# 1NC Harvard Round 2

### 1NC---Topicality

#### Interpretation: “Appropriation of outer space” by private entities refers to the exercise of exclusive control of space.

TIMOTHY JUSTIN TRAPP, JD Candidate @ UIUC Law, ’13, TAKING UP SPACE BY ANY OTHER MEANS: COMING TO TERMS WITH THE NONAPPROPRIATION ARTICLE OF THE OUTER SPACE TREATY UNIVERSITY OF ILLINOIS LAW REVIEW [Vol. 2013 No. 4]

The issues presented in relation to the nonappropriation article of the Outer Space Treaty should be clear.214 The ITU has, quite blatantly, created something akin to “property interests in outer space.”215 It allows nations to exclude others from their orbital slots, even when the nation is not currently using that slot.216 This is directly in line with at least one definition of outer-space appropriation.217 [\*\*Start Footnote 217\*\*Id. at 236 (“Appropriation of outer space, therefore, is ‘the exercise of exclusive control or exclusive use’ with a sense of permanence, which limits other nations’ access to it.”) (quoting Milton L. Smith, The Role of the ITU in the Development of Space Law, 17 ANNALS AIR & SPACE L. 157, 165 (1992)). \*\*End Footnote 217\*\*]The ITU even allows nations with unused slots to devise them to other entities, creating a market for the property rights set up by this regulation.218 In some aspects, this seems to effect exactly what those signatory nations of the Bogotá Declaration were trying to accomplish, albeit through different means.219

#### Private appropriation of extracted space resources is distinct from appropriation “of” outer space. Despite longstanding permission of appropriation of extracted resources, sovereign claims are still universally prohibited.

Abigail D. Pershing, J.D. Candidate @ Yale, B.A. UChicago,’19, "Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today," Yale Journal of International Law 44, no. 1

II. THE FIRST SHIFT IN CUSTOMARY INTERNATIONAL LAW’S INTERPRETATION OF THE NON-APPROPRIATION PRINCIPLE

Since the drafting of the Outer Space Treaty, several States have chosen to reinterpret the non-appropriation principle as narrower in scope than its drafters originally intended. This reinterpretation has gone largely unchallenged and has in fact been widely adopted by space-faring nations. In turn, this has had the effect of changing customary international law relating to the non-appropriation principle. Shifting away from its original blanket application in 1967, States have carved out an exception to the non-appropriation principle, allowing appropriation of extracted space resources.53 This Part examines this shift in the context of the two branches of the United Nation’s customary international law standard: State practice and opinio juris.

A. State Practice

The earliest hint of a change in customary international law relating to the interpretation of the non-appropriation clause came in 1969, when the United States first sent astronauts to the moon. As part of his historic journey, astronaut Neil Armstrong collected moonrocks that he brought back with him to Earth and promptly handed off to the National Aeronautics and Space Administration (NASA) as U.S. property.54 Later, the USSR similarly claimed lunar material as government property, some of which was eventually sold to private citizens. 55 These first instances of space resource appropriation did not draw much attention, but they presented a distinct shift marking the beginning of a new period in State practice. Having previously been limited by their technological capabilities, States could now establish new practices with respect to celestial bodies. This was the beginning of a pattern of appropriation that slowly unfolded over the next few decades and has since solidified into the general and consistent State practice necessary to establish the existence of customary international law. Currently, the U.S. government owns 842 pounds of lunar material.56 There is little question that NASA and the U.S. government consider this material, as well as other space materials collected by American astronauts, to be government property.57 In fact, NASA explicitly endorses U.S. property rights over these moon rocks, stating that “[l]unar material retrieved from the Moon during the Apollo Program is U.S. government property.”5

The U.S. delegation’s reaction to the language of the 1979 Moon Agreement further cemented this interpretation that appropriation of extracted resources is a permissible exception to the non-appropriation clause of Article II. Although the United States is not a party to the Moon Agreement, it did participate in the negotiations.59 The Moon Agreement states in relevant part: Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or nongovernmental organization, national organization or nongovernmental entity or of any natural person.60

In response to this language, the U.S. delegation made a statement laying out the American view that the words “in place” imply that private property rights apply to extracted resources61—a comment that went completely unchallenged. That all States seemed to accept this point, even those bound by the Moon Agreement, is further evidence of a shift in customary international law.62

B. Opinio Juris: Domestic Legislation

Domestic law, both in the United States and abroad, provides further evidence of the shift in customary international law surrounding the issue of nonappropriation as it relates to extracted space resources.

Domestic U.S. space law is codified at Section 51 of the U.S. Code and has been regularly modified to expand private actors’ rights in space.63 Beginning in 1984, the Commercial Space Launch Act provided that “the United States should encourage private sector launches and associated services.”64 The goal of the 1984 Act was to support commercial space launches by private companies and individuals.65 It did not, however, specifically discuss commercial exploitation of space. The first such mention of commercial use of space appeared in 2004, with the Commercial Space Launch Amendments Act.66 This Act specifically aimed at regulating space tourism but did not explicitly guarantee any private rights in space.67

The most significant change in U.S. space law came with the passage of the Spurring Private Aerospace Competitiveness and Entrepreneurship (SPACE) Act in 2015. As incorporated into Section 51 of the Code, this Act provides: A United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States.68

Whereas the idea that private corporations might go into space may have seemed far-fetched to the drafters of the Outer Space Treaty, the SPACE Act of 2015 was the first instance of a government recognizing such a trend and officially supporting private companies’ commercial rights to space resources under law. With the new 2015 amendment to Section 51 in place, U.S. companies can now rest assured that any profits they reap from space mining are firmly legal—at least within U.S. jurisdictions.

Although the United States was the first country to officially reinterpret the non-appropriation principle, other countries are following suit. On July 20, 2017, Luxembourg passed a law entitled On the Exploration and Utilization of Space Resources with a vote of fifty-five to two.69 The law took effect on August 1, 2017.70 Article 1 of the new law states simply that “[s]pace resources can be appropriated,” and Article 3 expressly grants private companies permission to explore and use space resources for commercial purposes.71 Official commentary on the law establishes that its goal is to provide companies with legal certainty regarding ownership over space materials—a goal that the commentators regard as legal under the Outer Space Treaty despite the non-appropriation principle.72 The next country to enact similar legislation may be the United Arab Emirates (UAE). According to the UAE Space Agency director general, Mohammed Al Ahbabi, the UAE is currently in the process of drafting a space law covering both human space exploration and commercial activities such as mining.73 To further this goal, in 2017 the UAE set up the Space Agency Working Group on Space Policy and Law to specify the procedures, mechanisms, and other standards of the space sector, including an appropriate legal framework.74

C. Opinio Juris: Legal Scholarship

Other major space powers are also considering similar laws in the future, including Japan, China, and Australia. 75 Senior officials within China’s space program have explicitly stated that the country’s goal is to explore outer space and to take advantage of outer space resources.76 The general international trend clearly points in this direction in anticipation of a potential “space gold rush.” 7

Mirroring the shift in State practice and domestic laws, the legal community has also changed its approach to the interpretation of the nonappropriation principle. Whereas at the time of the ratification of the Outer Space Treaty the majority of legal scholars tended to apply the non-appropriation principle broadly, most legal scholars now view appropriation of extracted materials as permissible.78 Brandon Gruner underscores that this new view is historically distinct from prior legal interpretation, noting that modern interpretations of the Outer Space Treaty’s non-appropriation principle differ from those of the Treaty’s authors.79

In contrast to earlier legal theory that denied the possibility of appropriation of any space resources, scholars now widely accept that extracting space resources from celestial bodies is a “use” permitted by the Outer Space Treaty and that extracted materials become the property of the entity that performed the extraction.80 Stressing the fact that the Treaty does not explicitly prohibit appropriating resources from outer space, other authors conclude that the use of extracted space resources is permitted, meaning that the new SPACE Act is a plausible interpretation of the Outer Space Treaty.81

However, scholars have been careful to cabin the extent to which they accept the legality of appropriation. For instance, although Thomas Gangale and Marilyn Dudley-Rowley acknowledge the legality of private appropriation of extracted space resources, they nonetheless emphasize that “[o]wnership of and the right to use extraterrestrial resources is distinct from ownership of real property” and that any such claim to real property is illegal.82 Lawrence Cooper is also careful to point out this distinction: “[t]he [Outer Space] Treaties recognize sovereignty over property placed into space, property produced in space, and resources removed from their place in space, but ban sovereignty claims by states; international law extends this ban to individuals.”83 Although there remain some scholars who still insist on the illegality of the 2015 U.S. law and State appropriation of space resources generally,84 their dominance has waned since the 1960s. These scholars are now a minority in the face of general acceptance among the legal community that minerals and other space resources, once extracted, may be legally claimed as property. 85

Taken together, the elements described above—statements made in the international arena, de facto appropriation of space resources in the form of moon rocks, the adoption of new national policies permitting appropriation of extracted space resources, and the weight of the international legal community’s opinion— indicate a fundamental shift in customary international law. The Outer Space Treaty’s non-appropriation clause has been redefined via customary international law norms from its broad application to now include a carve-out allowing appropriation of space resources once such resources have been extracted.

#### Violation: they defend debris which is not permanent or exclusive, and doesn’t constitute ownership of a celestial body.

#### Prefer

#### 1] Limits – they explode the topic to include banning anything in space like tourism, photography, sending rovers, collecting ice cores, launching satellites, deflecting debris, can’t sell rocks on EBAY, etc. and make it so there is *no* unified neg generics. That kills fairness by exploding the neg prep burden since outer space is so vague and no generics exist to answer both the photography and the rovers aff, so affs would just win with a tiny impact every round.

#### 2] Ground – we can’t read generics like the space democracy or the space colonization DAs, the Moon PIC, and property rights NCs which hyperfocuses debate on minute parts of the literature and makes neg engagement impossible. Even if we can, link magnitude means their small aff will always outweigh which also kills clash.

#### Voters

#### Fairness – debate is a game so any unfair advantage means they should lose, and controls the internal link to education

#### Education – is the reason schools fund debate, carries on to the real world

#### Drop the debater - dropping the argument doesn’t rectify abuse since winning T proves why we don’t have the burden of rejoinder against their aff.

#### Competing interps –

#### Reasonability leads to a race to the bottom

#### Arbitrary and infinitely regressive

#### No RVIs

#### The aff shouldn’t win for being Topical – they have the burden for doing so

### 1NC---Space Elevators PIC

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

#### It Competes:

#### 1] Space Elevators constitute Appropriation – they impede orbits.

Matignon 19 Louis de Gouyon Matignon 3-3-2019 "LEGAL ASPECTS OF THE SPACE ELEVATOR TRANSPORTATION SYSTEM" <https://www.spacelegalissues.com/space-law-legal-aspects-of-the-space-elevator-transportation-system/> [PhD in space law (co-supervised by both Philippe Delebecque, from Université Paris 1 Panthéon-Sorbonne, France, and Christopher D. Johnson, from Georgetown University || regularly write articles on the website Space Legal Issues so as to popularise space law and public international law]//Elmer

An Earth-based space elevator would consist of a cable with one end attached to the surface near the equator and the other end in space beyond geostationary orbit. An orbit is the curved path through which objects in space move around a planet or a star. The 1967 Treaty’s regime and customary law enshrine the principle of non-appropriation and freedom of access to orbital positions. Space Law and International Telecommunication Laws combined to protect this use against any interference. The majority of space-launched objects are satellites that are launched in Earth’s orbit (a very small part of space objects – scientific objects for space exploration – are launched into outer space beyond terrestrial orbits). It is important to precise that an orbit does not exist: satellites describe orbits by obeying the general laws of universal attraction. Depending on the launching techniques and parameters, the orbital trajectory of a satellite may vary. Sun-synchronous satellites fly over a given location constantly at the same time in local civil time: they are used for remote sensing, meteorology or the study of the atmosphere. Geostationary satellites are placed in a very high orbit; they give an impression of immobility because they remain permanently at the same vertical point of a terrestrial point (they are mainly used for telecommunications and television broadcasting). A geocentric orbit or Earth orbit involves any object orbiting Planet Earth, such as the Moon or artificial satellites. Geocentric (having the Earth as its centre) orbits are organised as follow: 1) Low Earth orbit (LEO): geocentric orbits with altitudes (the height of an object above the average surface of the Earth’s oceans) from 100 to 2 000 kilometres. Satellites in LEO have a small momentary field of view, only able to observe and communicate with a fraction of the Earth at a time, meaning a network or constellation of satellites is required in order to provide continuous coverage. Satellites in lower regions of LEO also suffer from fast orbital decay (in orbital mechanics, decay is a gradual decrease of the distance between two orbiting bodies at their closest approach, the periapsis, over many orbital periods), requiring either periodic reboosting to maintain a stable orbit, or launching replacement satellites when old ones re-enter. 2) Medium Earth orbit (MEO), also known as an intermediate circular orbit: geocentric orbits ranging in altitude from 2 000 kilometres to just below geosynchronous orbit at 35 786 kilometres. The most common use for satellites in this region is for navigation, communication, and geodetic/space environment science. The most common altitude is approximately 20 000 kilometres which yields an orbital period of twelve hours. 3) Geosynchronous orbit (GSO) and geostationary orbit (GEO) are orbits around Earth at an altitude of 35 786 kilometres matching Earth’s sidereal rotation period. All geosynchronous and geostationary orbits have a semi-major axis of 42 164 kilometres. A geostationary orbit stays exactly above the equator, whereas a geosynchronous orbit may swing north and south to cover more of the Earth’s surface. Communications satellites and weather satellites are often placed in geostationary orbits, so that the satellite antennae (located on Earth) that communicate with them do not have to rotate to track them, but can be pointed permanently at the position in the sky where the satellites are located. 4) High Earth orbit: geocentric orbits above the altitude of 35 786 kilometres. The competing forces of gravity, which is stronger at the lower end, and the outward/upward centrifugal force, which is stronger at the upper end, would result in the cable being held up, under tension, and stationary over a single position on Earth. With the tether deployed, climbers could repeatedly climb the tether to space by mechanical means, releasing their cargo to orbit. Climbers could also descend the tether to return cargo to the surface from orbit.

#### 2] Space Elevators produce Debris:

#### a] Paint flakes off

O'Callaghan 19 Jonathan O'Callaghan September 2019 “What is space junk and why is it a problem?” <https://www.nhm.ac.uk/discover/what-is-space-junk-and-why-is-it-a-problem.html#:~:text=All%20space%20junk%20is%20the,it%20re%2Denters%20the%20atmosphere.&text=When%20two%20satellites%20collide%2C%20they,creating%20lots%20of%20new%20debris>. (freelance space and science journalist based in the UK)//Elmer

Finally, under the influence of extreme ultraviolet radiation, impinging atomic oxygen and impacting micro particles erode the surfaces of space objects. This leads to mass loss of surface coatings and to the detachment of paint flakes with sizes from micrometre to mm.

#### Paint is Debris.

Fedde 16 Corey Fedde 5-13-2016 "Space debris danger: Fast-moving paint flake dings window of space station" <https://www.csmonitor.com/Science/2016/0513/Space-debris-danger-Fast-moving-paint-flake-dings-window-of-space-station> (Corey Fedde interned for The Christian Science Monitor's business desk and rapid response team from 2015 to 2016. He received a Bachelor's Degree in English from Principia College in 2015. His hobbies include reading, writing, and long walks on the beach.)//Elmer

Space debris danger: Fast-moving paint flake dings window of space station A small paint flake orbiting Earth chipped one of the windows on the International Space Station. Space debris could be a growing danger to future space missions. Space travel brings with it a list of potential dangers, but astronaut Tim Peake added one more on Thursday: paint chips. The International Space Station (ISS) was struck sometime last month by a flake of paint or small metal fragment that caused a chip in the windows of the Cupola, "the best room with a view anywhere," the European Space Agency (ESA) said in a press release. Besides its official duty as the control room for the ISS's robotic arms, the Cupola room also serves as an observation area for astronauts on board to get a good view of Earth and approaching spacecraft. The ISS and the view from the Cupola are largely unharmed and safe. The ISS' most crucial areas for crew and technical equipment are built with shielding to withstand small strikes in orbit. Space debris, however, remains a danger. "While a chip like the one shown here may be minor, larger debris would pose a serious threat," the ESA said.

#### b] Space Elevators require Spacecraft Launches.

Edwards 3 Bradley C. Edwards 3-1-2003 "The Space Elevator NIAC Phase II Final Report" http://www.niac.usra.edu/files/studies/final\_report/521Edwards.pdf (PhD and works at Eureka Scientific)//Elmer

Propulsion One of the major components that impacts the construction, risk, cost, schedule, and complexity of the space elevator is the propulsion system on the deployment spacecraft. The reason this single component has such a dramatic effect on the program is because it can be the largest mass component that needs to be deployed on conventional rockets and thus limits the initial ribbon size that can be deployed from space. A reduction in the initial ribbon size ripples throughout the system and impacts everything else. With this in mind we have worked hard to understand and reduce the size and risks associated with the propulsion system. Initially, we had proposed a very conventional chemical rocket system of liquid and solid engines. This system was very massive and required some complex maneuvers on-orbit. It was viable but obviously a system driver. An alternative to chemical systems that has been around for decades but only used in limited numbers is electric propulsion in various forms.

#### Spacecraft Launches produce Debris.

Polyakov 21 Max Polyakov 5-5-2021 "We’re polluting our future home – before we even live there. Here’s why we need to clean up our space junk." <https://www.weforum.org/agenda/2021/05/why-we-need-to-clean-up-space-junk-debris-low-earth-orbit-pollution-satellite-rocket-noosphere-firefly/> (Founder, Noosphere Ventures, Firefly Aerospace, EOS Data Analytics)//Elmer

Where does space junk come from? As long as humans launch objects into orbit, space debris is inevitable. Rocket launches leave boosters, fairings, interstages, and other debris in LEO. So do rocket explosions, which currently account for seven of the top 10 debris-creating events.

#### 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.

#### Nanomaterials solve Warming and Water Scarcity.

Khullar 17 Bhavya Khullar 9-4-2017 "Nanomaterials Could Combat Climate Change and Reduce Pollution" <https://www.scientificamerican.com/article/nanomaterials-could-combat-climate-change-and-reduce-pollution/> (Former Programme Officer with the Food Safety and Toxins Unit, Centre for Science and Environment (CSE))//Elmer

August 18, 2017 — 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, a member of the chemistry faculty at the Center for Nanotechnology, Indian Institute of Technology Guwahati. HARVESTING CO2 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. The technology shows promise, but it’s not yet ready for prime time. “While the nanosponge is a good material to deal with oil spills, these results are confined to the laboratory,” says Ashok Ganguli, director of the Institute of Nano Science and Technology in Mohali, Punjab, India. “Large-scale synthesis is required if we have to remove oil from seawater which is spread over several miles.” Although scientists have yet to successfully synthesize nanomaterials for cleaning oil spills at a scale large enough for practical application, “this may become possible with more research and industry partnerships,” Chattopadhyay says.

#### 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).

#### 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. The implication is to reject 1ar theory BUT if you don’t then… Reasonability on 1AR shells –reasonability checks 2AR sandbagging by preventing really abusive 1NCs while still giving the 2N a chance.

#### DTA on 1AR shells - They can blow up blippy 20 second shells in the 2AR while I have to split my time and can’t preempt 2AR spin which necessitates judge intervention and means 1AR theory is irresolvable so you shouldn’t stake the round on it.

### 1NC---SSA DA

#### The plan demands tons of SSA resources

Sundalh 2000 [Mark Sundalh, J.D. candidate, Hastings College of the Law, 2001; Ph.D. (Classics), Brown University, 2000; B.A., University of California, Los Angeles, 1993.] “Unidentified Orbital Debris: The Case for a Market-Share Liability Regime” Hastings International and Comparative Law Review, Vol. 24, No. 1, Fall 2000 (<https://repository.uchastings.edu/cgi/viewcontent.cgi?article=1532&context=hastings_international_comparative_law_review>) – MZhu

Using a state's contribution to the existing identified debris population as the index for determining liability may create a perverse incentive for states to scale down their debris tracking activities. Since liability would be tied to the number of debris fragments whose ownership is known, states may try to reduce their liability simply by halting their efforts to identify debris. However, because several nations would soon be engaged in debris detection, the desire of each of these states to increase the risk-contribution of other states (and thereby reduce their own contribution) would cause each of them to track each other's debris aggressively. The sum of this multinational effort would easily offset the perverse incentive to reduce tracking one's own objects.

#### That undermines space weather assessment

Ferguson 15[Dale Ferguson PhD, “The Space Weather Threat to Situational Awareness, Communications, and Positioning Systems,” <http://ieeexplore.ieee.org/xpls/icp.jsp?arnumber=7070693#authors>]

According to [20] and [21], space situational awareness is a key goal for the U.S. DoD. The DoD must determine, in real time if possible, whether anomalies are due to the space weather or to hostile actions. Also, operations may be affected by efforts to prevent space weather-related outages, so space weather prediction and real-time anomaly resolution are very important to U.S. Security. The military has long relied on long-range communications as have key commercial concerns such as banking. Both the U.S. and German air forces understood the potential impact of space weather on communications during World War II [32]. Indeed, the U.S. Air Force established a Geophysics Directorate soon after it founded its first laboratory, the Air Force Cambridge Research Laboratory, in the late 1940s and then (1952) set up the Sacramento Peak Observatory to study solar effects on the environment relative to Air Force operations. Today these space weather research units have evolved into the Air Force Research Laboratory’s Space Weather Center of Excellence, the Solar Optical Observing Network and the National Solar Observatory. Space weather remains a major concern for all aerospace operations today. But there are several particular aspects of space weather that warrant special attention now. As the military faces increased competition for scarce resources, it has turned to commercial and private sector assets to supplement, and even replace military capabilities. This is particularly true in communications, whether space-based, ground-based, or Internet-based. We are now also relying on civil and commercial space services for crucial data such as imagery. However, these commercial assets seldom have the same degree of protection that military systems do. They tend not to be designed to be as effective as military systems against either man-made or natural threats such as space weather. Additionally, the economy upon which U.S. strength is based is increasingly dependent on, and vulnerable to, space weather effects. It is clear that a major event such as the 1859 Carrington event would devastate civil and military communications, as well as potentially destroy the global economy. It has been estimated that a Carrington event now could blow out thousands of transformers on the nation’s power grid, and it would be months before replacements could be put into place and full electrical power could be restored. And the probability of extreme events is not insignificant. On July 23, 2012, the Sun launched a CME that, had it been directed at earth, is estimated to have been as severe as the 1859 Carrington event [22]. However, there are potentially devastating problems at much lower levels of space environmental disturbances. Schrijver and Rabanal [23] show that commercial users believe they could use space weather data to mitigate more routine, but nonetheless serious impacts to routine services such as GPS positioning and even commercial power. Data now emerging show that many routine outages on such utilities as the power grid are highly correlated with routine space weather activity. Even the rate of lightning strikes during storms has been correlated with space weather activity [24]. This raises an additional concern. Today, routine problems with the communication links such as the Internet are often difficult to distinguish as to origin—is it manmade or natural? A significant attack or degradation in critical services could be masked by space weather disturbances. It may take some time, and a deliberate attack could do significant damage before its true nature was discerned. It is thus crucial to much better understand and predict the specific impact of space weather on routine operations, particularly commercial and civil systems we are increasingly dependent upon.

#### Lack of space weather data causes extinction

Dancer 16 [Benjamin Dancer, Director of Public Relations for the Colorado EMP Task Force on National and Homeland Security, which is the Colorado branch of a Congressional Advisory Board., 5-22-2016 https://www.benjamindancer.com/blog/2016/5/7/space-weather-an-existential-threat]

Could space weather threaten our civilization? It’s not a question most people think about. I started thinking about it for the first time in 2010 when I did the research for my novel Patriarch Run. That research introduced me to a lot of interesting people, and it brought me inside a pretty eclectic community: the small group of experts who understand just how close it is our civilization has chosen to dance to the apocalypse. The sun emitted a mid-level solar flare, peaking at 3:01 p.m. EDT on Oct. 2, 2014. NASA's Solar Dynamics Observatory, which watches the sun 24-hours a day, captured images of the flare. Solar flares are powerful bursts of radiation. Harmful radiation from a flare cannot pass through Earth's atmosphere to physically affect humans on the ground, however -- when intense enough -- they can disturb the atmosphere in the layer where GPS and communications signals travel. This flare is classified as an M7.3 flare. M-class flares are one-tenth as powerful as the most powerful flares, which are designated X-class flares. The Old Man RSS It was that community of experts who invited me in April to the Space Weather Workshop in Broomfield, Colorado. The workshop had three co-sponsors: National Oceanic and Atmospheric Administration (NOAA) Space Weather Prediction Center National Science Foundation (NSF) Division of Atmospheric and Geospace Sciences National Aeronautics and Space Administration (NASA) Heliophysics Division So I got to hang out with the world's foremost experts on the subject of space weather. And let me tell you it was quite surreal to be in a room full of scientists who understood that the factual conversation they were having in the conference hall would be dismissed as the stuff of conspiracy theories if it were to be heard on the street. The gist of what they were talking about is this: over the course of the last century, our civilization has unintentionally evolved to become utterly dependent on an electronic infrastructure that was built without a full understanding of the havoc space weather could wreak on its critical components. In other words, our critical infrastructure is ridiculously vulnerable to the sun's normal weather patterns. Diffuse gas—called plasma—flows outward from the sun as the “solar wind” and carries with it solar magnetic field lines that become entangled with the Earth's own magnetic field lines. Location of "holes" were detected in indicated pink layers, near Earth. One of the most unsettling moments occurred at a talk tucked away in the basement of the hotel given by Bill Murtagh, the Assistant Director of Space Weather for the White House Office of Science and Technology Policy (OSTP). Murtagh summarized what the scientific community currently understands about the impact severe space weather could have on modern civilization. It was a pretty grim analysis. “These space weather events are massive.” Murtagh spread his hands as wide as his arms would allow and said, “If this represents the size of a large coronal mass ejection, the earth would be about the size of a grain of sand between my hands being buffeted by that storm.” Although such events seem rare on a human timescale, the probability is near certainty that the Earth will be hit by very large storms. Such storms could result in economic catastrophe. But it gets worse. A storm large enough could pose an existential threat to the human species. At this point, there are two important questions to answer. 1. How is it that weather from space could threaten electronic systems like the power grid? 2. And how is it that humanity has become so dependent on electricity that the sudden collapse of that infrastructure could threaten systems as rooted in the soil as our food supply? When a coronal mass ejection disturbs the Earth's magnetic field, geomagnetically induced currents (GICs) are created that can fry circuits and melt the windings of heavy-duty transformers. If large transformers at enough substations were to fail, the entire electric grid could go down. A prolonged power outage could last anywhere between a few weeks to forever, depending on the severity of the damage. One of the many issues we'd be facing in such a crisis would be the replacement of the transformers. The windings for these large transformers are handcrafted, and it takes months, if not years, to fulfill an order when the electrical infrastructure is intact. In the event of a crisis, it would be very difficult, if not impossible, to fulfill a large order of replacement transformers. The repair couldn't happen quickly. Meanwhile, if the power is out across the country, a lot of bad things will take place. There is an historical example of this phenomenon. In 1859 the earth was buffeted by a coronal mass ejection known as the Carrington Event. That storm took down the electrical infrastructure of the planet. Fortunately for the people alive in 1859 (and their descendants), civilization wasn't yet dependent on that infrastructure. At this point, I'll transition and answer the second question. If you'd like to learn more about space weather and the mechanisms of destruction to our critical infrastructure, you could read other posts on this blog (there are some great resources at the links in this post) or you could read the intelligence report given to Jack in Patriarch Run. The second question... 100 years ago you didn't need electricity to feed the population. The "pre-electrical" carrying capacity of the planet was less than 2 billion people. Our electrical infrastructure has increased the planet's carrying capacity to 7.5 billion. Before refrigeration, food was grown just outside the urban centers. In other words, everybody ate locally. You can't feed our population of 325 million Americans (and growing) without our electrical infrastructure. The loss of the grid wasn't an existential threat 100 years ago because our grandparents were more self-reliant. They had more agricultural area per capita around their urban centers to meet their needs, as there were only 76 million Americans in 1900. It's just not possible for today's population, which is 4 times as large, to live as close to the land (as locally) as our grandparents did 100 years ago. It is a statement of fact to say that our major metropolitan centers have outstripped their local carrying capacities. To meet the human need we now outsource the production of food and basic goods from around the world. That outsourcing makes us quite vulnerable to an interruption in supply. Moreover, there is a whole list of things we can't do without electricity: irrigate crops, refine fuel, produce fertilizer, produce pesticides, process food, refrigerate food, transport food, etc. So let's examine a worst-case scenario. Without electricity, we could not distribute clean water to our cities or provide sanitation or healthcare. There would be no commerce as we have come to know it. Such a collapse would probably result in widespread starvation, the reintroduction of diseases vanquished by modern sanitation, unprecedented social unrest, and a skyrocketing mortality rate. But what if it's just a little storm? When the big players in Washington, like FEMA, wrapped their heads around the potential catastrophe, they asked Bill Murtagh to answer a couple very important questions. "If we were to prepare for a 100 year storm, what does that look like? What about a 1,000 year storm?" Murtagh's answer. "We don't know. This is a fairly new science, and we don't have enough data yet." The Washington players wanted to know just how big the Carrington Event was? "What do we need to do to prepare for a storm like that?" The answer. "We don't have enough data to know how big that storm was." "Well, then what's the maximum? What's the most the sun can throw at us?" Murtagh's answer. "We don't know." What we do know is that there are critical components to our infrastructure that cannot be easily replaced, which means that there is a damage threshold that if crossed would render the situation unrecoverable.

### 1NC---Orbital Use Fee CP

#### 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 CP is competitive – you should give us Normal Means Competition – it was clearly flagged in the 1AC and actively defended as how the Plan would be implemented, meaning the CP is a distinct Policy Option. Specification PICs are best for in-depth, nuanced, and detailed debates by holding Affs accountable which is better for Topic Ed and Real-World Policy Education.

#### 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).

## 1NC---Case

### 1NC---AT: 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.

#### Comprehensive SSA is the only factor limiting a Chinese A2/AD bubble

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Rahul, with Aradhya Shandilya. “Mitigating the threat in space: Chi- nese military space capability and India's response". National Security, Vi- vekananda International Foundation Vol.II (1), (2019) pp. 115-136. <https://www.vifindia.org/sites/default/files/national-security-vol-2-issue-1-article-RkAs.pdf>

--focus on info dominance to win war – will ight short, decisive battles in info dark situations and make it too costly for us to go

--need a2/ad bubble to zone us out – key is target acquisition which relies on ssa to know what sats to hit

The PLA’s focus on asserting information dominance has led to the integration of network warfare and electronic warfare capabilities for counterspace operations as well, likely under the ambit of the SSF. The warning signs of an advanced cyber capability against space assets came through exercises conducted by China as early as 2007 and 2008. US satellites were hacked into in both these exercises and in the former, satellite communication with ground stations was interrupted for 12 minutes, displaying China’s ability to suspend critical information flow of the enemy in times of conflict.22 Beijing has continued to develop and test these capabilities. In 2014, an American imaging satellite was hacked and was prevented from transferring remote imaging for 2 days to ground stations for processing.23

Such Denial of Service (DOS) attacks fit into China’s plans for short, decisive victories in information dark situations for the enemy, even to transfer functions onto redundant capabilities, it would take precious time that could be used by the Chinese military to conduct offensive operations with superior information, playing into the strategy laid out in several Chinese doctrines. The only aspect that is yet to be executed is China’s ability to coordinate such attacks to create an A2/AD bubble in a region, which is the PLA’s eventual objective especially in maritime conflicts fought around the Chinese mainland or island groups.

To create such a bubble against a network of satellites would require not just the possession of such counterspace capabilities, but target acquisition and circumvention of defense measures. Target acquisition requires comprehensive Space Situational Awareness (SSA) capabilities,V which China does not possess at the moment and is unlikely to be operational in the near future. Hence, while the Chinese currently have the capability to interrupt normal functions of certain critical space- based infrastructure, it is unlikely they can create information dark zones for large satellite networks such as the ones the US possesses; they may still have the ability to acquire a tactical edge through their capabilities for short periods of time.

#### A2/AD makes Taiwan invasion possible

Cordesman and Kendall, 16

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--Being able to have dominance is key – they need to be able to deny us freedom of access in space and have total informational superiority – otherwise we can undermine A2/AD from space

--speifically we can use GPS to fuck with their stuff or hit beidou which they rely on to make a2ad work– if we’re zoned out of space bc of arms control we cant

For many watchers of the Asia-Pacific, anti-access/area-denial (A2/AD) is the most serious challenge the U.S. faces in shaping its forces for the region. Anti-access/area-denial (A2/AD) is a Chinese strategy based around restricting enemy access to a certain strategic location, while it exerts forceful control over a territorial asset like Taiwan or a disputed maritime claim. It is designed to “ [deter, dissuade or defeat](http://www.defense.gov/Portals/1/Documents/pubs/2016%20China%20Military%20Power%20Report.pdf) ” the involvement of a third party in a confrontation or conflict over such issues, and is targeted at the United States or any of its Pacific allies that might intervene. At the same time, the actual implementation of A2/AD is immensely complicated. Both China and the United States need to be careful in assessing what China can and cannot do, and what its strategic impact is in both the competition and risk of conflict between them. A2/AD requires advanced intelligence, surveillance, and reconnaissance (ISR), as well as advanced targeting, communications, naval, air, missile defense, and cyber capabilities. China has spent a “ [generation](http://www.mitpressjournals.org/doi/pdf/10.1162/ISEC_a_00249)” attempting to develop the technological capabilities necessary, and it still remains debatable if they are capable of A2/AD implementation. If China is to successfully develop A2/AD capability, it will owe much credit to its rapidly advancing space capability and satellite infrastructure. At its simplest, A2/AD is centered on conventional counterforce targeting. In order to deny access, China must be able to execute a [kill-chain](http://www.mitpressjournals.org/doi/pdf/10.1162/ISEC_a_00249) starting with, “target detection and including munition delivery, weapon guidance, damage assessment, and potential restrike” of its opponent’s battleships, aircraft carriers, fighter jets, submarines, information hubs, and missile positions at long distances. This requires significant tracking and C4ISR ability, much of which can only be provided by space-based assets. Further necessitating advanced space-based tracking capabilities is the fact that the Pacific Ocean is a massive battlefield. China has roughly 875,000 [nautical square miles](http://www.oni.navy.mil/Portals/12/Intel%20agencies/China_Media/2015_PLA_NAVY_PUB_Print.pdf?ver=2015-12-02-081247-687) in its near seas area to monitor and control—expanding to another 1.5 million if the strategically important Philippine Sea becomes involved. Additionally, the seas lanes near China’s coast are some of worlds most trafficked by civilian ships making tracking and identification even more difficult. China must also build the integrated system necessary for the substantial tracking needed for A2/AD. This [requires](http://www.andrewerickson.com/wp-content/uploads/2014/02/China-Air-Space-Based-ISR_Chinas-Near-Seas-Combat-Capabilities_CMS11_201402.pdf), “high-quality real-time satellite imagery and target locating data and fusion, as well as of reliable indigenous satellite positioning, navigation, and timing (PNT)”. Accordingly, China has undergone a substantial expansion of its satellite program. In 2000, China [possessed](http://origin.www.uscc.gov/sites/default/files/Annual_Report/Chapters/Chapter%202%2C%20Section%202%20-%20China%27s%20Space%20and%20Counterspace%20Programs.pdf) only 10 satellites, that [number](http://www.ucsusa.org/nuclear-weapons/space-weapons/satellite-database#.V7Ifhk0rLct) now stands at 181. For comparison, the United States and Russia have 576 and 140, respectively. China shows no signs of slowing down, having launched a Gaofen 3 satellite on August 10th, with a Chinese official [noting](http://www.nytimes.com/reuters/2016/08/10/world/asia/10reuters-southchinasea-china-satellite.html?_r=0), “Gaofen 3 will be very China has also now deployed satellites with an array of capabilities such as [electro-optical](http://www.space.com/8013-china-launches-military-reconnaissance-satellite.html) (EO), [synthetic aperture radar](http://news.xinhuanet.com/english/2016-08/10/c_135582857.htm) (SAR), and [electronic reconnaissance](https://project2049.net/documents/china_electronic_intelligence_elint_satellite_developments_easton_stokes.pdf)(ELINT). Different satellites have various weaknesses like tracking during poor weather conditions, functioning at nighttime, and image quality. Thus, it is of paramount importance to maintain an array of satellite technology for tracking moving targets. Next, China’s A2/AD strategy requires space capabilities for missile guidance. To this end China has spent years developing its own version of Global Positioning System (GPS) entitled Beidou. Currently, [Beidou](http://origin.www.uscc.gov/sites/default/files/Annual_Report/Chapters/Chapter%202%2C%20Section%202%20-%20China%27s%20Space%20and%20Counterspace%20Programs.pdf) has 19 operational satellites and is deployed regionally by the PLA with plans to expand to worldwide coverage by 2020 following expansion to 35 total satellites. Most missiles utilize some sort of GPS or similar technology for targeting. This is a lesson that China learned in a particularly shocking way during the 1995-1996 Taiwan Strait Crisis. In the midst of the crisis, China was “testing” missiles by launching them in the vicinity of Taiwan. However, in the midst of these tests the PLA was unable to track a number of the launched missiles. This was attributed by the PLA to GPS interference—which is owned and run by the United States government. A retired Chinese colonel [noted](http://www.scmp.com/article/698161/unforgettable-humiliation-led-development-gps-equivalent), “It was a great shame for the PLA ... an unforgettable humiliation. That's how we made up our mind to develop our own global [satellite] navigation and positioning system, no matter how huge the cost, Beidou is a must for us. We learned it the hard way.” Missile development has been a substantial focus of Chinese military modernization. The National Air and Space Intelligence Center has [stated](http://fas.org/programs/ssp/nukes/nuclearweapons/NASIC2013_050813.pdf) that, “China has the most active and diverse ballistic missile development program in the world”. In the mid-1990s China possessed only about 30-50 short-range ballistic missiles (SRBMs) with the capability to reach Taiwan. According to the [Pentagon](http://www.defense.gov/Portals/1/Documents/pubs/2016%20China%20Military%20Power%20Report.pdf), China now possesses roughly 1,200 SRBMs and an additional 400 land-attack cruise missiles (LACMs). These potentially can hold targets in the first and second island chain—like US bases in Japan, Korea, and Guam—at risk. In an A2/AD situation, PLA strategists envision launching multi-axis salvos including an array of ballistic and cruise missiles in order to overpower and confuse the opposition’s missile defense. China’s massive missile and satellite proliferation are tied together as space capabilities are necessary to ensure the long-range precision capability of the advanced missiles. China’s production of the [DF-21D](http://missilethreat.com/missiles/df-21-21a-21b-21c-21d-css-5/?country=china#china) and [DF-26](http://nationalinterest.org/blog/the-buzz/chinas-df-26-anti-ship-ballistic-missile-what-does-the-16260), the world’s first anti-ship ballistic missiles (ASBM), were also developed with A2/AD in mind. The implications of ASBMs are so significant that it has even led to [debates](http://warontherocks.com/2016/07/the-threat-is-here-its-just-distributed-unevenly-a2ad-and-the-aircraft-carrier/) regarding the future efficacy of the aircraft carrier. The ability to legitimately threaten U.S. forward deployed aircraft carriers and battleships in the Pacific makes A2/AD look plausible. However, ASBMs are not a new concept. In the 1970’s the [Soviets](http://www.andrewerickson.com/2016/03/my-latest-assessment-of-chinese-and-foreign-anti-ship-ballistic-missile-asbm-development-now-available-in-janes-navy-international/) invested substantial time and energy into an ASBM before failing due to problems regarding tracking and targeting. Indeed, Andrew S. Erickson [notes](http://www.andrewerickson.com/2013/05/chinese-anti-ship-ballistic-missile-development-drivers-trajectories-and-strategic-implications/) regarding current Chinese capabilities, “C4ISR technologies probably still lag behind the requirement to identify and track a U.S. aircraft carrier in real time under wartime conditions.” These problems can be mitigated to some degree in a near seas situation with over-the-horizon radar, sea-based radar, and UAV ISR. However, effective space-based C4ISR capable of providing faster processing, more imagery, and data fusion is necessary for the ASBM to reach its full potential for targeting across the Asia-Pacific. This makes China’s continuing aggressive space expansion absolutely critical to its A2/AD efforts. China plans not only to utilize it own space capabilities in an A2/AD scenario, it also plans to deny it opponent’s capability, with the goal of achieving “information superiority”. Due to the high level of reliance the US has placed on its space capabilities, PLA strategists see it as a weakness that can be exploited.

#### A2/AD backed siege on Taiwan goes nuclear

Dr. Adam Lowther 15, Director, School of Advanced Nuclear Deterrence Studies, Air Force Global Strike Command, with Alex Littlefield is a professor at Feng Chia University, Taiwan and the Prospects for War Between China and America, August 11, http://thediplomat.com/2015/08/taiwan-and-the-prospects-for-war-between-china-and-america/

Possible Scenario¶ While there are several scenarios where conflict between the United States and China is possible, some analysts believe that a conflict over Taiwan remains the most likely place where the PRC and the U.S. would come to blows. Beijing is aware that any coercive action on its part to force Taiwan to accept its political domination could incur the wrath of the United States. To prevent the U.S. from intervening in the region, China will certainly turn to its anti-access/area-denial (A2/AD) strategy, beginning with non-lethal means and non-lethal threats to discourage the American public from supporting the use of force in support of Taiwan.¶ If thwarted in its initial efforts to stop Chinese aggression against Taiwan, the United States may be tempted to resort to stronger measures and attack mainland China. A kinetic response to a cyber-attack, for example, although an option, would very likely lead to escalation on the part of the Chinese. Given the regime’s relative weakness and the probability that American attacks (cyber and conventional) on China will include strikes against PLA command and control (C2) nodes, which mingle conventional and nuclear C2, the Chinese may escalate to the use of a nuclear weapon (against a U.S. carrier in China’s self-declared waters for example) as a means of forcing de-escalation.¶ In the view of China, such a strike would not be a violation of its no-first-use policy because the strike would occur in sovereign Chinese waters, thus making the use of nuclear weapons a defensive act. Since Taiwan is a domestic matter, any U.S. intervention would be viewed as an act of aggression. This, in the minds of the Chinese, makes the United States an outside aggressor, not China.¶ It is also important to remember that nuclear weapons are an asymmetric response to American conventional superiority. Given that China is incapable of executing and sustaining a conventional military campaign against the continental United States, China would clearly have an asymmetry of interest and capability with the United States – far more is at stake for China than it is for the United States.¶ In essence, the only effective option in retaliation for a successful U.S. conventional campaign on Chinese soil is the nuclear one. Without making too crude a point, the nuclear option provides more bang for the buck, or yuan. Given that mutually assured destruction (MAD) is not part of China’s strategic thinking – in fact it is explicitly rejected – the PRC will see the situation very differently than the United States.¶ China likely has no desire to become a nuclear peer of the United States. It does not need to be in order to achieve its geopolitical objectives. However, China does have specific goals that are a part of its stated core security interests, including reunification with Taiwan. Reunification is necessary for China to reach its unstated goal of becoming a regional hegemon. As long as Taiwan maintains its de facto independence of China it acts as a literal and symbolic barrier to China’s power projection beyond the East China Sea. Without Taiwan, China cannot gain military hegemony in its own neighborhood.¶ China’s maritime land reclamation strategy for Southeast Asia pales in scope and significance with the historical and political value of Taiwan. With Taiwan returned to its rightful place, the relevance to China of the U.S. military presence in Japan and South Korea is greatly diminished. China’s relationship with the Philippines, which lies just to the south of Taiwan, would also change dramatically.¶ Although China criticizes the United States for playing the role of global hegemon, it is actively seeking to supplant the United States in Asia so that it can play a similar role in the region. While Beijing may take a longer view toward geopolitical issues than Washington does, Chinese political leaders must still be responsive to a domestic audience that demands ever higher levels of prosperity.¶ Central to China’s ability to guarantee that prosperity is the return of Taiwan, and control of the sea lines of commerce and communication upon which it relies. Unfortunately, too many Americans underestimate the importance of these core interests to China and the lengths to which China will ultimately go in order to guarantee them – even the use of nuclear weapons.¶ Should China succeed it pushing the United States back, the PRC can deal with regional territorial disputes bilaterally and without U.S. involvement. After all, Washington invariably takes the non-Chinese side.¶ China sees the U.S. as a direct competitor and obstacle to its geopolitical ambitions. As such it is preparing for the next step in a crisis that it will likely instigate, control, and conclude in the Taiwan Straits. China will likely use the election or statement of a pro-independence high-ranking official as the impetus for action. This is the same method it used when it fired missiles in the Straits in response to remarks by then-President Lee Teng-hui, ushering in the 1996 Taiwan Straits Crisis. The U.S. brought an end to the mainland’s antics when the U.S.S Nimitz and six additional ships sailed into the Straits.¶ Despite the pro-China presidency of Ma Ying-jeou, China continues to expand its missile force targeting Taiwan and undertakes annual war games that simulate an attack on Taiwan.¶ China has not forgotten the humiliation it faced in 1996 and will be certain no U.S. carrier groups have access to the Strait during the next crisis. The Second Artillery Corps’ nuclear capabilities exist to help secure the results China seeks when the U.S. is caught off-guard, overwhelmed, and forced to either escalate a crisis or capitulate.¶ While the scenario described is certainly not inevitable, the fact than many American readers will see it as implausible if not impossible is an example of the mirror-imaging that often occurs when attempting to understand an adversary. China is not the United States nor do Chinese leaders think like their counterparts in the United States. Unless we give serious thought to possible scenarios where nuclear conflict could occur, the United States may be unprepared for a situation that escalates beyond its ability to prevent a catastrophe.

#### Squo debris thumps

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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.

#### 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.

### 1NC---AT: Space Col

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

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.

### 1NC---AT: Climate Change

#### Data not key to solve warming – and it’s not used anwyays

Starr 14 - psychologist, journalist, and professor emeritus at the City University of New York, Brooklyn College (Bernard, “Our Oceans Are Dying: Mobilizing an Indifferent Public to Confront This Crisis,” Huffington Post, 6-27-14, http://www.huffingtonpost.com/bernard-starr/our-oceans-are-dying\_b\_5533322.html)

After an eighteen-month investigation, the Commission, made up of former heads of state, government officials, and prominent business leaders concluded that our oceans are dying from climate change, pollution, and over-fishing. The Commission proposes an eight point program to rescue the oceans over the next five years. Why should we be concerned? José María Figueres, Co-chair of the Commission and former president of Costa Rica, has summed up the dire situation with these words: "The ocean provides 50 percent of our oxygen and fixes 25 percent of global carbon emissions. Our food chain begins in that 70 percent of the planet." He added that "a healthy ocean is key to our well-being, and we need to reverse its degradation." He warned: "Unless we turn the tide on ocean decline within five years, the international community should consider turning the high seas into an off-limits regeneration zone until its condition is restored." A Commission video states the crisis even more starkly: "No ocean, no us!" In his brief talk at the reception, David Miliband, also co-chair of the Ocean Commission and former UK Foreign Secretary, urged politicians, scientists, journalists, and ordinary citizens to rally behind the salvation of our oceans and the planet -- and to get the message out to others. Will getting the message out turn the tide in the battle to save the planet? I doubt it. **We are swimming in information and messages**. Earlier the this year leading scientists declared that we are fast approaching the critical point of no return for climate change -- a point with predictable devastating consequences. But **who is listening?** The public continues to be **frighteningly indifferent**. Who among the public is willing to place the salvation of the planet over immediate personal concerns? That question was dramatically called to my attention recently when I presented a list of critical issues to a group of seniors enrolled in a life-long learning program and asked them which one they would place first. The list included: terrorism and national defense, global warming, jobs, vanishing icebergs, protecting Social Security, income inequality, ocean pollution, sustaining Medicare, protecting the Amazon rain forests, reducing fossil fuel emissions, regulating Wall Street and the banks, stopping fracking (shale gas drilling), protecting wildlife (elephants, lions, whales, etc.), eliminating genetically modified foods (GMOs), campaign finance reform, free college education for all, national healthcare (Medicare for all). I was particularly interested in the seniors' answers since popular wisdom says that seniors are more concerned than other age groups with the welfare of children, grandchildren, and future generations. And no issue is more vital for the well-being of future generations than the viability of life on the planet. Psychologist Erik Erikson called this concern of older adults "generativity." But the seniors defied conventional wisdom. Jobs, Social Security, and income inequality topped their listings. Only one person, toward the end of the discussion, cited climate change -- and his response seemed almost gratuitous in recognition that we were about to screen a documentary on the melting of icebergs. Perhaps I should not have been surprised. Politicians avoid talking about environmental issues for fear of losing favor with their constituents, who are clamoring for jobs, mortgage relief, and financial security. During the 2012 presidential debates between Barack Obama and Mitt Romney environmental issues took a far **back** seat; in fact, they were barely mentioned. Both candidates knew instinctively that in the throes of an economic crisis placing the salvation of the planet high on the national agenda would not generate votes. It might even take away votes from people who feared the candidate would be indifferent to their personal struggles. So where does this leave us? If more environmental studies and more alarming news will not mobilize leaders and the public for an all-out commitment to the preservation of our small vulnerable corner of the universe, what will? Perhaps we need to shift our focus from information to changing human behavior. Let's enlist leading behavioral scientists and psychological associations to address how to awaken the public to the urgency of protecting the planet. Let's launch a campaign to make this the number-one priority. And let's adopt these mantras: No planet, no jobs; no planet, no Social Security; no planet, no mortgages; no planet, no corporate bonus packages. No planet, no us.

### 1NC---AT: 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.

### 1NC---AT: 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.

### 1NC---AT: Astronomy

#### Two Thumpers:

#### 1] Status Quo Debris thumps – 1AC Turner is about the 9,300 tons of “shiny satellites” and “junk” that already exist

#### 2] Light Pollution –

Vaonis 19 "Why do the Stars Disappear?" <https://vaonis.com/light-pollution-astronomy> //Elmer

What are the effects of light pollution on astronomy? The light throughput generated by a city or a town does not spread itself exactly where it is meant to. An excessive amount of that light is projected towards the sky, forming a huge diffusive orange or blue halo depending on the primary type of light source used within the area. Whether inside these urban areas or in suburbs, the adjective “dark sky” seems to be obsolete, on grounds of this blurred veil disabling any contrasted view of the stars. Consequently, it becomes pretty hard to spot the stars and the constellations since the cities’ glow are decreasing the luminosity threshold – called magnitude – our eyes are capable of reaching. In a totally light-pollution-free sky, 6.5 is the limit magnitude our eyes can detect without help of any sorts of optical instruments. In other words, theoretically 2 500 stars of our sky would be accessible to the naked eye. In most of the cities, though, the magnitude over the one stars are being hidden because of light pollution drops down to 4.0 or 3.0. In these harsh conditions, only 300 or 200 stars are visible except in the heavy populated urban areas like Paris, London, New York, Hong Kong where around 30 stars and less are still shining. Keen amateur astronomers are the main victims of the rise of light pollution. Even today, professional astronomers observing through state-of-the-art telescopes are concerned by the over use of lighting, like in Chile.