## **Contention 1: Space Mining**

Space mining by private entities will be full scale in a few years

Krishnan 20 CA Krishnan, former Deputy Chief and advisor defense industries, 8-6-2020, Space mining: Just around the corner?, https://www.theweek.in/news/sci-tech/2020/08/06/Space-mining-Just-around-the-corner.html, 12-30-2021

Fast paced developments **are** taking place in the field of space mining technology with **private players** in the lead. Optical mining using concentrated sunlight, robotics, automated mining applications, advanced drilling machines etc are just a few examples. Participation of private players has reduced the investment burden and greatly **enhanced** the width and **pace** of innovation. It is believed that launch of the first asteroid mining vehicle as well as setting up of the first fuelling stations on the Moon and in low earth orbit could become a reality **within a decade**.

#### Guaranteed property rights are needed to reassure companies that they actually get to sell what they mine, incentivizing space investment

Wall 15 Mike Wall, 11-20-2015, New Space Mining Legislation Is 'History in the Making', https://www.space.com/31177-space-mining-commercial-spaceflight-congress.html, 12-30-2021

Space mining just got a **big boost.** The U.S. Congress' passage of a bill that allows American companies to **own** and sell materials they extract from the moon, asteroids or other celestial bodies should help **spur** the development of off-Earth mining, representatives of the nascent industry say. "It sets up a firm foundation for the next phase of our business," said Chris Lewicki, president and chief engineer of Planetary Resources, which plans to mine water and metals from near-Earth asteroids. [Asteroid Mining: Planetary Resources' Plan in Pictures] "It's a sign to everyone that [exploiting] space resources, and commercial space exploration, is underway, and it's **happening now**," Lewicki told Space.com. "It's not something that's going to happen in the far future. You are seeing history in the making." The bill, known as the U.S. Commercial Space Launch Competitiveness Act (CSLCA), was approved by the Senate on Nov. 10 and by the House of Representatives on Monday (Nov. 16). The CSLCA will now go to the White House, and most experts expect President Barack Obama to sign it. The bill addresses a number of spaceflight issues. For example, it extends the United States' commitment to the International Space Station through at least 2024, and it gives private companies until 2023 to meet human-spaceflight safety standards, pushing back the original deadline by seven years. But the space-mining aspect of CSLCA has generated the most headlines. The bill's Title IV reads, in part: "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 resources obtained in accordance with applicable law, including the international obligations of the United States."

### Climate Change Impact:

#### 1) Mining on Earth is the biggest waste producer, contributing to climate change – space mining solves

MacWhorter 16 Kevin MacWhorter 16, J.D. Candidate, William & Mary Law School, "Sustainable Mining: Incentivizing Asteroid Mining in the Name of Environmentalism", William & Mary Environmental Law and Policy Review, Vol 40, Issue 2, Article 11, https://scholarship.law.wm.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1653&context=wmelpr

A. Rare Element Mining on Earth In the next sixty years, scientists predict that certain elements crucial to modern industry such as platinum, zinc, copper, phosphorous, lead, gold, and indium could be exhausted on Earth. 12 Many of these have no synthetic alternative, unlike chemical elements such as oil or diamonds.13 Liquid-crystal display (LCD) televisions, cellphones, and laptops are among the various consumer technologies that use precious metals.14Further, green technologies including wind turbines, solar panels, and catalytic converters require these rare elements. 15 As demand rises for both types of technologies, and as reserves of rare metals fall, prices skyrocket.16 Demand for nonrenewable resources creates conflict, and consumerism in rich countries results in harsh labor treatment for poorer countries.17 In general, the mining industry is extremely destructive to Earth’s environment.18 In fact, depending on the method employed, mining can destroy entire ecosystems by polluting water sources and contributing to deforestation.19 It is by its nature an unsustainable practice, because it involves the extraction of a finite and non-renewable resource.20 Moreover, by extracting tiny amounts of metals from relatively large quantities of ore, the mining industry contributes the largest portion of solid wastes in the world.21 The Environmental Protection Agency (EPA) describes the industry as the source of more toxic and hazardous waste than any other industrial sector [in the United States], costing billions of dollars to address the public health and environmental threats to communities. 22 Poor regulations and oxymoronic corporate definitions of sustainability, however, make it unclear as to just how much waste the industry actually produces.23 Platinum provides an excellent case study of the issue, because it is an extremely rare and expensive metal—an ore expected to exist in vast quantities in asteroids.24 Further, production of platinum has increased sharply in the past sixty years in order to keep up with growing demand for use in new technologies.25 In fact, despite their high costs, platinum group metals are so useful that [one] of [four] industrial goods on Earth require them in production. 26 Scholars do not expect demand to slow any time soon.27 Among other technologies, industries use platinum in products such as catalytic converters, jewelry production, various catalysts for chemical processing, and hydrogen fuel cells.28 While there is no consensus on how far the Earth’s reserves of platinum will take humanity, many scientists agree that platinum ore reserves will deplete in a relatively short amount of time.29 With the rate of mining at an all-time high,30 it is increasingly clear that historical patterns of mineral resources and development cannot simply be assumed to continue unaltered into the future. 31 The platinum mining industry, however, has a strong incentive to increase its rate of extraction as profits grow with the rate of demand. Without any alternative, this destructive practice will continue into the future.32 So-called platinum-group metal (PGM) ores are mined through underground or open cut techniques.33 Due to these practices, all but a very small fraction of the mined platinum ore is disposed of as solid waste.34 The environmental consequences of platinum production are thus quite significant, but like the mining industry in general, the amount of waste is typically under-reported.35 While this is due to high production levels at the moment, those levels will only increase given the estimated future demand of platinum.36 In spite of the negative consequences, mining continues unabated because it is economically important to many areas.37 The future environmental costs provide a major challenge in creating a sustainable system. Relegating at least some mining companies to near-Earth asteroids would reduce the negative effects of future mining levels on Earth. The economic benefits of mining need not be sacrificed for the sake of the environment.38

#### 2] Space mining is necessary to provide green energy and infrastructure. The earth simply doesn’t have enough energy and metals to transition to stop climate change.

Duran 21, (Paloma Duran is a journalist and industry analyst at Mexico Business News, “Is Space Mining the Best Option to Face Climate Change?”), 11-03-21, Mexico Business News, https://mexicobusiness.news/mining/news/space-mining-best-option-face-climate-change // MNHS NL

Going to net zero means that more mining is needed. Experts have said that the current supply cannot support the necessary metals demand for the green transition. As a result, new mining alternatives have gained greater relevance, among them is space mining. Several countries, including Mexico, have shown their interest in this alternative, creating a new space race. “The solar system can support a billion times greater industry than we have on Earth. When you go to vastly larger scales of civilization, beyond the scale that a planet can support, then the types of things that civilization can do are incomprehensible to us … We would be able to promote healthy societies all over the world at the same time that we would be reducing the environmental burden on the Earth,” said Dr. Phil Metzger, Planetary Scientist at the University of Central Florida. Currently, there are several attempts to address global warming and transition to a net zero carbon economy. There has been an increasing interest in renewable energy and infrastructure, which has increased demand for various minerals, especially lithium, cobalt, nickel, copper and rare earth elements. However, according to experts, the world is close to entering a metals supercycle, where demand will exceed available supply, causing prices to skyrocket. Consequently, the mining industry has sought alternatives to achieve the required supply. Options include recycling and improved mine waste management, sea mining and space mining. The latter is considered one of the alternatives with the greatest potential. However, a regulatory framework is still lacking and there is almost no experience in this regard. Despite the lack of knowledge regarding space mining, it has become a very attractive option since the planet is running out of resources. While some people believe that land-based mining is cheaper than space mining, experts believe this may change in the long term. Furthermore, within the solar system there are countless bodies rich in minerals, ores and elements that will accelerate the fight against climate change. “There will come a point when there is nothing left to mine on the surface, prompting mines to reach even further below. But even those resources are destined to run out and so we will aim toward ocean mining, which already has specific technologies that are being developed. Nevertheless, even those mines are limited as well. The mine of the future, which today may seem unlikely, will no longer be on our planet. There will be a time when space mining will be as common as an open leach mine,” Eder Lugo, Minerals Head at Siemens, told MBN. More than 150 million asteroids measuring approximately 100m are believed to be in the inner solar system alone. In addition, astronomers have also identified abundant minerals near the Earth’s space and the Main Asteroid Belt. There are three main groups into which asteroids are divided: C- type, S- type, and M- type. The last two groups are the most abundant in minerals such as gold, platinum, cobalt, zinc, tin, lead, indium, silver, copper and rare earth metals. "Energy is limited here. Within just a few hundred years, you will have to cover all of the landmass of Earth in solar cells. So, what are you going to do? Well, what I think you are going to do is you are going to move out in space … all of our heavy industry will be moved off-planet and Earth will be zoned residential and light-industrial,” said Jeff Bezos, Founder of Amazon and the Space Launch Provider Blue Origin.

#### Climate Change causes extinction and worsens all impacts--- We have to take action

Griffin, 2015 (David, Professor of Philosophy at Claremont, “The climate is ruined. So can civilization even survive?”, CNN, 4/14/2015, <http://www.cnn.com/2015/01/14/opinion/co2-crisis-griffin/> )

Although most of us worry about other things, climate scientists have become increasingly worried about the survival of civilization. For example, Lonnie Thompson, who received the U.S. National Medal of Science in 2010, said that virtually all climatologists "are now convinced that global warming poses a clear and present danger to civilization." Informed journalists share this concern. The climate crisis "threatens the survival of our civilization," said Pulitzer Prize-winner Ross Gelbspan. Mark Hertsgaard agrees, saying that the continuation of global warming "would create planetary conditions all but certain to end civilization as we know it." These scientists and journalists, moreover, are worried not only about the distant future but about the condition of the planet for their own children and grandchildren. James Hansen, often considered the world's leading climate scientist, entitled his book "Storms of My Grandchildren." The threat to civilization comes primarily from the increase of the level of carbon dioxide (CO2) in the atmosphere, due largely to the burning of fossil fuels. Before the rise of the industrial age, CO2 constituted only 275 ppm (parts per million) of the atmosphere. But it is now above 400 and rising about 2.5 ppm per year. Because of the CO2 increase, the planet's average temperature has increased 0.85 degrees Celsius (1.5 degrees Fahrenheit). Although this increase may not seem much, it has already brought about serious changes. The idea that we will be safe from "dangerous climate change" if we do not exceed a temperature rise of 2C (3.6F) has been widely accepted. But many informed people have rejected this assumption. In the opinion of journalist-turned-activist Bill McKibben, "the one degree we've raised the temperature already has melted the Arctic, so we're fools to find out what two will do." His warning is supported by James Hansen, who declared that "a target of two degrees (Celsius) is actually a prescription for long-term disaster." The burning of coal, oil, and natural gas has made the planet warmer than it had been since the rise of civilization 10,000 years ago. Civilization was made possible by the emergence about 12,000 years ago of the "Holocene" epoch, which turned out to be the Goldilocks zone - not too hot, not too cold. But now, says physicist Stefan Rahmstorf, "We are catapulting ourselves way out of the Holocene." This catapult is dangerous, because we have no evidence civilization can long survive with significantly higher temperatures. And yet, the world is on a trajectory that would lead to an increase of 4C (7F) in this century. In the opinion of many scientists and the World Bank, this could happen as early as the 2060s. What would "a 4C world" be like? According to Kevin Anderson of the Tyndall Centre for Climate Change Research (at the University of East Anglia), "during New York's summer heat waves the warmest days would be around 10-12C (18-21.6F) hotter [than today's]." Moreover, he has said, above an increase of 4C only about 10% of the human population will survive. Believe it or not, some scientists consider Anderson overly optimistic. The main reason for pessimism is the fear that the planet's temperature may be close to a tipping point that would initiate a "low-end runaway greenhouse," involving "out-of-control amplifying feedbacks." This condition would result, says Hansen, if all fossil fuels are burned (which is the intention of all fossil-fuel corporations and many governments). This result "would make most of the planet uninhabitable by humans." Moreover, many scientists believe that runaway global warming could occur much more quickly, because the rising temperature caused by CO2 could release massive amounts of methane (CH4), which is, during its first 20 years, 86 times more powerful than CO2. Warmer weather induces this release from carbon that has been stored in methane hydrates, in which enormous amounts of carbon -- four times as much as that emitted from fossil fuels since 1850 -- has been frozen in the Arctic's permafrost. And yet now the Arctic's temperature is warmer than it had been for 120,000 years -- in other words, more than 10 times longer than civilization has existed. According to Joe Romm, a physicist who created the Climate Progress website, methane release from thawing permafrost in the Arctic "is the most dangerous amplifying feedback in the entire carbon cycle." The amplifying feedback works like this: The warmer temperature releases millions of tons of methane, which then further raise the temperature, which in turn releases more methane. The resulting threat of runaway global warming may not be merely theoretical. Scientists have long been convinced that methane was central to the fastest period of global warming in geological history, which occurred 55 million years ago. Now a group of scientists have accumulated evidence that methane was also central to the greatest extinction of life thus far: the end-Permian extinction about 252 million years ago. Worse yet, whereas it was previously thought that significant amounts of permafrost would not melt, releasing its methane, until the planet's temperature has risen several degrees Celsius, recent studies indicate that a rise of 1.5 degrees would be enough to start the melting. What can be done then? Given the failure of political leaders to deal with the CO2 problem, it is now too late to prevent terrible developments. But it may -- just may -- be possible to keep global warming from bringing about the destruction of civilization. To have a chance, we must, as Hansen says, do everything possible to "keep climate close to the Holocene range" -- which means, mobilize the whole world to replace dirty energy with clean as soon as possible.

**Commercial mining solves extinction from scarcity, climate, terror, war, and disease, and provides necessary resources to prevent conflict here on earth**

**Pelton 17**—(Director Emeritus of the Space and Advanced Communications Research Institute at George Washington University, PHD in IR from Georgetown).. Pelton, Joseph N. 2017. The New Gold Rush: The Riches of Space Beckon! Springer. Accessed 8/30/19.

Are We Humans Doomed to **Extinction**? What will we do when Earth’s resources are used up by humanity? The world is now hugely **over populated**, with billions and billions crammed into our over**crowded** cities. By 2050, we may be 9 billion strong, and by 2100 well over 11 billion people on Planet Earth. Some at the United Nations say we might even be an amazing 12 billion crawling around this small globe. And over 80 % of us will be living in congested cities. These cities will be ever more vulnerable to **terror**ist attack, **natural disaster**, and other plights that come with overcrowding and a dearth of jobs that will be fueled by rapid automation and the rise of artifi cial intelligence across the global economy. We are already rapidly **running out of water** and **minerals**. **Climate change** is threatening our very **existence**. Political leaders and even the Pope have cautioned us against inaction. Perhaps the naysayers are right. **All humanity is at tremendous risk.** Is there no hope for the future? This book is about hope. We think that there is literally heavenly hope for humanity. But we are not talking here about divine intervention. We are envisioning a new space economy that recognizes that there is more water in the skies that all our oceans. Th ere is a new wealth of natural resources and clean energy in the reaches of outer space—more than most of us could ever dream possible. There are those that say why waste money on outer space when we have severe problems here at home? Going into space is not a waste of money. It is our future. It is our hope for new jobs and resources. The great challenge of our times is to reverse public thinking to see space not as a resource drain but as the doorway to opportunity. The new space frontier can literally open up a “gold rush in the skies.” In brief, we think there is new hope for humanity. We see a new a pathway to the future via new ventures in space. For too long, space programs have been seen as a money pit. In the process, we have overlooked the great abundance available to us in the skies above. It is important to recognize there is already the beginning of a new gold rush in space—a pathway to astral abundance. “New Space” is a term increasingly used to describe radical new commercial space initiatives—many of which have come from Silicon Valley and often with backing from the group of entrepreneurs known popularly as the “space billionaires.” New space is revolutionizing the space industry with lower cost space transportation and space systems that represent significant cost savings and new technological breakthroughs. “New Commercial Space” and the “New Space Economy” represent more than a new way of looking at outer space. These new pathways to the stars could prove vital to **human survival**. If one does not believe in spending money to probe the mysteries of the universe then perhaps we can try what might be called “calibrated greed” on for size. One only needs to go to a cubesat workshop, or to Silicon Valley or one of many conferences like the “Disrupt Space” event in Bremen, Germany, held in April 2016 to recognize that entrepreneurial New Space initiatives are changing everything [ 1 ]. In fact, the very nature and dimensions of what outer space activities are today have changed forever. It is no longer your grandfather’s concept of outer space that was once dominated by the big national space agencies. The entrepreneurs are taking over. The hopeful statements in this book and the hard economic and technical data that backs them up are more than a minority opinion. It is a topic of growing interest at the World Economic Forum, where business and political heavyweights meet in Davos, Switzerland, to discuss how to stimulate new patterns of global economic growth. It is even the growing view of a group that call themselves “space ethicists.” Here is how Christopher J. Newman, at the University of Sunderland in the United Kingdom has put it: Space ethicists have offered the view that space exploration is not only desirable; it is a duty that we, as a species, must undertake in order to secure the survival of humanity over the longer term. Expanding both the resource base and, eventually, the habitats available for humanity means that any expenditure on space exploration, far from being viewed as frivolous, can legitimately be rationalized as an ethical investment choice. (Newman) On the other hand there are space ethicists and space exobiologists who argue that humans have created ecological ruin on the planet—and now space debris is starting to pollute space. Th ese countervailing thoughts by the “no growth” camp of space ethicists say we have no right to colonize other planets or to mine the Moon and asteroids—or at least no right to do so until we can prove we can sustain life here on Earth for the longer term. However, for most who are planning for the new space economy the opinion of space philosophers doesn’t really fl oat their boat. Legislators, bankers, and aspiring space entrepreneurs are far more interested in the views of the super-rich capitalists called the space billionaires. A number of these billionaires and space executives have already put some very serious money into enterprises intent on creating a new pathway to the stars. No less than five billionaires with established space ventures—Elon Musk, Paul Allen, Jeff Bezos, Sir Richard Branson, and Robert Bigelow—have invested millions if not billions of dollars into commercializing space. They are developing **new tech**nologies and establishing space enterprises that can bring the wealth of outer space down to Earth. This is not a pipe dream, but will increasingly be the **economic reality** of the 2020s. These wealthy space entrepreneurs see major new economic opportunities. To them space represents the last great frontier for enterprising pioneers. Th us they see an ever-expanding space frontier that offers opportunities in low-cost space transportation, satellite solar power satellites to produce clean energy 24h a day, space mining, space manufacturing and production, and eventually space habitats and colonies as a trajectory to a better human future. Some even more visionary thinkers envision the possibility of terraforming Mars, or creating new structures in space to protect our planet from cosmic hazards and even raising Earth’s orbit to escape the rising heat levels of the Sun in millennia to come. **Some**, of course, will say this is **sci-fi hogwash**. It can’t be done. We say that this is what people would have said in 1900 about air**planes**, rocket ships, cell phones and nuclear devices. The skeptics **laughed** at **Columbus** and his plan to sail across the oceans to discover new worlds. When Thomas Jefferson bought the Louisiana Purchase from France or Seward bought Alaska, there were plenty of naysayers that said such investment in the unknown was an extravagant waste of money. A healthy skepticism is useful and can play a role in economic and business success. Before one dismisses the idea of an impending major new space economy and a new gold rush, it might useful to see what has already transpired in space development in just the past five decades. The world’s first geosynchronous communications satellite had a throughput capability of about 500 kb / s. In contrast, today’s state of the art Viasat 2 —a half century later— has an impressive throughput of some 140 Gb/s. Th is means that the relative throughput is nearly 300,000 greater, while its lifetime is some ten times longer (Figs. 1.1 and 1.2 ). Each new generation of communications satellite has had more power, better antenna systems, improved pointing and stabilization, and an extended lifetime. And the capabilities represented by remote sensing satellites , meteorological satellites , and navigation and timing satellites have also expanded their capabilities and performance in an impressive manner. When satellite applications first started, the market was measured in millions of dollars. Today commercial satellite services exceed a quarter of a billion dollars. Vital services such as the Internet, aircraft traffi c control and management, international banking, search and rescue and much, much more depend on application satellites. Th ose that would doubt the importance of satellites to the global economy might wish to view on You Tube the video “If Th ere Were a Day Without Satellites?” [ 2 ]. Let’s check in on what some of those very rich and smart guys think about the new space economy and its potential. (We are sorry to say that so far there are no female space billionaires, but surely this, too, will come someday soon.) Of course this twenty-fi rst century breakthrough that we call the New Space economy will not come just from new space commerce. It will also come from the amazing new technologies here on Earth. Vital new terrestrial technologies will accompany this cosmic journey into tomorrow. Information technology, robotics, **a**rtificial **i**ntelligence and commercial space travel systems have now set us on a course to allow us humans to harvest the amazing riches in the skies—new natural resources, new energy, and even totally new ways of looking at the **purpose of human existence**. If we pursue this course steadfastly, it can be the beginning of a New Space renaissance. But if we don’t seek to realize our **ultimate destiny** in space, Homo sapiens can end up in the **dustbin of history**—just like literally **millions of already failed species**. In each and every one of the five mass extinction events that have occurred over the last 1.5 billion years on Earth, some 50–80 % of all species have gone the way of the **T. Rex**, the **woolly mammoth**, and the **Dodo bird** along with extinct **ferns**, **grasses** and **cacti**. On the other hand, the best days of the human race could be just beginning. If we are smart about how we go about discovering and using these riches in the skies and applying the best of our new technologies, it could be the start of a new beginning for humanity. Konstantin Tsiokovsky, the Russian astronautics pioneer, who fi rst conceived of practical designs for spaceships, famously said: “A planet is the cradle of mankind, but one cannot live in a cradle forever.” Well before Tsiokovsky another genius, Leonardo da Vinci, said, quite poetically: “Once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return.” The founder of the X-Prize and of Planetary Resources, Inc., Dr. Peter Diamandis, has much more brashly said much the same thing in quite diff erent words when he said: “The meek shall inherit the Earth. The rest of us will go to Mars.” The New Space Billionaires Peter Diamandis is not alone in his thinking. From the list of “visionaries” quoted earlier, Elon Musk, the founder of SpaceX; Sir Richard Branson, the founder of Virgin Galactic; and Paul Allen, the co-founder of Microsoft and the man who financed SpaceShipOne, the world’s first successful spaceplane have all said the future will include a vibrant new space economy. Th ey, and others, have said that we can, we should and we soon shall go into space and realize the bounty that it can offer to us. Th e New Space enterprise is today indeed being led by those so-called space billionaires , who have an exciting vision of the future. They and others in the commercial space economy believe that the exploitation of outer space may open up a new golden age of astral abundance. They see outer space as a new frontier that can be a great source of new materials, energy and various forms of new wealth that might even save us from excesses of the past. Th is gold rush in the skies represents a new beginning. We are not talking about expensive new space ventures funded by NASA or other space agencies in Europe, Japan, China or India. No, these eff orts which we and others call New Space are today being forged by imaginative and resourceful commercial entrepreneurs. Th ese twenty-fi rst century visionaries have the fortitude and zeal to look to the abundance above. New breakthroughs in technology and New Space enterprises may be able to create an “astral life raft” for humanity. Just as Columbus and the Vikings had the imaginative drive that led them to discover the riches of a new world, we now have a cadre of space billionaires that are now leading us into this New Space era of tomorrow. These **bold leaders**, such as **Paul Allen** and Sir **Richard Branson**, plus other space entrepreneurs including **Jeff Bezos of Amazon** and **Blue Origin**, and **Robert Bigelow**, Chairman of Budget Suites and Bigelow Aerospace, not only dream of their future in the space industry but also have **billions** of dollars in assets. These are the **bright stars of an entirely new industry** that are leading us into the age of New Space commerce. These space billionaires, each in their own way, are proponents of a new age of astral abundance. Each of them is launching new commercial space industries. They are literally transforming our vision of tomorrow. These new types of entrepreneurial aerospace companies—the New Space enterprises—give new hope and new promise of transforming our world as we know it today. The New Space Frontier What happens in space in the next few decades, plus corresponding new information technologies and advanced robotics, will change our world forever. These changes will redefi ne wealth, change our views of work and employment and upend almost everything we think we know about economics, wealth, jobs, and politics. Th ese changes are about truly disruptive technologies of the most fundamental kinds. If you thought the Internet, smart phones, and spandex were disruptive technologies, just hang on. You have not seen anything yet. In short, if you want to understand a transition more fundamental than the changes brought to the twentieth century world by computers, communications and the Internet, then read this book. There are truly riches in the skies. Near-Earth asteroids largely composed of platinum and **rare earth metals** have an incredible value. Helium-3 isotopes accessible in outer space could provide **clean and abundant energy**. There is far more water in outer space than is in our oceans. In the pages that follow we will explain the potential for a cosmic shift in our global economy, our ecology, and our commercial and legal systems. These can take place by the end of this century. And if these changes do not take place we will be in trouble. Our conventional petro-chemical energy systems will fail us economically and eventually blanket us with a hydrocarbon haze of smog that will threaten our health and our very survival. Our rare precious metals that we need for modern electronic appliances will skyrocket in price, and the struggle between “haves” and “have nots” will grow increasingly **ugly**. A lack of affordable and readily available **water**, natural **resources**, **food**, **health care** and medical supplies, plus systematic threats to **urban security** and **systemic war**fare are the alternatives to astral abundance. The choices between astral abundance and a downward spiral in global standards of living are stark. Within the **next few decades** these problems will be increasingly real. By then the world may almost be **begging** for new, out of- the-box thinking. International peace and security will be an indispensable prerequisite for exploitation of astral abundance, as will good government for all. No one nation can be rich and secure when everyone else is poor and insecure. In short, global space security and strategic space defense, mediated by global space agreements, are part of this new pathway to the future.

## Contention 2: Space-Based Solar Power

**Private mega constellations, also known as a huge cluster of satellites, appropriate space**

Takaya et al 18 “The Principle of Non-Appropriation and the Exclusive Uses of LEO by Large Satellite Constellations” Yuri Takaya-Umehara [Visiting researcher at the University of Tokyo since April 2017. She was affiliated to the Kobe University to provide a course on space law to post-graduate students (2011-2017). She chairs a working group on the formulation of global norms in space law organized by the Keio University since 2018. She obtained her Ph.D. degree at the IDEST of Paris XI University in France, LL.M. at the Leiden University in the Netherlands.] Quentin Verspieren [Ph.D. in public policy @ The University of Tokyo, Assistant Professor of Space Policy @UTokyo, General Manager, Global Strategy @ArkEdge Space Inc., Associate Research Fellow @ESPI] Goutham Karthikeyan [The University of Tokyo & Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency (ISAS-JAXA)] 2018 https://www.researchgate.net/publication/328094878\_The\_Principle\_of\_Non-Appropriation\_and\_the\_Exclusive\_Use\_of\_LEO\_by\_Large\_Satellite\_Constellations SM

* LSC = large satellite constellations
* Outlines “L”SC thresholds

By investigating expected large satellite constellation projects and by reviewing existing interpretations of international space law, this paper argues that the exclusive use of specific LEO orbits by a large constellation of satellite could constitute a violation of the non-appropriation principle by means of occupation and by means of use, drawing a parallel between orbits as resources and the exploitation of tangible mineral resources in space. Based on this, the important question to be raised is what constitutes an exclusive use of a specific orbit. In other words, an important hurdle in the concrete evaluation of whether a planned or established constellation potentially violates the non-appropriation principle through an exclusive use of LEO resides in the lack of clear definition on what can be considered an exclusive use. While the authors claim that legal issue can be clearly solved in abstracto, it naturally shifts towards a regulatory challenge.

This regulatory challenge consists in first defining qualitatively what is the exclusive use of an orbit before translating this definition into measurable, technical rules. In this paper, the authors define an exclusive use of an orbit by a state40 as any use that would prevent/hinder the usage of the same orbit by any other state. Translating this definition into an applicable regulation could consist in defining a threshold of orbital collision risk or a threshold of density of satellites along an orbit based on its altitude, shape, relative velocity of neighbouring objects, etc. It is however not the purpose of this space law paper. What is more appropriate here is to think about which organization or forum would be in charge of elaborating this technical definition. Serious candidates could be the ITU, with excellent track-record in dealing with the use of the GEO region but which would have to review its “first come, first served” principle, or the UNCOPUOS, aiming for the widespread adoption of a new piece of international law. Moreover, even if its rules suffer from a low implementation rates, the IADC would be an appropriate discussion platform thanks to its very deep technical focus.

#### Private mega-constellations allow us to start collecting space-based solar power within the next decade. These megaconstellations offer low costs, operational benefits and mass production – which solves warming and creates effective energy transition

Leonard **David, 21** (Leonard David, Space solar power's time may finally be coming, Space, <https://www.space.com/space-solar-power-research-advances>, 11-3-2021)//

Over the past decade, researchers have made impressive advances that increase the likelihood that space solar power (SSP) will be realized during the next decade, said John Mankins, president of Artemis Innovation Management Solutions of Santa Maria, California. His view: the longstanding vision for SSP as a sustainable energy alternative should be revisited in light of such recent advances. Bolstering that outlook is a set of key perspectives, Mankins told Space.com. "Climate change is really going to be a disaster. Nations are committed to go [carbon net-zero](https://www.livescience.com/climate-report-net-zero.html) … and they have no idea how to do it." The rapidly unfolding value of "New Space" is also reshaping the landscape of 21st century space activities, he added. "Two of the biggest hurdles to the realization of SSP have always been the cost of launch and the cost of hardware," said Mankins. "Add flight rate, and all of a sudden you're looking at numbers always talked about for solar power satellites." Another recent change is the dawn of the megaconstellations, Mankins added.  That's exemplified by SpaceX's [Starlink](https://www.space.com/spacex-starlink-satellites.html" \t "_blank) broadband network, a mass-production effort that now cranks out 30 tons of satellites a month. SpaceX is on course to potentially manufacture 40,000 satellites within five years, and launch all of them.  "The path to low-cost hardware has been shown," Mankins said. "It's modular and mass-produced. The hurdles of less-expensive launch and lowering hardware costs have been overcome." Mankins said that the economics of SSP concepts in the near term, within the next decade, have never been more viable. He flagged advances in space launch capabilities; progress in robotics for space assembly, maintenance and servicing systems; and the growth in various component technologies, such as high-efficiency solid state power amplifiers. As a result, SSP is ready to see the light of day, Mankins said. An early entrant in focusing on understanding the energy policy needed and establishment of SSP is James Michael Snead, president of the Spacefaring Institute. He's adopted the use of the term "astroelectricity" to describe the transmitted electrical power produced by SSP systems. In looking at what he terms the "[coming age of astroelectricity](https://www.youtube.com/watch?v=5E-0NYnAaUA)," he sees a world needing a replacement for oil and natural gas, the two primary sources of energy currently maintaining an industrial standard of living.  Snead envisions a world in the year 2100 where about 20% of electrical power comes from terrestrial nuclear and renewables, with 80% supplied by astroelectricity. "Just as the military, economic and diplomatic control of Middle East oil has substantially influenced world events for the past 80 years, the control of space solar power platforms will come to dominate outer space activities this century," Snead told Space.com. If SSP becomes a reality later this century, Snead said, the U.S. military will be required to protect and defend these new sources of national energy security just as it guards oil infrastructure in the Persian Gulf today. "While some people are developing SSP concepts that would be launched from the Earth and autonomously assembled in geostationary Earth orbit, I do not see this as a successful proposition," said Snead. He believes that building the thousands of SSP platforms needed requires a substantial [space industrialization effort](https://www.space.com/nasa-low-earth-orbit-iss-commercialization.html) involving more than a million people in space by the end of the century.  The starting point, Snead said, will be establishing the enabling "astrologistics" infrastructure operating throughout the Earth-moon system. He stressed that those astrologistics require high-priority U.S. Air Force — not [Space Force](https://www.space.com/42089-space-force.html) — leadership to draw upon nearly a century of human flight/operational logistics experience and expertise. That is necessary to manage industry's efforts to design and build the required new human spaceflight systems, with a clearly needed emphasis on safety and effectiveness, Snead said. As these new military astrologistics capabilities begin, Snead contends, commercialization of these capabilities will extend these safety and operational benefits to support the coming space industrial revolution needed to undertake SSP. "This is exactly what happened to enable U.S. airline manufacturers to dominate the airline and air cargo industry for decades. It is a successful model to now replicate in space — a model that neither NASA nor the U.S. Space Force can effectively execute," Snead said. While new artwork, economic plots and conceptual SPS thinking and visions flow, there's an in-space technology experiment already underway.  On its latest mission, which launched in May 2020, the Space Force's robotic [X-37B space plane](https://www.space.com/25275-x37b-space-plane.html) is toting the Photovoltaic Radio-frequency Antenna Module Flight Experiment (PRAM-FX), a Naval Research Laboratory (NRL) investigation into transforming solar power into radio-frequency microwave energy.  The focus of that X-37B investigation is not establishing an actual power-beaming link, but more on appraising the performance of sunlight-to-microwave conversion. "It is performing like a champ," said Paul Jaffe, an NRL electronics engineer working on power beaming and solar power satellites. "We are getting data regularly, and that data is exceeding our expectations," he told Space.com. [PRAM-FX](https://www.space.com/x-37b-space-plane-solar-power-beaming) is principally made out of commercial parts, not "space-grade" hardware. "The fact that it is continuing to operate and give us positive results is quite encouraging," Jaffe said. Commercial parts are mass-produced, while many space-grade parts are one-offs. Solar power satellites, like those envisioned in high Earth orbit, would have thousands of elements made out of similar components being tested onboard the X-37B, Jaffe said. There's much more work ahead, of course.  "The big strike against space solar power has always been making the economics work. People who have looked at the idea seriously do understand that, from a physics standpoint, there is no reason you couldn't do it," Jaffe said.  "With mass production of space hardware, and with the cost reduction of space access, it is more plausible that it could work," he added. "I would caution against excessive optimism … but also point out that things are changing. There are a lot of encouraging developments." SPS will assuredly be compared to a "levelized cost of energy" metric, Jaffe concluded. "There's just not enough data to come up with a levelized cost of energy basis for space solar power. It's premature. What you are seeing now is laying the foundation for that sort of evaluation." To that end, Mankins of Artemis Innovation Management Solutions has rolled out SPS-ALPHA ("Solar Power Satellite by means of Arbitrarily Large Phased Array"), a design he showcased at the 72nd International Astronautical Congress, which was held from Oct. 25 to Oct. 29 in Dubai, United Arab Emirates. Detailing a business model and step-by-step SSP roadmap, he feels the concept promises a clear, affordable path to deploying a critically needed new energy option. "I believe you could have operational solar power satellites to scale within a decade," Mankins said.  That possibility, combined with the fact that multiple nations are eying SSP as a promising power generation system of the future, begs a question: Is there a solar power satellite race afoot? It is close to that, Mankins said. "I think it has to be cooperation among friends and allies. But I think it's very likely to end up being competition with China. The longer we wait with regard to the urgency of policies on [climate change](https://www.space.com/climate-change-dimming-earth), the more likely it is we're going to miss the boat." Mankins is a 26-year veteran of assessing SSP and the technologies required. "The moment has come," he said. "I think the right answer is really clear: We need to just go do it."

#### Space based solar power, also known as SBSP key to solve climate change – Katete 21

Katete, Esthere. (December 17 2021) “Space-Based Solar Power: The Future Source of Energy?”https://www.greenmatch.co.uk/blog/2020/02/space-based-solar-power // LHP BT + LHP PS

Space-based solar power (SBSP) involves collecting the sun’s energy in space, and then wirelessly transmitting it to Earth. There are several [advantages to solar energy](https://www.greenmatch.co.uk/blog/2014/08/5-advantages-and-5-disadvantages-of-solar-energy). Although expensive, it **is** **a** great source of [clean energy](https://www.greenmatch.co.uk/blog/clean-energy) that has the capacity to provide more energythan the world consumes **or is predicted to consume in the future**. A space-based solar power technological process includes using [solar panels](https://www.greenmatch.co.uk/solar-energy/solar-panels) to collect solar energy in space with reflectors or inflatable mirrors that direct solar radiation onto solar panels, and then beaming it on Earth through a microwave or laser. The energy is then received on Earth via a microwave antenna (a rectenna). **According to the** [**National Space Society**](https://space.nss.org/space-solar-power/)**,** space-based solar power **has the** potential to dwarf all the other sources of energy combined**. They argue that space-based solar power can provide large quantities of energy** with very little negative environmental impact**. It can also** solve our current energy and greenhouse gas emissions problems**.** The infographic below highlights information about space-based solar power, current related trends, and what different countries are doing in terms of research and funding. Current Global Energy Consumption and Trends **The** world’s energy consumption is only growing. According to a report by the University of Oxford’s Our World in Data, on the global primary energy consumption, the current world consumption is over 160,000 TWh annually. Solar energy contributes only 585 TWh. Although there is an increase in renewable energy solutions, investments, and usage, oil, coal, and gas still generate more than 80% of the global energy that is consumed - with solar energy generating less than 1%. Between 2004 and 2015, investments in renewable energy increased by 600% from £36.2 billion (US$46.7 billion) to £220.6 billion (US$284.8 billion). Current predictions indicate that the world population will reach [9.7 billion by 2050](https://www.un.org/development/desa/en/news/population/world-population-prospects-2019.html). With the increase in population, the world energy consumption is also predicted to grow by 50% by 2050. In addition, climate change impacts are accelerating. Although we generate a big percentage of the world energy from fossil fuels, fossil fuels contribute significantly to the increase of climate change. **Comparatively,** solar energy is the [safest source of energy](https://ourworldindata.org/uploads/2020/02/Safest-source-of-energy.png) today - though it still only contributes a small percentage of the global energy production. The death rates from solar production are 1,230 times lower than coal, and it has one of the lowest CO2 emissions, at 5g CO2 eq per kWh. Why Space-Based Solar Power? Space-based solar power has several benefits; unlike solar panels on our roofs that can only generate electricity during the day, space-based solar power can generate continuous electricity, 24 hours a day, 99% of the year. This is because, unlike Earth, the space environment does not have night and day, and the satellites are in the Earth's shadow for only a maximum of 72 minutes per night. **Space-based solar panels can generate** 2,000 gigawatts of power constantly. This is **40 times more energy than a solar panel would generate on Earth annually**. This is also several folds higher than the [efficiency of solar panels](https://www.greenmatch.co.uk/blog/2014/11/how-efficient-are-solar-panels) today. **What’s more, is that space-based** solar power would generate [0% greenhouse gas emissions](https://space.nss.org/space-solar-power/) unlike other alternatives **energy like nuclear, coal, oil, gas, and ethanol**. The current source of energy that generates the lowest CO2 is nuclear power, which generates CO2 of 5g CO2 eq per kWh. **Space-based solar power** generates almost 0% hazardous waste to our environment **compared to nuclear power**. Why Are We Not There Yet? While space-based solar power is an innovative concept, we are not able to fully launch a system into space yet. Launching a space-based solar system is very expensive. In fact, the cost is estimated to be about 100 times too high to compete with current utility costs. One of the causes of the high costs is the high cost of launching the panels to space, which is mostly due to the high mass per watt generated by the current solar panels. In other words, the solar panels are currently too heavy per watt generated to make it feasible. Currently, the cost of launching in space is estimated to be £7,716 per kilogram - approximately £154 per watt. In comparison to the cost that homeowners pay today, which is approximately £2 per watt peak, the cost in space is extremely high to be competitive. In UK homes, the [installation cost of solar panels](https://www.greenmatch.co.uk/blog/2014/08/what-is-the-installation-cost-for-solar-panels) can be as low as £1.5 per watt. Other reasons for high costs include the overall high transport costs to space. This is because transporting all other materials that are needed to space would require many space shuttle launches, and these space shuttles are currently not reusable. So, not only is the launch of solar panels themselves expensive, but the additional materials needing to be transported is also expensive. A lot of research and engineering is still ongoing to find the most feasible way to launch space-based solar panels and launch systems, at a lower cost. The environment out in space also has several hazards that could cause damage to the solar panels. These include space debris and extreme solar radiation, which could degrade the solar panels up to 8 times faster than panels installed on Earth. Finally, there is a potential of wasting large amounts of energy when transporting or during transmission from space to Earth. Therefore, scientists and engineers must continue their R&D efforts to ensure little to no energy is lost during the process. Current SBSP Projects and Progress The key players in SBSP include China, the US, and Japan, who have shown progress in terms of technology advancements, partnerships, and launch plans. China is already progressing to launch into space. The China Aerospace Science and Technology Corporation plans to launch small to medium solar satellites in the stratosphere that can harness energy in space between 2021 and 2025. China also plans to generate one megawatt of energy from space-based solar panels by 2030, and to be operating a commercially viable solar space station by 2050. In the US, there are ongoing partnerships and investments. For example, a $100 million partnership between Northrop Grumman and U.S. Air Force Research Laboratory has been established to provide advanced technology for SBSP. Also in the US, a $17.5 million collaboration between Northrop Grumman Corporation and Caltech was set up to develop the space solar power project called ‘The Space Solar Power Initiative’. The initiative’s goal was to develop scientific and technological innovations that would enable a space-based solar power system generate electricity at a cost comparable to current sources of electricity. There has been ongoing research and technological advancements. In the US, the development of the SPS-ALPHA Mark-II concept is underway. This, if successful, would enable construction of huge platforms in space that can remotely deliver tens of thousands of megawatts of electricity to Earth, using wireless power transmissions. This will also enable delivery of affordable power to Earth and on space missions. In addition, progress is being made to build reusable launch systems. Success in this will lower the cost of transport to space and overall cost of space-based solar power. An example is SpaceX, that is currently working on reusable launch vehicles that can be used for transport to space. In Japan, researchers successfully transmitted electric power wirelessly using microwaves. Researchers transformed 1.8 kW of electric power into microwaves and accurately transmitted it into a receiver that was 55 metres away. This was a technological advancement towards bringing SBSP closer to reality. Japan also made space-based solar systems part of its future space exploration vision. Future Outlook for SBSP Fossil fuels are finite and can eventually run out. According to predictions, oil and natural gas could run out in 50 years and coal production in 115 years. With ongoing research and investments, there is a high possibility that space-based solar power is the viable [future of solar power](https://www.greenmatch.co.uk/blog/2015/01/the-future-for-solar-power-in-the-uk). If the cost of space-based solar power can be lowered, it is likely to be a major source of sustainable energy that cannot diminish. Major players like China, who already have timelines of implementing the technology in space, may be able to provide some key learnings for future improvements in the technology.

## On the aff case:

#### On contention 1 about rocket pollution:

#### 1] Private companies are innovating and have developed emission free fuel

NSS 21 7-23-2021 "Why Space Tourism?" <https://space.nss.org/why-space-tourism/> (National Space Society)//Elmer

Space Tourism Will Not Be a Pollution Disaster It is possible to accept all the benefits above, and still express concern about the potential that a really successful space tourism industry will pollute the air and contribute to global warming. Fortunately, Blue Origin’s New Shepard produces only water as an exhaust, so neither is going to be an issue even if there are 1,000s of flights per year. Some have claimed that space tourism will be more polluting per passenger mile since there are fewer passengers per vehicle at the current time, but (a) New Shepard has zero carbon/zero pollution, and (b) over time space tourism vehicles will grow in capacity, just like airliners did. The Virgin Galactic engine is more problematic, but will most likely be replaced by a more sustainable engine before flight volumes become large. Some might be more worried about SpaceX’s StarShip/SuperHeavy driving global warming when used for point-to-point travel on the Earth, and for space tourism. Elon Musk has declared his intention to produce the methane fuel it uses directly from the atmosphere using solar power, assuring that the fuel cycle is carbon-neutral. In terms of air pollution, StarShip in a point-to-point mode will to a large degree replace airplanes currently flying while using cleaner burning methane, potentially resulting in less pollution than is the case currently. In any case, trips to space will likely always remain a minor part of point-to-point travel on the Earth. Currently, in the U.S. alone, there are about 5,700 passenger flights PER DAY. Even if we are simultaneously supporting dozens of orbital hotels, building a city on Mars, and constructing a network of space solar power satellites, we will be hard pressed to generate more than a tiny fraction of that traffic level.

#### 2] Their author is exaggerating. Rockets contribute 0.0000059 percent to global emissions

Brown 21 — (Mike Brown, Mike Brown is a London-based journalist who covers innovation at Inverse. He is the author of Musk Reads, a regular newsletter that focuses on electric cars, space exploration, clean energy, and everything in-between. Mike holds a BA in English from Queen Mary, University of London, and an MS in journalism from Columbia Journalism School. His work has featured in CityMetric, International Business Times, Neowin.net, Building Magazine, and more. He has also made guest appearances on CBC Radio, Cheddar, Good Day New York, Trailblazers, and more. , “Are space rockets bad for the Earth? Why the question ignores an important truth“, Inverse, 11-23-2021, Available Online at https://www.inverse.com/innovation/are-rockets-environmentally-friendly, accessed 1-15-2022, HKR-AR)

Current rocket launches have a negligible effect on total carbon emissions — Everyday Astronaut found they accounted for 0.0000059 percent of global carbon emissions in 2018, while the airline industry produced 2.4 percent the same year.

But the long-term effect is less clear, especially as companies like SpaceX move from hosting 26 launches in a year to 1,000 launches per rocket in a year.

“I think we can guess that rockets won't be a huge impact on the environment, and they probably won't stand out as a sole source of new problems,” Darin Toohey, professor at the University of Colorado Boulder’s Atmospheric and Ocean Sciences, tells Inverse. “But they will add to the growing list of activities that have negative impacts on the environment.”

**3. There are a million different causes for global warming. They don’t have any evidence saying that launch emissions uniquely cause global warming or enough environmental damage to warrant full attention, so even if we ended all the launches, nothing would actually change and climate change would still happen**

**4. Their Miraux 21 evidence says that ozone would decrease by at most 6% and Letzing 21 says ice could shrink by 5% if we shot 1,000 rockets. First, there’s no indication we would be shooting that many. Second, at most 6% is vague, and it’s not clear whether that is even alarming. And third, they never gave any evidence at all as to how ozone depletion or ice depletion are uniquely bad for global warming that they’re a priority.**

**5. We turn their entire impact: Because the neg solves climate change by ending mining on Earth, providing the necessary metals, and renewable energy, we’re the ones that actually solve climate change and prevent the structural violence that it causes.**

## AT: Debris

#### 1] Collision risk is infinitesimally small

Fange 17 Daniel Von Fange 17, Web Application Engineer, Founder and Owner of LeanCoder, Full Stack, Polyglot Web Developer, “Kessler Syndrome is Over Hyped”, 5/21/2017, http://braino.org/essays/kessler\_syndrome\_is\_over\_hyped/

The orbital area around earth can be broken down into four regions. Low LEO - Up to about 400km. Things that orbit here burn up in the earth’s atmosphere quickly - between a few months to two years. The space station operates at the high end of this range. It loses about a kilometer of altitude a month and if not pushed higher every few months, would soon burn up. For all practical purposes, Low LEO doesn’t matter for Kessler Syndrome. If Low LEO was ever full of space junk, we’d just wait a year and a half, and the problem would be over. High LEO - 400km to 2000km. This where most heavy satellites and most space junk orbits. The air is thin enough here that satellites only go down slowly, and they have a much farther distance to fall. It can take 50 years for stuff here to get down. This is where Kessler Syndrome could be an issue. Mid Orbit - GPS satellites and other navigation satellites travel here in lonely, long lives. The volume of space is so huge, and the number of satellites so few, that we don’t need to worry about Kessler here. GEO - If you put a satellite far enough out from earth, the speed that the satellite travels around the earth will match the speed of the surface of the earth rotating under it. From the ground, the satellite will appear to hang motionless. Usually the geostationary orbit is used by big weather satellites and big TV broadcasting satellites. (This apparent motionlessness is why satellite TV dishes can be mounted pointing in a fixed direction. You can find approximate south just by looking around at the dishes in your northern hemisphere neighborhood.) For Kessler purposes, GEO orbit is roughly a ring 384,400 km around. However, all the satellites here are moving the same direction at the same speed - debris doesn’t get free velocity from the speed of the satellites. Also, it’s quite expensive to get a satellite here, and so there aren’t many, only about one satellite per 1000km of the ring. Kessler is not a problem here. How bad could Kessler Syndrome in High LEO be? Let’s imagine a worst case scenario. An evil alien intelligence chops up everything in High LEO, turning it into 1cm cubes of death orbiting at 1000km, spread as evenly across the surface of this sphere as orbital mechanics would allow. Is humanity cut off from space? I’m guessing the world has launched about 10,000 tons of satellites total. For guessing purposes, I’ll assume 2,500 tons of satellites and junk currently in High LEO. If satellites are made of aluminum, with a density of 2.70 g/cm3, then that’s 839,985,870 1cm cubes. A sphere for an orbit of 1,000km has a surface area of 682,752,000 square KM. So there would be one cube of junk per .81 square KM. If a rocket traveled through that, its odds of hitting that cube are tiny - less than 1 in 10,000.

1. **Solvency - The plan is mitigatory at best - can’t solve**

Many areas have already reached the tipping point of space debris. The only way to solve the problem is through actually removing it

Wright 2007 (David Wright, Senior researcher at the union of concerned scientists in Cambridge Mass, Space Debris, *Physics Today*, August 2007,https://notendur.hi.is/thg29/Aflfr%C3%A6%C3%B0iverkefni/PTO000035.pdf)

A study released by NASA’s orbital Debris Program Office in 2006, before the Chinese test, showed that parts of space have already reached supercritical debris densities. In particular, the study shows that in the heavily used altitude band from 900 to 1000 km, the number of debris fragments larger than 10cm is expected to more than triple over the next 200 years, even assuming no additional objects are launched to the band. The study estimates that the total population of large debris in LEO will increase by 40% in that time, even assuming no additional launches. The Debris from the Chinese test will make matters worse. An important implication of the study is that while mitigation efforts are important for slowing the increases, only debris-remediation measures such as removing large, massive objects already in orbit can hope to prevent their consequences. Remediation efforts such as robotic missions to remove defunct satellites and rockets are very expensive but are being studied

#### 3] TURN: Property rights in the Neg world is the only way to incentive clean up

Blodger 16 [Ian Blodger, JD Candidate at University of Minnesota Law School, 2016, “Reclassifying Geostationary Earth Orbit as Private Property: Why Natural Law and Utilitarian Theories of Property Demand Privatization”, The Minnesota Journal of Law, Science, and Technology Vol 17, Issue 1, <https://scholarship.law.umn.edu/cgi/viewcontent.cgi?article=1006&context=mjlst> ] // Triumph Debate

First, allowing privatization of geostationary orbit will mitigate future space debris and potentially allow for a clean up of current debris.150 Analyzing different methods for reducing space debris, Nodir Aldinov, Peter Alexander, and Brenda Cunningham concluded that the lack of costs associated with launching a satellite (apart from the costs necessary to build and place the satellite in orbit) allows for more satellites than optimum.151 This is because corporations seeking to maximize profits have no need to take account of the negative externality its satellite launches impose on other firms.152 Aldinov, Alexander, and Cunningham conclude that by instituting a tax on each launch, actors would be incentivized to internalize externalities, which would in turn bring the number of launches to the socially optimum level.153 They further contend that the profits from the launch tax could be used to invest in programs to seek out and actively clean up space.154 The creation of a property interest in GEO locations will not only accomplish the end results of a tax, but it also provides an incentive to launch a satellite in the first place. By creating a property interest in geostationary orbit, the market will quickly establish a price for the zone.155 This price will act in cost of the satellite (which will inevitably be lost), but also a potential return on the investment in the property right itself.156 The creation of this additional cost and benefit will eliminate negative externalities associated with too many satellite launches.157 Additionally, allowing actors to resell their orbital zone or reuse it as needed provides an added incentive to actively clean up the area.158 Therefore, like the imposition of a tax, creating a private interest in a GEO slots will decrease the number of excess satellites launched into GEO, and provide incentives to clean up the area in order to maximize profits. Unlike a tax however, property rights more efficiently ensure a preservation of a clean space environment.159 Murray N. Rothbard’s book, For a New Liberty, discusses a libertarian approach to pollution and finds that the government’s control over pollution regulations is much less efficient than a private property owner enforcing their rights through the court system.160 In part, this inefficiency results from an apathetic enforcement of the laws, which do not benefit the enforcers.161 Rothbard additionally argues the government’s assessment of the potential harms of pollution often differ from those who have a stake in the matter, and thus fail to take into account the full magnitude of the situation, leading to inefficient tax regimes.162 In a private system with redress to the courts, property owners will zealously defend their property from trespass, and will do so efficiently, because they are able to take into account the relevant variables that threaten their property, where the government cannot take such an individualized approach.163 Thus, while the benefits derived from a system of taxation and a private property system are similar, the allocation of private property will ultimately lead to a more efficient protection of GEO. This, in turn, will effectively eliminate the need for indirect costs associated with preventing harm to satellites in orbit. Currently, satellites must contain equipment necessary to track, and maneuver away from orbiting debris.164 With a reduction in the number of satellites and an increased number of satellites moved to graveyard orbits, and the potential for a reduction in other forms of debris, the need for such sophisticated technology will decrease.165 The market will control this as well, since risk adverse actors will desire avoidance systems so they can ensure a return on the resale of the property after the satellite’s eventual failure.16

#### 4] TURN: Private entities are key for debris removal innovation – only in the Neg world is there cleanup

Moore, Adrian. “It's Time For US To Get Serious About Cleaning Up Space Junk,”.” TheHill. July 27, 2021. Web. December 13, 2021. .

Orbital debris management is not well organized within the government. Right now, the Department of Defense (DOD) does most tracking of space debris for the U.S. out of the need to protect military satellites and national security interests. NASA has its own less advanced systems for tracking debris. However, orbital debris management is not just about tracking debris anymore. It is also about forming collision warning systems and safely managing traffic in space. To do this efficiently, we need a civil repository for all orbital debris components, something that many commercial space companies have already created on their own to stay aware of orbital debris and help protect their satellites in space. Tracking debris may be a national security priority, but providing space traffic control is not really in the Defense Department’s mission. We should be utilizing the private sector’s expertise and advancements in this area. For example, Astroscale has contracts with both the Japanese and European space agencies to develop orbital debris removal capability. And responsibility for developing collision warnings and space traffic management would be best suited for the Office of Space Commerce, an office with existing connections to the commercial space industry, NASA and DOD. Partnering with the debris tracking and removal systems private companies are developing while freeing up DOD to focus on military awareness and NASA to focus on research and development would be the most efficient way forward. If government works with private industry through strategic public-private partnerships, the U.S. can best address the threats posed by orbital debris and create sustainable policies for safe space exploration.

**5: the whole argument is nonunique; public satellites would also collide and create debris**

**At the end of their speech they also throw in this argument that we can just focus on the Earth to save it. However, TURN: private entities in space free up governments to focus on and solve Earth problems**

#### NASA is able to preserve resources by leveraging private partnerships

Miriam Kramer 21, author of Space, “NASA's plans for the future hinge on the success of private companies,” Axios, 12-7-2021, https://www.axios.com/nasa-private-spaceflight-plans-5a5710e6-5223-4da3-8c5d-5a712e1d862e.html

The private space players who will drive NASA's plans for the coming decade are declaring themselves and defining the stakes. Why it matters: NASA plans to focus on getting people to Mars and the Moon, and its deep space exploration ambitions hinge on the agency being able to successfully hand over major operations in low-Earth orbit to private companies. The space agency hopes companies will build private space stations that its astronauts can use and to continue to buy space on private rockets for launching its satellites and other payloads to orbit and beyond. NASA's "big experiment" right now is to test where these commercial partnerships work, the Planetary Society's Casey Dreier told Axios. What's happening: Last week, NASA announced it would award multimillion-dollar contracts to three teams of commercial space companies to start designing and building privately operated space stations.