect space-borne and ground-based infrastructure or endanger human life or health). NEO - Near-Earth objects (Detecting natural objects that can potentially impact Earth and cause damage).”[2]

#### That turns the Aff - SSA data-sharing increases risks of ASAT attacks – turns Case since it leads to Satellite Destruction.

Green 16 – Major (B.A., University of Washington; J.D., University of Virginia; LL.M., McGill University); wrote this article while Chief of Space and International Law, Headquarters 14th Air Force (AFSTRAT) / Joint Functional Component Command for Space (JFCC SPACE), Vandenberg Air Force Base, California. He is a member of the District of Columbia Bar. Brian D., “ARTICLE: SPACE SITUATIONAL AWARENESS DATA SHARING: SAFETY TOOL OR SECURITY THREAT?” 75 A.F. L. Rev. 39. Lexis.

[\*43] In turn, achieving and maintaining SSA requires the continual collection, fusion, and analysis of information about Earth's orbital environment and the objects in it. The information takes a variety of forms, including but not limited to imagery generated from optical sensors and ranging data derived from radar systems; numeric values quantifying an object's orbital position; scientific measurements of space weather effects such as solar wind; and other information about a space object's design, shape, capabilities, and intended purpose. This article uses the term "SSA data" to refer to such information. Given the number of objects orbiting the Earth, 4 the hyper-velocities at which they travel, and the complexity of integrating geographically dispersed networks of sophisticated sensors to identify and track them, most states and 5 non-state satellite operators lack the internal resources to make their SSA as robust as they might like. Therefore, many states and other satellite owners and operators turn outward to share the data they possess, in the hope of reciprocal sharing that will improve their own SSA, and ultimately, their prospects of space mission assurance. 6 Sharing SSA data more widely can help assure spacecraft mission success, as it can reduce the likelihood that maneuverable satellites will suffer accidental collisions and EMI. On the other hand, in an era when satellites have become indispensable tools of modern warfare and several nations have demonstrated the ability to target, strike, and disable satellites in orbit, sharing SSA data too broadly could also increase a country's vulnerability to intentional anti-satellite (ASAT) attack. It thus becomes imperative to seek to answer key questions: (1) To what extent does a space-faring state's sharing of its SSA data advance that state's national [\*44] interests; and (2) Within what legal and strategic framework should SSA data sharing occur? The answer to the first question will shape the answer to the second. This article will comprise five sections. Section I will define key terms, explain the major types of SSA data that can be collected, and introduce the challenges associated with SSA data sharing. Section II will recount the history of ASAT threats and discuss how emerging ASAT weapons and dual-use technologies may affect incentives for SSA data sharing. Section III will examine the history of SSA data collection and sharing, both during and after the Cold War. Section IV will analyze the major existing sources of international law that relate to SSA data sharing. Section V will review proposals for improving international SSA data sharing and advocate for the expansion of SSA data sharing via bilateral and small-group multilateral agreements along the lines of the U.S. statutory model. B. THE SSADATA-SHARING DILEMMA As outer space has grown more congested with both useful satellites and debris, SSA has become increasingly important. 7 To avoid destructive collisions between satellites and other space objects, states and other entities that launch and operate satellites need to be aware of man-made and natural hazards that exist in the space environment, and be able to predict how they might interact with existing or planned space activities. To this end, the development and dissemination of SSA data has fostered safer space operations for all. 8 But what if a malicious actor wants to target another nation's space object for destruction? Although the United States and the Soviet Union halted kinetic anti-satellite testing by the mid-1980s, and for many years no other state had demonstrated the means to threaten a satellite in orbit, the safety and security of satellites in the 21st Century has once again fallen into doubt. On March 15, 2016, Lieutenant General David J. Buck, Commander, Joint Functional Component for Space (CDR JFCC SPACE), testified before Congress, "Our ability to deliver space effects is challenged by the unprecedented development of counter-space programs... resources invested and systems designed to deny or degrade our freedom of action... [W]e can no longer take for granted the strategic, operational and tactical advantages we've come to depend on from space." 9 [\*45] China's launch of an ASAT missile to destroy a Chinese weather satellite in orbit in January 2007 reignited the ASAT debate. 10 It raised the specter that providing too much SSA data could enable a State to identify another State's strategically important satellites and use that information to disable or destroy them--not only inflicting harm on the satellite's owner or users, but potentially causing a cascade of destruction throughout the extraterrestrial commons as other satellites collided with its scattered remains. 11 Recent Russian and Chinese deployments of highly maneuverable satellites, 12 including one with a movable arm, 13 as well as Chinese jammers, lasers, and cyber weapons, 14 have caused some to worry about the application of new technologies to disable or co-opt a satellite without exploding it into a globe-encircling debris field--thus minimizing the risks to the attacker and third parties. On the other hand, such technologies could be used for benign applications such as on- orbit satellite repair and refueling, space debris cleanup, or as a precursor to a manned orbital rendezvous. 15 Furthermore, because any country that possesses space launch capability, or even medium-to-long-range ballistic missiles, could potentially adapt its missiles or launch vehicles as ASAT weapons, 16 the advances in missile technology by hostile regimes such as Iran and North Korea should make some countries reluctant to share detailed SSA data too broadly. If precise and timely information about a satellite, such as its purpose, location, direction, and telemetry data, are made available to its owner's enemies, then an enemy that has space object detection and tracking capabilities, and missile launch capabilities that can reach the satellite's orbit, [\*46] may be able to use that data to detect, track, and destroy the satellite. The enemy could also use less destructive means to interfere with the targeted satellite, such as jamming its signal or using lasers to blind its optical sensors, when it knows the satellite is passing overhead.

#### Squo solves debris – private tracking, surveillance, in-orbit servicing and green satellite tech all happening now – includes Starlink

CSTP 20 – OECD Committee, The strategic objectives of the Committee as defined in its Mandate and by the work priorities agreed by Member countries' Ministers responsible for science and technology provide the framework for the Secretariat's proposals for activities to be developed or initiated under the aegis of the Committee itself or its subsidiary bodies (NESTI, TIP, GSF, BNCT and IPSO) [This paper was approved and declassified by written procedure by the Committee for Scientific and Technological Policy (CSTP) on 11 March 2020 and prepared for publication by the OECD Secretariat, “SPACE SUSTAINABILITYTHE ECONOMICS OF SPACE DEBRIS IN PERSPECTIVE,” OECD Science, Technology and Industry Policy Papers, April 2020, No. 87, https://www.oecd-ilibrary.org/science-and-technology/space-sustainability\_a339de43-en]

An emerging “space debris economy”?

* Will we see a more intensive use of cubesats and miniaturised technologies in lower orbits? Cubesats have been the fastest-growing category of launched satellites in the last years and, when launched at lower altitudes, are naturally compliant with debris mitigation guidelines. They are also ever more performant and affordable, and dedicated launch opportunities become more widespread. Furthermore, they increasingly receive preferential treatment in risk-based national legislations (e.g. introduction of sliding scale in the UK Outer Space Act for insurance requirements).
* Space surveillance and tracking capabilities, in both GEO and LEO: New (private) sources of situational awareness data are becoming increasingly important, with data analytics and modelling fuelled by advances in digital technologies. Private sector debris catalogues and tracking capabilities for the geostationary orbit may now be almost as good as government capabilities (IDA, 2016[76]), while solutions for the low-earth orbit are emerging. Start-ups such as LeoLabs provide data and services based on low-cost ground equipment and sophisticated data analysis. The company, which in October 2019 had three radars in the United States and New Zealand, has developed a cloud-based “Space Regulatory and Sustainability Platform” for the New Zealand Space Agency, a first of its kind, destined to track objects launched from New Zealand to ensure compliance with permit conditions (MBIE, 2019[77]). A novel project called TruSat intends to use blockchain technology to crowdsource and validate satellite orbital positions worldwide via open source software (TruSat, 2019[78]). The US Air Force Research Laboratory has signed agreements with several commercial space situational awareness data providers (e.g. Numerica, LeoLabs, ExoAnalytics) to get access to sensor networks and algorithms (Numerica, 2019[79]). The Space Situational Awareness (SSA) open-architecture data-sharing platform under development by the US Department of Commerce, including data from different government agencies, is also expected to spur innovative value-added products and services.
* In-orbit servicing solutions: Several governmental agencies and commercial companies have developed, or are in the process of acquiring, some capabilities for in-orbit servicing (e.g. NASA, DARPA, ESA, JAXA). In-orbit servicing involves a number of complex operations in space: the servicing of space platforms (e.g. satellite, space station) to replenish consumables and degradables (e.g. propellants, batteries, solar array); replacing failed functionality; and/or enhancing the mission through software and hardware upgrades. This is a major challenge as, when on orbit, space platforms can move at speeds of several kilometres a minute. The first commercial in-orbit servicing mission was launched in 2019, by a MEV-1 spacecraft developed by Orbital ATK for an Intelsat geostationary satellite. The main short-term market is seen in the life extension of geostationary satellites, with some 300 potential candidates, at least in theory (Kennedy, 2018[80]). However, the key benefits of in-orbit servicing are expected in the future. Satellite design is currently heavily restricted by extreme launch conditions, but the possibility of servicing could enable a much more flexible and modular satellite design, able to take advantage of the latest advances in materials and electronics, beyond software upgrades (Jaffart, 2018[81]). Market forecasts estimate a USD 3 billion market for in-orbit servicing over the 2017-27 period, mainly driven by life extension services (Northern Sky Research, 2018[82]).
* Active debris removal solutions: Active debris removal is at a less mature technological level, but several firms are preparing demonstration missions (e.g. Astroscale in 2020). Potential candidates for removal include more than 200 critical debris objects (3-9 tonnes); mainly rocket bodies, but also the European Envisat satellite. JAXA, has formally launched a project to remove a large piece of debris by 2025 (a Japanese rocket body) in a public-private partnership (Japanese Delegation to UNCOPUOS, 2019[83]). Both Airbus and Thales Alenia Space are developing in-orbit servicing vehicles with debris removal functions, some of which have been tested on the RemoveDEBRIS mission (Surrey Space Centre, 2019[84]; OECD, 2019[11]).

• “Green” satellite design and technology: The demand for space-environment friendly satellite design is picking up. This includes features to reduce or avoid debris creation (explosion-safe batteries, deorbit technologies) and/or facilitating active removal (e.g. markers or grapple fixtures). One example is OneWeb, which is installing grapple fixtures on their satellites. In Europe, all future Sentinel satellites will be designed for demise. Affordable deorbit technologies are already being tested on orbit. Canada’s three-kilo CanX-7 satellite was launched in 2016 and is currently using its four 1 m2 drag sails to deorbit at a significantly faster rate than it would have without the sails. Amazon’s Kuiper constellation intends to use unpressurised and non-explosive propellant to mitigate accidental explosions, and satellites losing contact with ground control would automatically deactivate themselves, first by self-passivation and orbit-lowering, then depleting all energy reservoirs and switching off charging circuits (FCC, 2019[85]). SpaceX’ Starlink satellites are equipped with automated collision avoidance systems (although it is unclear which role the system played in the near-collision with the ESA Aeolus satellite).

A recent promising initiative is the “Space Sustainability Rating” scheme, originally conceived by teams from the MIT Media Lab, European Space Agency, and World Economic Forum. The initiative intends to be similar to the most widely used green building rating system in the construction industry, called the LEED certification for Leadership in Energy and Environmental Design. The objective is to promote mission designs and operational concepts that mitigate debris creation, and create a label that can encourage operators to behave more responsibly.

#### Squo debris thumps

**Wall 21** [Mike Wall, Michael Wall is a Senior Space Writer with [Space.com](http://space.com/) and joined the team in 2010. He primarily covers exoplanets, spaceflight and military space. He has a Ph.D. in evolutionary biology from the University of Sydney, Australia, a bachelor's degree from the University of Arizona, and a graduate certificate in science writing from the University of California, Santa Cruz. 11/15/21, "Kessler Syndrome and the space debris problem," Space, [https://www.space.com/kessler-syndrome-space-debris accessed 12/10/21](https://www.space.com/kessler-syndrome-space-debris%20accessed%2012/10/21)] Adam

Earth orbit is getting more and more crowded as the years go by. Humanity has launched about 12,170 satellites since the dawn of the space age in 1957, [according to the European Space Agency](https://www.esa.int/Safety_Security/Space_Debris/Space_debris_by_the_numbers) (ESA), and 7,630 of them remain in orbit today — but only about 4,700 are still operational. That means there are nearly 3,000 defunct spacecraft zooming around Earth at tremendous speeds, along with other big, dangerous pieces of debris like upper-stage rocket bodies. For example, orbital velocity at 250 miles (400 kilometers) up, the altitude at which the ISS flies, is about 17,100 mph (27,500 kph). At such speeds, even a tiny shard of debris can do serious damage to a spacecraft — and there are huge numbers of such fragmentary bullets zipping around our planet. ESA estimates that Earth orbit harbors at least 36,500 debris objects that are more than 4 inches (10 centimeters) wide, 1 million between 0.4 inches and 4 inches (1 to 10 cm) across, and a staggering 330 million that are smaller than 0.4 inches (1 cm) but bigger than 0.04 inches (1 millimeter). These objects pose more than just a hypothetical threat. From 1999 to May 2021, for example, the ISS conducted 29 debris-avoiding maneuvers, including three in 2020 alone, [according to NASA officials](https://www.nasa.gov/mission_pages/station/news/orbital_debris.html). And that number continues to grow; the station performed [another such move in November 2021](https://www.space.com/space-station-dodging-chinese-space-junk-spacex-crew-3), for example. Many of the smaller pieces of space junk were spawned by the explosion of spent rocket bodies in orbit, but others were more actively emplaced. In January 2007, for instance, China intentionally destroyed one of its defunct weather satellites in a much-criticized test of anti-satellite technology that generated [more than 3,000 tracked debris objects](https://swfound.org/media/9550/chinese_asat_fact_sheet_updated_2012.pdf) and perhaps 32,000 others too small to be detected. The vast majority of that junk remains in orbit today, experts say. Spacecraft have also collided with each other on orbit. The most famous such incident occurred in February 2009, when Russia's defunct Kosmos 2251 satellite slammed into the operational communications craft Iridium 33, producing [nearly 2,000 pieces of debris](https://swfound.org/media/6575/swf_iridium_cosmos_collision_fact_sheet_updated_2012.pdf) bigger than a softball. That 2009 smashup might be evidence that the Kessler Syndrome is already upon us, though a cataclysm of "Gravity" proportions is still a long way off. "The cascade process can be more accurately thought of as continuous and as already started, where each collision or explosion in orbit slowly results in an increase in the frequency of future collisions," [Kessler told Space Safety Magazine in 2012](http://www.spacesafetymagazine.com/space-debris/kessler-syndrome/don-kessler-envisat-kessler-syndrome/).

#### No Escalation over Satellites:

#### 1] Planning Priorities

Bowen 18 Bleddyn Bowen 2-20-2018 “The Art of Space Deterrence” <https://www.europeanleadershipnetwork.org/commentary/the-art-of-space-deterrence/> (Lecturer in International Relations at the University of Leicester)//Elmer

Space is often an afterthought or a miscellaneous ancillary in the grand strategic views of top-level decision-makers. A president may not care that one satellite may be lost or go dark; it may cause panic and Twitter-based hysteria for the space community, of course. But the terrestrial context and consequences, as well as the political stakes and symbolism of any exchange of hostilities in space matters more. The political and media dimension can magnify or minimise the perceived consequences of losing specific satellites out of all proportion to their actual strategic effect.

#### 2] Military Precedent

Zarybnisky 18, Eric J. Celestial Deterrence: Deterring Aggression in the Global Commons of Space. Naval War College Newport United States, 2018. (Senior Materiel Leader at United States Air Force)//Elmer

PREVENTING AGGRESSION IN SPACE While deterrence and the Cold War are strongly linked in the public’s mind through the nuclear standoff between the United States and the Soviet Union, the fundamentals of deterrence date back millennia and deterrence remains relevant. Thucydides alludes to the concept of deterrence in his telling of the Peloponnesian War when he describes rivals seeking advantages, such as recruiting allies, to dissuade an adversary from starting or expanding a conflict.6F 6 Aggression in space was successfully avoided during the Cold War because both sides viewed an attack on military satellites as highly escalatory, and such an action would likely result in general nuclear war.7F 7 In today’s more nuanced world, attacking satellites, including military satellites, does not necessarily result in nuclear war. For instance, foreign countries have used highpowered lasers against American intelligence-gathering satellites8F 8 and the United States has been reluctant to respond, let alone retaliate with nuclear weapons. This shift in policy is a result of the broader use of gray zone operations, to which countries struggle to respond while limiting escalation. Beginning with the fundamentals of deterrence illuminates how it applies to prevention of aggression in space.

#### No space war – prefer data over political rhetoric

Klimas interviewing Weeden 18 [Brian Weeden, smart space guy. Is the space war threat being hyped? August 3, 2018. https://www.politico.com/story/2018/08/03/space-war-threat-hype-force-760781]

There’s been increasing rhetoric...about the militarization of space and the potential for conflicts on Earth to extend into space. That’s driven in part by reports about anti-satellite testing in Russia and China...The report really grew out of our frustration at the level of publicly available information on this topic. A lot of what you get are public statements from military leadership or politicians, or sometimes news articles talking about something and it’s really hard to get down to details and...sort through what might be real, what might be hype. Our goal was to dig into the open source material and see what we could determine from a factual standpoint was really going on -- what types of capabilities were being developed and how might they be used in a future conflict. Ultimately we hoped that would lead to a more informed debate about what U.S. strategy should be to address those threats. What sort of feedback have you gotten so far? A lot of the feedback has been either informal or private because a lot of the issues we talk about, people in the government research using classified materials. So it’s difficult for them to give detailed feedback. In general, the feedback we’ve gotten has been pretty positive. People have said they like the fact that this sort of stuff is being put in the public domain and encouraged us to continue. Were your findings better or worse than the picture public discourse paints? In general, it’s a little bit better. A lot of political rhetoric and news stories focus on the most extreme examples, so using kinetic weapons

to blow up satellites. While there is research and development going on to develop those capabilities, what we found is there’s yet to be any publicly-known example of them being used. What is being used and what seems to be of the most utility are the non-kinetic things, like jamming and cyber attacks. The good news is we have yet to see the most destructive kinetic attacks that can cause really harmful long-term damage to the space environment, but unfortunately we are seeing non-kinetic attacks being used, and that’s likely to continue.

### Space Col

#### Laundry List card, absolutely no warrants for any of this, has to be reexplained in the 1AR which is new, if they do this we get new cards in the 2NR to respond

#### No existential risks – even if there were, space col can’t solve OR terrestrial refuges do – solves infinite value

Szocik 18 (Konrad Szocik, Assistant Professor at the University of Information Technology and Management in Rzeszow, Poland (Department of Philosophy and Cognitive Science), 2018. “Should and could humans go to Mars? Yes, but not now and not in the near future”. Futures. doi:10.1016/j.futures.2018.08.004)

4.5. There is no risk on Earth sufficient to justify the expense of a space refuge Space refuge is justified only when there is at least one kind of catastrophe on Earth which will lead to extinction of the entire human species. Baum (2015) and Baum et al. (2015) do not believe that space settlement offers advantage over terrestrial refuge. If terrestrial refuge (aquatic and/or subterranean) is able to protect against the strongest catastrophes including asteroid impact, the unique serious rationale accepted by public opinion for space human mission fails. As Alexey Turchin and Brian Patrick Green (2017) show, aquatic refuges based on adaptation of nuclear submarines may effectively play their role. They may be surface independent, which is the basic criterion of any refuge (Baum et al. 2015). They are cheaper and easier in engineering terms when compared with Mars settlement. A space refuge would not be able to cope with currently-occurring risks, e.g. overpopulation and climate change. Human overpopulation can be limited only on Earth by terrestrial policy and, if this can be done, no space base is necessary. If it is not possible, then no space base can solve this problem. For example, space settlement is not able to alleviate global warming, against Milligan’s suggestion. The unique way to do that on Earth is to reduce methane emission and/or to cool Earth by turning sunlight into space, as Solar Radiation Management proposes (Farquhar et al. 2017). There is only indirect, not direct applicability of space exploration. For instance, space technology might be applied to cope with asteroid impact or increasing the Sun temperature (Crawford). But these exogenous catastrophes caused by cosmic events are unlikely in lifespan of current and future generations (Tegmark and Bostrom 2005, p. 754), and for this reason they offer poor incentive for human space program. The unique rationale for space refuge mission could be future development of the Sun which will be getting more and more warmer in next billions years. But this threat does not justify human space settlement due to its high risk and high costliness (Jebari 2015). Nick Beckstead speculates on possible disasters on Earth deleterious also for humans living in shelters, e.g. scenarios that include invasion of aliens, runaway AI, or ecophagy caused by nanotechnology (Beckstead 2015).9 Beckstead rightly adds that the big challenge is not only rate of survival immediately after catastrophe but also chances for survival in long-term scale including collapse in food production and supply chain, and associated social and political collapse. It is hard to imagine catastrophe which kills the entire Earth population excluding people living in refuge. In this case, rationale for refuge fails.

#### Space Colonization causes novel species generation and spreads humanity too wide – both make communication and intergalactic governance impossible

Torres 18, Phil. Phil Torres is the director of the Project for Human Flourishing and the author of Morality, Foresight, and Human Flourishing: An Introduction to Existential Risks."Why We Should Think Twice About Colonizing Space." Nautilus, 23 July 2018, nautil.us/blog/why-we-should-think-twice-about-colonizing-space.

In a recent article in Futures, which was inspired by political scientist Daniel Deudney’s forthcoming book Dark Skies, I decided to take a closer look at this question. My conclusion is that in a colonized universe the probability of the annihilation of the human race could actually rise rather than fall. The argument is based on ideas from evolutionary biology and international relations theory, and it assumes that there aren’t any other technologically advanced lifeforms capable of colonizing the universe (as a recent study suggests is the case). Consider what is likely to happen as humanity hops from Earth to Mars, and from Mars to relatively nearby, potentially habitable exoplanets like Epsilon Eridani b, Gliese 674 b, and Gliese 581 d. Each of these planets has its own unique environments that will drive Darwinian evolution, resulting in the emergence of novel species over time, just as species that migrate to a new island will evolve different traits than their parent species. The same applies to the artificial environments of spacecraft like “O’Neill Cylinders,” which are large cylindrical structures that rotate to produce artificial gravity. Insofar as future beings satisfy the basic conditions of evolution by natural selection—such as differential reproduction, heritability, and variation of traits across the population—then evolutionary pressures will yield new forms of life. But the process of “cyborgization”—that is, of using technology to modify and enhance our bodies and brains—is much more likely to influence the evolutionary trajectories of future populations living on exoplanets or in spacecraft. The result could be beings with completely novel cognitive architectures (or mental abilities), emotional repertoires, physical capabilities, lifespans, and so on. In other words, natural selection and cyborgization as humanity spreads throughout the cosmos will result in species diversification. At the same time, expanding across space will also result in ideological diversification. Space-hopping populations will create their own cultures, languages, governments, political institutions, religions, technologies, rituals, norms, worldviews, and so on. As a result, different species will find it increasingly difficult over time to understand each other’s motivations, intentions, behaviors, decisions, and so on. It could even make communication between species with alien languages almost impossible. Furthermore, some species might begin to wonder whether the proverbial “Other” is conscious. This matters because if a species Y cannot consciously experience pain, then another species X might not feel morally obligated to care about Y. After all, we don’t worry about kicking stones down the street because we don’t believe that rocks can feel pain. Thus, as I write in the paper, phylogenetic and ideological diversification will engender a situation in which many species will be “not merely aliens to each other but, more significantly, alienated from each other.” But this yields some problems. First, extreme differences like those just listed will undercut trust between species. If you don’t trust that your neighbor isn’t going to steal from, harm, or kill you, then you’re going to be suspicious of your neighbor. And if you’re suspicious of your neighbor, you might want an effective defense strategy to stop an attack—just in case one were to happen. But your neighbor might reason the same way: she’s not entirely sure that you won’t kill her, so she establishes a defense as well. The problem is that, since you don’t fully trust her, you wonder whether her defense is actually part of an attack plan. So you start carrying a knife around with you, which she interprets as a threat to her, thus leading her to buy a gun, and so on. Within the field of international relations, this is called the “security dilemma,” and it results in a spiral of militarization that can significantly increase the probability of conflict, even in cases where all actors have genuinely peaceful intentions. So, how can actors extricate themselves from the security dilemma if they can’t fully trust each other? On the level of individuals, one solution has involved what Thomas Hobbes’ calls the “Leviathan.” The key idea is that people get together and say, “Look, since we can’t fully trust each other, let’s establish an independent governing system—a referee of sorts—that has a monopoly on the legitimate use of force. By replacing anarchy with hierarchy, we can also replace the constant threat of harm with law and order.” Hobbes didn’t believe that this happened historically, only that this predicament is what justifies the existence of the state. According to Steven Pinker, the Leviathan is a major reason that violence has declined in recent centuries. The point is that if individuals—you and I—can overcome the constant threat of harm posed by our neighbors by establishing a governing system, then maybe future species could get together and create some sort of cosmic governing system that could similarly guarantee peace by replacing anarchy with hierarchy. Unfortunately, this looks unpromising within the “cosmopolitical” realm. One reason is that for states to maintain law and order among their citizens, their various appendages—e.g., law enforcement, courts—need to be properly coordinated. If you call the police about a robbery and they don’t show up for three weeks, then what’s the point of living in that society? You’d be just as well off on your own! The question is, then, whether the appendages of a cosmic governing system could be sufficiently well-coordinated to respond to conflicts and make top-down decisions about how to respond to particular situations. To put it differently: If conflict were to break out in some region of the universe, could the relevant governing authorities respond soon enough for it to matter, for it to make a difference? Probably not, because of the immense vastness of space. For example, consider again Epsilon Eridani b, Gliese 674 b, and Gliese 581 d. These are, respectively, 10.5, 14.8, and 20.4 light-years from Earth. This means that a signal sent as of this writing, in 2018, wouldn’t reach Gliese 581 d until 2038. A spaceship traveling at one-quarter the cosmic speed limit wouldn’t arrive until 2098, and a message to simply affirm that it had arrived safely wouldn’t return to Earth until 2118. And Gliese 581 is relatively close as far as exoplanets go. Just consider that he Andromeda Galaxy is some 2.5 million light-years from Earth and the Triangulum Galaxy about 3 million light-years away. What’s more, there are some 54 galaxies in our Local Group, which is about 10 million light-years wide, within a universe that stretches some 93 billion light-years across. These facts make it look hopeless for a governing system to effectively coordinate law enforcement activities, judicial decisions, and so on, across cosmic distances. The universe is simply too big for a government to establish law and order in a top-down fashion. But there is another strategy for achieving peace: Future civilizations could use a policy of deterrence to prevent other civilizations from launching first strikes. A policy of this sort, which must be credible to work, says: “I won’t attack you first, but if you attack me first, I have the capabilities to destroy you in retaliation.” This was the predicament of the US and Soviet Union during the Cold War, known as “mutually-assured destruction” (MAD). But could this work in the cosmopolitical realm of space? It seems unlikely. First, consider how many future species there could be: upwards of many billions. While some of these species would be too far away to pose a threat to each other—although see the qualification below—there will nonetheless exist a huge number within one’s galactic backyard. The point is that the sheer number would make it incredibly hard to determine who initiated a first strike, if one is attacked. And without a method for identifying instigators with high reliability, one’s policy of deterrence won’t be credible. And if one’s policy of deterrence isn’t credible, then one has no such policy! Second, ponder the sorts of weapons that could become available to future spacefaring civilizations. Redirected asteroids (a.k.a., “planetoid bombs”), “rods from God,” sun guns, laser weapons, and no doubt an array of exceptionally powerful super-weapons that we can’t currently imagine. It has even been speculated that the universe might exist in a “metastable” state and that a high-powered particle accelerator could tip the universe into a more stable state. This would create a bubble of total annihilation that spreads in all directions at the speed of light

—which opens up the possibility that a suicidal cult, or whatever, weaponizes a particle accelerator to destroy the universe. The question, then, is whether defensive technologies could effectively neutralize such risks. There’s a lot to say here, but for the present purposes just note that, historically speaking, defensive measures have very often lagged behind offensive measures, thus resulting in periods of heightened vulnerability. This is an important point because when it comes to existentially dangerous super-weapons, one only needs to be vulnerable for a short period to risk annihilation. So far as I can tell, this seriously undercuts the credibility of policies of deterrence. Again, if species A cannot convince species B that if B strikes it, A will launch an effective and devastating counter strike, then B may take a chance at attacking A. In fact, B does not need to be malicious to do this: it only needs to worry that A might, at some point in the near- or long-term future, attack B, thus making it rational for B to launch a preemptive strike (to eliminate the potential danger). Thinking about this predicament in the radically multi-polar conditions of space, it seems fairly obvious that conflict will be extremely difficult to avoid. The lesson of this argument is not to uncritically assume that venturing into the heavens will necessarily make us safer or more existentially secure. This is a point that organizations hoping to colonize Mars, such as SpaceX, NASA, and Mars One should seriously contemplate. How can humanity migrate to another planet without bringing our problems with us? And how can different species that spread throughout the cosmos maintain peace when sufficient mutual trust is unattainable and advanced weaponry could destroy entire civilizations? Human beings have made many catastrophically bad decisions in the past. Some of these outcomes could have been avoided if only the decision-makers had deliberated a bit more about what could go wrong—i.e., had done a “premortem” analysis. We are in that privileged position right now with respect to space colonization. Let’s not dive head-first into waters that turn out to be shallow.

### Climate Change

#### I/L is rocket launches which they don’t stop – other things thump that need rockets like the public sector and no i/l to co2

### Satellites

#### Solar flares will end satellites inevitably – no defense – proves only DA turns the I/L.

Wild 15 (Jim Wild, Professor of Space Physics at Lancaster University, “With So Much Vested In Satellites, Solar Storms Could Bring Life To A Standstill,” July 30, 2015, https://theconversation.com/with-so-much-vested-in-satellites-solar-storms-could-bring-life-to-a-standstill-45204)

These can disrupt satellite operations by depositing electrical charge within the on-board electronics, triggering phantom commands or overloading and damaging sensitive components. The effects of space weather on the Earth’s upper atmosphere disrupts radio signals transmitted by navigation satellites, potentially introducing positioning errors or, in more severe cases, rendering them unusable. These are not theoretical

hazards: in recent decades, solar storms have caused outages for a number of satellites services – and a handful of satellites have been lost altogether. These were costly events – satellite operator losses have run into hundreds of millions of dollars. The wider social and economic impact was relatively limited, but even so it’s unclear how our growing amount of space infrastructure would fare against the more extreme space weather that we might face. When Space Weather Becomes A Hurricane The largest solar storm on record was the Carrington event in September 1859, named after the British astronomer who observed it. Of course there were no Victorian satellites to suffer the consequences, but the telegraph systems of the time were crippled as electrical currents induced in the copper wires interfered with signals, electrocuted operators and set telegraph paper alight. The geomagnetic storm it triggered was so intense that the northern lights, usually a polar phenomenon, were observed as far south as the Bahamas. Statistical analysis of this and other severe solar storms suggests that we can expect an event of this magnitude once every few hundred years – it’s a question of “when” rather than “if”. A 2007 study estimated a Carrington event today would cause US$30 billion in losses for satellite operators and threaten vital infrastructure in space and here on the ground. It’s a risk taken sufficiently seriously that it appears on the UK National Risk Register and has led the government to draw up its preparedness programme.

### Grid

#### Grid impact doesn’t cascade

Boyle 17 – Rebecca Boyle, citing Rob Manning, vice president for transmission at the Electric Power Research Institute, and Thomas Berger, Director of Space Weather Prediction Center at NOAA. [How we’ll safeguard Earth from a solar storm catastrophe, 6-14-2017, https://www.nbcnews.com/mach/space/how-we-ll-safeguard-earth-solar-storm-catastrophe-n760021]

Odds are an EMP attack would be on a local scale, which means the grid would likely be fine overall, notes Scott Aaronson, senior director of national security policy at the Edison Electric Institute. There's no single point of failure in the country’s electrical system. The grid is somewhat of a misnomer because it’s really hundreds of independently operated utilities, each of which manages resources in its own way. Private industry owns 85 percent of the U.S.'s critical electrical infrastructure.

“To incidents on a smaller scale, the grid is extraordinarily resilient," Aaronson says. "There are 50,000 substations, and hundreds of control centers. The failure of one, or even several of those, has very limited impact on the broader set of infrastructure.”

He argues an EMP is less of a concern than everyday problems — from solar storms to Earth generated lightning, to the most mundane threats.