#### Private sector innovation in the commercial space industry is high now.

**Smith 18** [Matthew Smith, 6-11-2018, "Commercialized Space and You," Science in the News, https://sitn.hms.harvard.edu/flash/2018/commercialized-space-and-you/]//DDPT

Step aside, NASA. The 20th century model of space exploration is running out of fuel, and private companies are now leading the race for human expansion across the galaxy. Elon Musk, Richard Branson, and Jeff Bezos are three of the billionaires leading this extraterrestrial adventure with their respective companies, SpaceX, Virgin Galactic, and Blue Origin. Bezos, the founder of Amazon and currently the wealthiest person in the world, has a vision of sending autonomous rovers to the Moon and helping to eventually create a Moon Village. He has explained that collaborations with the National Aeronautics and Space Administration (NASA) and other government agencies are encouraged and appreciated, but are no longer essential to achieve his goal. [Musk](https://www.geekwire.com/2018/jeff-bezos-blue-origin-space-venture-go-moon-settlements/), who co-founded Tesla, has already launched nine rockets within the first five months of 2018, one of which was the most powerful private spacecraft [ever sent into orbit](http://sitn.hms.harvard.edu/flash/2018/spacex-launches-falcon-heavy-rocket-successfully/). Looking forward, SpaceX aims to complete its first manned mission to Mars in 2024, almost a decade earlier than NASA’s projections. Even the current US president is encouraging this shift to private companies driving [innovation in space](https://www.washingtonpost.com/news/the-switch/wp/2018/02/11/the-trump-administration-wants-to-turn-the-international-space-station-into-a-commercially-run-venture/?noredirect=on&utm_term=.d2c1eccab4ca). With almost [$1 billion](https://www.forbes.com/sites/alexknapp/2018/04/10/nearly-1-billion-was-invested-in-space-startups-in-1q2018-new-report-says/#5fdd019b285c) invested in space-focused startups in the first quarter of 2018, the commercialized space industry shows no sign of slowing down.

#### Private space appropriation is uniquely key to ensuring ongoing innovation towards space exploration and colonization.

**Cheng 20** [Dean Cheng, 09-16-2020, "Outer Space and Private Property," Heritage Foundation, https://www.heritage.org/space-policy/commentary/outer-space-and-private-property]//DDPT

Fully 53 years after the Outer Space Treaty, however, this has begun to change. The success of SpaceX, Blue Origin, Virgin Galactic, and other private companies has led to what has been termed Space 2.0.

The Obama administration’s decision to rely on commercial space-launch services to resupply the International Space Station opened the door to expanding private enterprise’s role in space.

The innovation exhibited in the various Falcon launches, including the ability to reuse the booster rockets, has seen a significant drop in the cost of placing payloads into orbit. As a result, a real opportunity exists for companies to begin thinking about how to use space not simply to improve terrestrial operations, but to make money from space and its physical resources.

The uncertainty associated with private property rights, however, has had a constraining effect on the ability to exploit space more extensively. Companies are unlikely to be willing to risk capital and assets if they are not sure that they will be able to profit from their investments.

#### The private sector is the key internal link to space exploration and colonization.

**Sharma 9/7** [Maanas Sharma, 9-7-2021, "The Space Review: The privatized frontier: the ethical implications and role of private companies in space exploration," The Space Review, https://www.thespacereview.com/article/4238/1]//DDPT

In recent years, private companies have taken on a larger role in the space exploration system. With lower costs and faster production times, they have displaced some functions of government space agencies. Though many have levied criticism against privatized space exploration, it also allows room for more altruistic actions by government space agencies and the benefits from increased space exploration as a whole. Thus, we should encourage this development, as the process is net ethical in the end. Especially if performed in conjunction with adequate government action on the topic, private space exploration can overcome possible shortcomings in its risky and capitalistic nature and ensure a positive contribution to the general public on Earth.

The implications of commercial space exploration have been thrust into the limelight with the successes and failures of billionaire Elon Musk’s company SpaceX. While private companies are not new to space exploration, their prominence in American space exploration efforts has increased rapidly in recent years, fueled by technological innovations, reductions in cost, and readily available funding from government and private sources.[1] In May 2020, SpaceX brought American astronauts to space from American soil for the first time in almost 10 years.[2] Recognizing the greatly reduced costs of space exploration in private companies, NASA’s budget has shifted to significantly relying on private companies.[3] However, private space companies are unique from government space agencies in the way they experience unique sets of market pressures that influence their decision-making process. Hence, the expansion of private control in the space sector turns into a multifaceted contestation of its ethicality.

The most obvious ethical concern is the loss of human life. Critics contend that companies must answer to their shareholders and justify their profits. This contributes to a larger overall psyche that prioritizes cost and speed above all else, resulting in significantly increased risks.[4] However, the possible increase in mishaps is largely overstated. Companies recognize the need for safety aboard their expeditions themselves.[5] After all, the potential backlash from a mishap could destroy the company’s reputation and significantly harm their prospects. According to Dr. Nayef Al-Rodhan, Head of the Geneva Centre for Security Policy’s Geopolitics and Global Futures Programme, “because there were no alternatives to government space programs, accidents were seen to some degree as par for the course… By comparison, private companies actually have a far more difficult set of issues to face in the case of a mishap. In a worst case scenario, a private company could make an easy scapegoat.” [6]

Another large ethical concern is the prominence capitalism may have in the future of private space exploration and the impacts thereof. The growth of private space companies in recent years has been closely intertwined with capitalism. Companies have largely focused on the most profitable projects, such as space travel and the business of space.[7] Many companies are funded by individual billionaires, such as dearMoon, SpaceX’s upcoming mission to the Moon.[8] Congress has also passed multiple acts for the purpose of reducing regulations on private space companies and securing private access to space. From this, many immediately jump to the conclusion that capitalism in space will recreate the same conditions in outer space that plague Earth today, especially with the increasing push to create a “space-for-space” economy, such as space tourism and new technologies to mine the Moon and asteroids. Critics, such as Jordan Pearson of VICE, believe that promises of “virtually unlimited resources” are only for the rich, and will perpetuate the growing wealth inequality that plagues the world today.[9]

However, others contend that just because private space exploration has some capitalist elements, it is by no means an embodiment of unrestricted capitalism. A healthy balance of restricted capitalism—for example, private space companies working through contracts with government agencies or independently under monitoring and regulation by national and international agreements—will avoid the pitfalls that capitalist colonialism faced down here on Earth. Even those who are generally against excessive government regulation should see the benefits of them in space. Lacking any consensus on definitions and rights in space will create undue competition between corporations as well as governments that will harm everyone rather than helping anyone. To create a conducive environment for new space-for-space exploration, one without confrontation but with protection for corporate astronauts, infrastructure, and other interests, governments must create key policies such as a framework for property rights on asteroids, the Moon, and Mars.[7,10]

Another key matter to note is restricted capitalism in space “could also be our salvation.”[11] Private space exploration could reap increased access to resources and other benefits that can be used to solve the very problems on Earth that critics of capitalism identify. Since governments offset some of their projects to private companies, government agencies can focus on altruistic projects that otherwise would not fit in the budget before and do not have the immediate commercial use that private companies look for. Scott Hubbard, an adjunct professor of aeronautics and astronautics at Stanford University, discusses how “this strategy allows the space agency to continue ‘exploring the fringe where there really is no business case’” but still has important impacts on people down on Earth.[12]

Indeed, this idea is a particularly powerful one when considering the ideal future of private companies in space exploration. Though there is no one set way governments will interact with companies, the consensus is that they must radically reimagine their main purpose as the role of private space exploration continues to grow. As governments utilize services from private space companies, “[i]nstead of being bogged down by the routine application of old research, NASA can prioritize their limited budget to work more on research of other unknowns and development of new long-term space travel technologies.”[13] According to the Council on Foreign Relations, such technologies have far-reaching benefits on Earth as well. Past developments obviously include communications satellites, by themselves a massive benefit to society, but also “refinements in artificial hearts; improved mammograms; and laser eye surgery… thermoelectric coolers for microchips; high-temperature lubricants; and a means for mass-producing carbon nanotubes, a material with significant engineering potential; [and h]ousehold products.”[2] Agencies like NASA are the only actors able to pursue the next game-changing missions, “where the profit motive is not as evident and where the barriers to entry are still too high for the private sector to really make a compelling business case.”[8] These technologies have revolutionized millions, if not billions, of lives, demonstrating the remarkable benefits of space exploration. It follows then that it is net ethical to prioritize these benefits.

This report concludes that the private sector, indeed, has a prominent role to play in the future of space exploration. Further, though private space exploration does bring the potential of increased danger and the colonization of space, these concerns can be effectively mitigated. Namely, strong government frameworks—particularly international ones—will minimize possible sources of ethical violations and ensure an optimal private sector role in space. This also allows government agencies to complete significantly more difficult, innovative projects which have transformative benefits for life on Earth.

#### Space exploration solves extinction and endless resource wars.

Collins 10 [Patrick Collins, professor of economics at Azabu University in Japan, and a Collaborating Researcher with the Institute for Space & Astronautical Science, as well as adviser to a number of companies, Adriano V. Autino is President of the Space Renaissance International; Manager, CEO/CTO, Systems Engineering Consultant / Trainer at Andromeda Systems Engineering LLC; and Supplier of methodological tools and consultancy at Intermarine S.p.A, Acta Astronautica, Volume 66, Issues 11–12, June–July 2010, “What the growth of a space tourism industry could contribute to employment, economic growth, environmental protection, education, culture and world peace”, Pages 1553–1562]

7. World peace and preservation of human civilisation

The major source of social friction, including international friction, has surely always been unequal access to resources. People fight to control the valuable resources on and under the land, and in and under the sea. The natural resources of Earth are limited in quantity, and economically accessible resources even more so. As the population grows, and demand grows for a higher material standard of living, industrial activity grows exponentially. The threat of resources becoming scarce has led to the concept of “Resource Wars”. Having begun long ago with wars to control the gold and diamonds of Africa and South America, and oil in the Middle East, the current phase is at centre stage of world events today [37]. A particular danger of “resource wars” is that, if the general public can be persuaded to support them, they may become impossible to stop as resources become increasingly scarce. Many commentators have noted the similarity of the language of US and UK government advocates of “war on terror” to the language of the novel “1984” which describes a dystopian future of endless, fraudulent war in which citizens are reduced to slaves.

7.1. Expansion into near-Earth space is the only alternative to endless “resource wars”

As an alternative to the “resource wars” already devastating many countries today, opening access to the unlimited resources of near-Earth space could clearly facilitate world peace and security. The US National Security Space Office, at the start of its report on the potential of space-based solar power (SSP) published in early 2007, stated: “Expanding human populations and declining natural resources are potential sources of local and strategic conflict in the 21st Century, and many see energy as the foremost threat to national security” [38]. The report ended by encouraging urgent research on the feasibility of SSP: “Considering the timescales that are involved, and the exponential growth of population and resource pressures within that same strategic period, it is imperative that this work for “drilling up” vs. drilling down for energy security begins immediately” [38].

Although the use of extra-terrestrial resources on a substantial scale may still be some decades away, it is important to recognise that simply acknowledging its feasibility using known technology is the surest way of ending the threat of resource wars. That is, if it is assumed that the resources available for human use are limited to those on Earth, then it can be argued that resource wars are inescapable [22] and [37]. If, by contrast, it is assumed that the resources of space are economically accessible, this not only eliminates the need for resource wars, it can also preserve the benefits of civilisation which are being eroded today by “resource war-mongers”, most notably the governments of the “Anglo-Saxon” countries and their “neo-con” advisers. It is also worth noting that the $1 trillion that these have already committed to wars in the Middle-East in the 21st century is orders of magnitude more than the public investment needed to aid companies sufficiently to start the commercial use of space resources.

Industrial and financial groups which profit from monopolistic control of terrestrial supplies of various natural resources, like those which profit from wars, have an economic interest in protecting their profitable situation. However, these groups’ continuing profits are justified neither by capitalism nor by democracy: they could be preserved only by maintaining the pretence that use of space resources is not feasible, and by preventing the development of low-cost space travel. Once the feasibility of low-cost space travel is understood, “resource wars” are clearly foolish as well as tragic. A visiting extra-terrestrial would be pityingly amused at the foolish antics of homo sapiens using long-range rockets to fight each other over dwindling terrestrial resources—rather than using the same rockets to travel in space and have the use of all the resources they need!

7.2. High return in safety from extra-terrestrial settlement

Investment in low-cost orbital access and other space infrastructure will facilitate the establishment of settlements on the Moon, Mars, asteroids and in man[/woman]-made space structures. In the first phase, development of new regulatory infrastructure in various Earth orbits, including property/usufruct rights, real estate, mortgage financing and insurance, traffic management, pilotage, policing and other services will enable the population living in Earth orbits to grow very large. Such activities aimed at making near-Earth space habitable are the logical extension of humans’ historical spread over the surface of the Earth. As trade spreads through near-Earth space, settlements are likely to follow, of which the inhabitants will add to the wealth of different cultures which humans have created in the many different environments in which they live.

Success of such extra-terrestrial settlements will have the additional benefit of reducing the danger of human extinction due to planet-wide or cosmic accidents [27]. These horrors include both man-made disasters such as nuclear war, plagues or growing pollution, and natural disasters such as super-volcanoes or asteroid impact. It is hard to think of any objective that is more important than preserving peace. Weapons developed in recent decades are so destructive, and have such horrific, long-term side-effects that their use should be discouraged as strongly as possible by the international community. Hence, reducing the incentive to use these weapons by rapidly developing the ability to use space-based resources on a large scale is surely equally important [11] and [16]. The achievement of this depends on low space travel costs which, at the present time, appear to be achievable only through the development of a vigorous space tourism industry.

### CP

#### CP Text:

#### -The appropriation of outer space by private entities is unjust in all instances except for Low Earth Orbit Satellite constellations.

#### -Private entities ought to appropriate outer space ONLY for the deployment and maintenance of LEO Satellites. -Governments ought to regulate the size and number of these commercial satellites to avoid light pollution

#### Solves broadband internet access which is key for Native communities.

**Venkatesan et al 20** (Aparna Venkatesan is a Professor in the Department of Physics and Astronomy at the University of San Francisco. James Lowenthal is a professor of Astronomy at Smith College. Parvathy Prem is a Planetary Scientist specializing in Planetary research at Johns Hopkins University Applied Physics Laboratory. Monica Vidaurri works as a research scientist at NASA Goddard Space Flight Center, specializing in astrobiology, policy, and ethics. “The impact of satellite constellations on space as an ancestral global commons”. November 06, 2020.)

**Satellite constellations could greatly improve** communications and ongoing **monitoring of** Earth **phenomena ranging from** weather and **climate to disaster management. Such large constellations also** have the potential to **offer global connectivity through** low-cost high-speed **broadband** internet. In principle, **this could be the critical leap needed to bridge the very real digital divide**2, **especially for** the world’s most minoritized populations, including **Indigenous communities.** This divide has been exposed as a chasm during this pandemic year, affecting many millions of students and low-income workers. **Broadband internet has become essential for daily life**, especially **during a pandemic** year when remote forms of learning, teaching, work and even health (for example, telemedicine) have become the norm. In 2019, the FCC offered US$20 billion in subsidies over ten years to address the digital divide in rural communities in the United States, which was quickly followed by a number of filings for LEOsats. **LEOsat broadband may benefit rural communities** more than urban areas—these ‘last mile’ connections are still challenging to complete relative to concentrated (urban) populations where ground-based cable/fibre internet infrastructure is cheaper. **Large satellite constellations thus have the potential to bridge the digital chasm**, but time will tell whether the promise of low-cost high-speed internet worldwide is achieved, **and** what the financial costs to customers are. **This potential democratization of space is worth noting, even if it may not lead to fair participation in space.**

### Case – Asteroid Mining

#### 1] Space mining will never work-it’s too expensive and companies aren’t guaranteed high prices – emperics prove

Fickling 20

[David Fickling, 12-21-2020, "We’re Never Going to Mine the Asteroid Belt," Bloomberg, https://www.bloomberg.com/opinion/articles/2020-12-21/space-mining-on-asteroids-is-never-going-to-happen]

Where would science fiction be without space mining? From Ellen Ripley in Alien and Dave Lister in Red Dwarf, to Sam Bell in Moon and The Expanse’s Naomi Nagata, the grittier end of interstellar drama would be bereft if it weren’t for overalled engineers and their mineral-processing operations. It’s such an alluring vision that real money has been put toward its realization. Alphabet Inc.’s Larry Page and Eric Schmidt, and Hollywood filmmaker James Cameron (director of the Alien sequel Aliens) all [invested in Planetary Resources Inc.](https://www.technologyreview.com/2019/06/26/134510/asteroid-mining-bubble-burst-history/), which raised venture finance with its mission of mining high-value minerals from asteroids and refining them into metal foams that could be shot back down to Earth. Deep Space Industries Inc., a rival startup, also had bold plans to extract resources from space. Though both companies have now been bought out and their projects put into mothballs, the idea of a space mining industry has refused to die. It’s wonderful that people are shooting for the stars — but those who declined to fund the expansive plans of the nascent space mining industry were right about the fundamentals. Space mining won’t get off the ground in any foreseeable future — and you only have to look at the history of civilization to see why. One factor rules out most space mining at the outset: gravity. On one hand, it guarantees that most of the solar system’s best mineral resources are to be found under our feet. Earth is the largest rocky planet orbiting the sun. As a result, the cornucopia of minerals the globe attracted as it coalesced is as rich as will be found this side of Alpha Centauri. Gravity poses a more technical problem, too. Escaping Earth’s gravitational field makes transporting the volumes of material needed in a mining operation hugely expensive. On Falcon Heavy, the large rocket being developed by Elon Musk’s SpaceX, transporting a payload to the orbit of Mars comes to as little as [$5,357 per kilogram](https://www.spacex.com/media/Capabilities&Services.pdf) — a drastic reduction in normal launch costs. Still, at those prices just lofting a single half-ton drilling rig to the asteroid belt would use up the annual exploration budget of a small mining company. Power is another issue. The international space station, with 35,000 square feet of solar arrays, generates up to 120 kilowatts of electricity. That drill would need a [similar-sized power plant](https://www.rocktechnology.sandvik/en/products/exploration-drill-rigs-and-tools/compact-core-drill-rigs/) — and most mining companies operate multiple rigs at a time. Power demands rise drastically once you move from exploration drilling to mining and processing. Bringing material back to Earth would raise the costs even more. Japan’s [Hayabusa2 satellite spent six years](https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=2014-076A#:~:text=Total%20cost%20of%20the%20mission,yen%20(roughly%20%24150%20million%20U.S.)) and 16.4 billion yen ($157 million) recovering a single gram of material from the asteroid Ryugu and returning it to Earth earlier this month. What might you want to mine from space? Water is an essential component of most earth-bound mining operations and a potential raw material for hydrogen-oxygen fuel that could be used in space. The [discovery in October of ice molecules](https://www.nasa.gov/press-release/nasa-s-sofia-discovers-water-on-sunlit-surface-of-moon/) in craters on the Moon was taken as a major breakthrough. Still, the concentrations of 100 to 412 parts per million are extraordinarily low by terrestrial standards. Copper, which typically costs about $4,500 per metric ton to refine, has an average ore grade of about 6,000 ppm. The more promising commodities are platinum, palladium, gold and a handful of rare related metals. Because of their affinity for iron, these so-called siderophile elements mostly sunk toward the metallic core of our planet early in its formation, and are relatively scarce in the Earth’s crust. Estimates of their abundance on some asteroids, such as [the enigmatic Psyche 16](https://solarsystem.nasa.gov/asteroids-comets-and-meteors/asteroids/16-psyche/in-depth/) beyond the orbit of Mars, suggest concentrations several times higher than can be found in terrestrial mines. Still, human ingenuity is all about cutting our coat according to our cloth. If such platinum-group metals are going to justify the literally astronomical costs of space mining, they’ll need to count on sustained high prices for the decade or so that would be needed to get such an operation up and running — and that sort of situation is all but unheard-of in the materials industry. When prices of an essential commodity get excessively high, chemists get extraordinarily good at finding ways to avoid using it, scrap merchants improve their recycling rates, and miners discover new deposits that wouldn’t have been viable at lower prices. Even [criminals get in on the game](https://www.bbc.com/news/business-49767195). That eventually pushes supply up and demand down, so that prices rebalance — a dynamic we’ve seen play out in the markets for rare earths, lithium and cobalt in recent years. The world mines about [three times more platinum](https://www.bloomberg.com/opinion/articles/2017-09-26/platinum-s-lesson-for-lithium-ion-batteries?sref=5JzLFdzD) than it did in the early 1970s, but prices have barely changed once adjusted for inflation. That might sound a disappointing prospect to those looking for excuses for humanity to colonize space — but really it should be seen as a tribute to our ingenuity. Humanity’s failure to exploit extraterrestrial ore reserves isn’t a sign that we lack imagination. If anything, it’s a sign of the adaptive genius that put us in orbit in the first place.

#### Appropriation is different from Extraction. Asteriod mining is not an instance of appropriation

**Wrench 19** [John G. Wrench, JD Candidate Case Western Reserve University School of Law, 2019, “Non-Appropriation, No Problem: The Outer Space Treaty Is Ready for Asteroid Mining”, Case Western Reserve Journal of International Law Vol 51. Issue 1,<https://scholarlycommons.law.case.edu/cgi/viewcontent.cgi?article=2546&context=jil> ] // Triumph Debate

The **non-appropriation** doctrine **restricts parties from making sovereign claims over underlying land**—the same restriction embedded in each of previous section’s legal regimes. **Without violating** the **non-appropriation** principle, **those regimes grant parties the right to extract resources from land they do not own, transfer that right, and limit wasteful use.** Each system similarly vests an entity with the authority to regulate and enforce those rules. With some tailoring, those rules could graft onto the uniqueness of outer space resource extraction.

#### This means that appropriation and extraction are different and you can extract resources without needing appropriation. Therefore, advocacies of extraction of resources are not sufficient to justify appropriation.

#### The affirmative has no enforcement mechanism – private corporations can just circumvent since they have the funding to launch rockets on their own.

Sheetz 21 [Michael, “Elon Musk’s SpaceX raised about $850 million, jumping valuation to about $74 billion”, CNBC. 16 February 2021. https://www.cnbc.com/2021/02/16/elon-musks-spacex-raised-850-million-at-419point99-a-share.html] //DebateDrills LC

SpaceX completed another monster equity funding round of $850 million last week, people familiar with the financing told CNBC, sending the company’s valuation skyrocketing to about $74 billion.

The company raised the new funds at $419.99 a share, those people said — or just 1 cent below the $420 price that [Elon Musk](https://www.cnbc.com/elon-musk/) [made infamous in 2018](https://www.cnbc.com/2018/09/28/sec-says-elon-musk-at-tesla-chose-420-price-as-pot-reference.html) when he declared he had “funding secured” to take [Tesla](https://www.cnbc.com/quotes/TSLA) private at that price.

The latest round also represents a jump of about 60% in the company’s valuation from its previous round in August, when [SpaceX raised near $2 billion at a $46 billion valuation](https://www.cnbc.com/2020/10/14/tesla-investor-ron-baron-spacex-has-a-chance-to-be-just-as-large.html).

SpaceX did not immediately respond to CNBC’s request for comment. In addition to SpaceX further building a war chest for its ambitious plans, company insiders and existing investors were able to sell $750 million in a secondary transaction, one of the people said.

The people spoke on condition of anonymity because SpaceX is not a publicly traded company and the fundraising talks were private. SpaceX raised only a portion of the funding available in the marketplace, with one person telling CNBC that the company received “insane demand” of about $6 billion in offers over the course of just three days.

#### Asteroid mining is key to sustaining our world after we run out of resources.

Elvis 21 [Martin (senior astrophysicist at the Center for Astrophysics, Harvard and Smithsonian), “Riches in Space”, Vox. 2 July 2021. https://aeon.co/essays/asteroid-mining-could-pay-for-space-exploration-and-adventure] //DebateDrills LC

What can we actually do with asteroids? That brings us to my favourite thing about them: their resources. Being an idealistic astrophysicist, my interest is in the money to be made from them. That really is idealistic because, if we can make a profit mining the asteroids, then doing bigger things in space will become a lot cheaper. Capitalism has its faults, but one thing it does well is to make things cheaper. I want to use it as a tool so that we can build far bigger telescopes than we could practically realise today. What do astronomers want? More light! Bigger telescopes! Asteroid mining could make that dream a reality.

The siren call of asteroids for miners is that the Main Belt asteroids contain vast amounts of resources. The iron found in asteroids adds up to some 10 million times the iron that we have in proven reserves on Earth. That’s a lot. It’s enough to build many rings of iron girders all the way around Earth’s orbit, along the lines of the science fiction novel Ringworld (1970) by Larry Niven. Not that a ringworld is a sensible thing to make, but it is a really big ring. More plausibly, with that much iron we could build cities in space, as envisaged by the physicist Gerard K O’Neill in the 1970s. Each of these cities would be big enough for a million people to live in. They would be rotating cylinders, and as a citizen of one you would be walking around inside the cylinder’s surface, feeling a fake gravity from the centrifugal force. That’s the scale of resources we’re talking about.

These vast material supplies could make for an era that people call ‘post-scarcity’, where there’s plenty for everyone, just as there is in the 23rd century of the Star Trek science fiction franchise. The starship crew on Star Trek don’t work to keep themselves fed and housed, that’s taken for granted. They work for adventure and exploration. Asteroid wealth could help all of us take a step towards that happy state.

The problem is how to get started. Iron in space is not going to make for giant profits in the short run. On the ground, it sells for less than $200 a ton. It would be worth more in space, but unfortunately there’s no one to buy huge tonnages of iron in space. To adapt the tagline from the Alien movies – ‘In space, no one can hear you sell.’ It certainly isn’t worth bringing space iron back to Earth since the cost of doing so would far exceed the price it could command. Starting to mine space for resources will have to begin with something so valuable that the cost of obtaining it in space is small by comparison. For now, the best bets are precious metals and – surprise – water.

Precious metals are obvious. Platinum sells for about $33.5 million a ton, and we know from meteorites that some asteroids are richer in platinum than any mine on Earth. That sounds promising. Platinum sales run at about 200 tons, or billions of dollars, per year. The bad news is that ‘richer than any mine on Earth’ is still concentrations of just tens of grams per ton, and extracting those precious grams isn’t easy. We can’t just bring an asteroid near to Earth to start extracting the platinum where we can have heavy machinery to work on it. That would take way too much fuel because, to carry more mass, rockets have to carry exponentially more fuel; unlike airplanes, they don’t get the oxygen for free from their surroundings, they have to pull it along with them. Any refining of platinum will have to be done robotically out in the native orbit of the asteroid. That’s quite a challenge.

Water is a less obvious money-maker. The surprise is that water is also worth millions per ton – if it’s sold in space. Water in space is really useful. It’s good for drinking, and the oxygen in it is good for breathing. You can split the hydrogen from the oxygen in H2O and you’ve got rocket fuel, and water is good at absorbing radiation to protect people from cancer-causing cosmic rays. So, in principle, water in orbit is pretty valuable. The good news is that up to 10 per cent of a water-rich asteroid can be water. It won’t be simple ice, most likely, but will be bound into clays and other rocks. Even better, water is much easier to extract than precious metals. Simply heating up the rock will release water that can then be captured.

[Insert Climate Change]

#### Space mining key to supplying the future world.

Duran 21 [Paloma, “Is Space Mining the Best Option to Face Climate Change?”, Mexico Business. 03 November 2021. https://mexicobusiness.news/mining/news/space-mining-best-option-face-climate-change]//DebateDrills LC

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.

#### Space mining produces less carbon emissions than mining on Earth.

MIT Tech Review 18 [ “Asteroid mining might actually be better for the environment”, MIT Technology Review. 19 October 2018. https://www.technologyreview.com/2018/10/19/139664/asteroid-mining-might-actually-be-better-for-the-environment/] //DebateDrills LC

Hein and co use these numbers to calculate that a kilogram of platinum mined from an asteroid would release some 150 kilograms of CO2 into Earth’s atmosphere. However, economies of scale from large asteroid-mining operations could lower this to about 60 kilograms of CO2 per kilogram of platinum.

That needs to be compared with the emission from Earth-based mining. Here, platinum mining generates significant greenhouse gases, mostly from the energy it takes to remove this stuff from the ground.

Indeed, the numbers are huge. The mining industry estimates that producing one kilogram of platinum on Earth releases around 40,000 kilograms of carbon dioxide. “The global warming effect of Earth-based mining is several orders of magnitude larger,” say Hein and co.

The figures for water are also encouraging. In this case, the authors calculate the greenhouse-gas emissions from an asteroid-mining operation that returns water to anywhere within the moon’s orbit, a so-called cis-lunar orbit.  They compare this to the emissions from sending the same volume of water from Earth into orbit.

The big difference is that a water-carrying vehicle from Earth can haul only a small percentage of its mass as water. But an asteroid-mining spacecraft can transport a significant multiple of its mass as water to cis-lunar orbit. “Substantial savings in greenhouse gas emissions can be achieved,” say Hein and co.

This interesting work should help to focus minds on the environmental impacts of mining, which are rapidly increasing in profile. But it is only a first step. There is significant uncertainty in the numbers here, so these will need to be better understood.

### 1NC – AT: Space Wars

#### Kessler Syndrome is unlikely – empirics prove –

#### Lewis 15 (Hugh Lewis [Senior Lecturer in Aerospace Engineering], “Space Debris, Kessler Syndrome, and the Unreasonable Expectation of Certainty - Room: The Space Journal.” Room, The Space Journal, room.eu.com/article/Space\_debris\_Kessler\_Syndrome\_and\_the\_unreasonable\_expectation\_of\_certainty.)

There is now widespread awareness of the space debris problem amongst policymakers, scientists, engineers and the public. Thanks to pivotal work by J.C. Liou and Nicholas Johnson in 2006 we now understand that the continued growth of the debris population is likely in the future even if all launch activity is halted. The reason for this sustained growth, and for the concern of many satellite operators who are forced to act to protect their assets, are collisions that are expected to occur between objects – satellites and rocket stages – already in orbit. In spite of several commentators warning that these collisions are just the start of a collision cascade that will render access to low Earth orbit all but impossible – a process commonly referred to as the ‘Kessler Syndrome’ after the debris scientist Donald Kessler – the reality is not likely to be on the scale of these predictions or the events depicted in the film Gravity. Indeed, results presented by the Inter-Agency Space Debris Coordination Committee (IADC) at the Sixth European Conference on Space Debris show an expected increase in the debris population of only 30% after 200 years with continued launch activity. Collisions are still predicted to occur, but this is far from the catastrophic scenario feared by some. Constraining the population increase to a modest level can be achieved, the IADC suggested, through widespread and good compliance with existing space debris mitigation guidelines, especially those relating to passivation (whereby all sources of stored energy on a satellite are depleted at the end of its mission) and post-mission disposal, such as de-orbiting the satellite or re-orbiting it to a graveyard orbit. Nevertheless, the anticipated growth of the debris population in spite of these robust efforts merits the investigation of additional measures to address the debris threat, according to the IADC.

#### Space wars are impossible and can’t escalate --- debris, high monetary costs, and lack of lift capabilities

Handberg, 17 – Faculty and Research, School of Politics, Security, and International Affairs, UCF Roger Handberg, “Is space war imminent? Exploring the possibility,” Comparative Strategy. 2017. <https://www.tandfonline.com/doi/pdf/10.1080/01495933.2017.1379832?needAccess=true>

--Space wars were discounted in 1960s – things haven’t changed now – environment still hostile – moreso now bc debris is worse

--Costs a ton to send stuff up there

--Lift capabilities are weak which means war can’t be sustained

--Replacements are slow so war has to be ended

Why now?

Recently, there has been an ongoing resurgence of interest in the possibilities for actual combat in outer space, effectively war in a new domain. Why this would become plausible now is interesting, since the physical realities present in the early days of space activity have not changed. Spacecraft remain vulnerable to attack from the ground by anti-satellite (ASAT) weapons, while the debris issue grows exponentially worse now, given the proliferation of such objects in space as part of the normal operations in outer space: used boosters, dead satellites, pieces of broken spacecraft and satellites, and small particles with deadly impact on other spacecraft. The space shuttles routinely returned to Earth with dings and scars from space debris, while the International Space Station (ISS) several times has been lifted out of harm’s way due to oncoming debris. More critically for assessing space-war possibilities, the sheer cost of conducting such operations remains extremely high, while the possibilities for sustaining combat in space are suspect due to lack of lift capability. The difficulty in orbiting replacement satellites to restore functionality remains, assuming the environment is not too hostile due to expanding debris fields. Replacement satellites or other space hardware are still slow-production items, although that in principle could be placed on more of an assembly-line basis, as was done with the Iridium satellite flotilla of 66 comsats plus multiple spares.19 Or, smaller cube satellites with more limited functionality could be orbited as gap fillers while larger, more functional satellites are built and flown if time exists to do so.

#### Kinetic space targeting requires huge resources that make it infeasible, but cyber attacks are an alt cause they don’t solve

Handberg, 17 – Faculty and Research, School of Politics, Security, and International Affairs, UCF Roger Handberg, “Is space war imminent? Exploring the possibility,” Comparative Strategy. 2017. <https://www.tandfonline.com/doi/pdf/10.1080/01495933.2017.1379832?needAccess=true>

Third, the most obvious initial attack of space-based assets will most likely come from cyber attacks, given that such actions do not necessarily require the scale of resources necessary for other modalities such as kinetic weapons, or even lasers or other energy-type weapons. One will have to position the weapons plus the infrastructure to permit rapid recycling of the weapons for the next attack. Firing off interceptors will likely be a one-off, meaning extremely precise targeting will be required if the attack is to be successful. Note that none of these systems require that individuals be placed in Earth orbit, despite the imagery describing such operations in fictional universes.

#### No space wars --- orbital bombardment fails, and people can’t be sent to space to fight, which caps escalation

--No space wars – people can’t be placed there because they’re too fragile – mostly just engineer nerds not marines

--0 uq – space has been militarized for awhile and we’ve had a space force under the purview of Air Force Strategic Command

--Physics – objects in orbit move fast, so orbital bombardment is literally impossible and would require huge amountns of weapons

Crane, 18 Leah Crane, Writes for New Scientist, BA in Physics/Astronomy, “The arms race in space,” New Scientist. Vol. 238. April 14, 2018. <https://www.sciencedirect.com/science/article/pii/S0262407918306559>

The US is making noises about beefing up its military presence off planet.

WAR in space is a hot topic in the US government. Last year, Congress considered and rejected a proposal to create a standalone "space force" to deal with threats in orbit, and in March, President Donald Trump brought it up again.

"Space is a war-fighting domain, just like the land, air and sea," Trump said at Marine Corps Air Station Miramar in San Diego. "We should have a new force called the space force. It's like the army and the navy, but for space, because we're spending a lot of money on space."

"We should have a new force called the space force. It's like the army and the navy, but for space"

The Trump administration's position was further detailed last month with the announcement of its national space strategy. It states that US "competitors and adversaries have turned space into a warfighting domain" and promises that any attacks on US space assets will be met with a deliberate response.

They sound like fighting words. But any space war won't be like Star Wars - no humans will zoom around in slick spaceships, death will not rain from the skies and it is unlikely that anything will be blown up.

"It's not fighter jocks, it's not marines, it's not special-operations guys," says Todd Harrison at the Center for Strategic and International Studies in Washington DC. "It's a bunch of engineers sitting in a control centre and sitting in labs. The space domain is going to be dominated by nerds."

We know this, because the US space force already exists. The Air Force Space Command has been around since 1982 and employs more than double the number of people at NASA, the US civilian space agency, to operate and protect military satellites. The space force proposal for Congress wasn't really about creating a new branch of the military, but part of a long-running push to move the space command out from under air force leadership, making space a higher priority.

Plus, sending a human to fight a war in space is simply not efficient. "Humans are fragile and sustaining them in space takes a lot of support," says Laura Grego at the Union of Concerned Scientists in Cambridge, Massachusetts. "The Chinese and the Russians aren't going to send marines to space either, because they know physics too."

Physics also rules out orbital bombardment. Objects in orbit move at high speeds, so aren't over a single spot on the planet for long. That means attacking a specific area at short notice would require placing hundreds of weapons in orbit to ensure one is overhead at the right moment. An aircraft carrier loaded with bombers or ballistic missiles would be much more effective.

#### Deterrence in space solves even if we’re more vulnerable ---

#### 1] Countries know we value our space assets and are willing to practice brinkmanship or escalate horizontally

Harrison, 9 – Director, Eisenhower Center for Space and Defense Studies Ambassador Roger G. Harrison, “Space Deterrence: The Delicate Balance of Risk,” Space and Defense, Volume 3, No. 1. Summer 2009. <http://www.usafa.edu/app/uploads/Space_and_Defense_3_1.pdf>

There are, however, potential mitigating factors. First, an adversary could not be certain that retaliation would be limited to space. Although the threat of escalation is often portrayed as inhibiting rather than empowering U.S. decision makers, that threat would also have to be taken seriously by an adversary. U.S. declaratory policy has always emphasized that retaliation for attacks on vital assets will be of a magnitude and by means of our choosing.38 No rational adversary could rule out a disproportionate response or so called “horizontal escalation” (for example in the cyber domain), especially if his conclusion was the same as ours: that limiting ourselves to space-for-space retaliation would leave the U.S. at a disadvantage. He would also have to take into account the possibility of a less than rational response to his action, perhaps leading to an even more rapid escalation.

The Cold War analogy is brinksmanship, the willingness to escalate unpredictably when vital strategic interests are threatened.

#### 2] No shot of a disarming strike --- we’d maintain BMD and be able to retaliate --- that makes our threats credible

Harrison, 9 – Director, Eisenhower Center for Space and Defense Studies Ambassador Roger G. Harrison, “Space Deterrence: The Delicate Balance of Risk,” Space and Defense, Volume 3, No. 1. Summer 2009. <http://www.usafa.edu/app/uploads/Space_and_Defense_3_1.pdf>

The second mitigating factor is that even in the absence of dedicated ASAT systems, a potential attacker is not likely to perceive the U.S. lacks capability to retaliate against the space assets of an adversary. Many nations perceive existing U.S. ballistic missile defense systems as having a dual-use nature, including potential anti-satellite capability. The U.S. reportedly has an active and acknowledged program of “negation” designed to deny an adversary the use of his space assets as force multipliers in the case of hostilities within the atmosphere. We may safely assume that other nations are pursuing similar programs. In our judgment, the most likely scenario for future space conflict is a “war of negation,” i.e. an attempt by each side to preserve the product of its space assets while denying those space services to the opponent. To win such a contest requires technological superiority, which the U.S. should make every effort to maintain and which, in this area as in others, is a vital element in maintaining space deterrence.

We conclude that the threat of retaliation can remain a credible element of our overall space deterrence. The attribution of attack is not an insuperable obstacle, and that questions of resolve will ultimately depend on the perceptions of a potential attacker in the circumstances existing when his decision to attack is being considered. A credible threat of retaliation may require willingness to escalate into other domains. It could include fielding ASAT systems if such systems are deployed by others, but the resulting arms race would not be in the interests of the United States. The U.S. should not be the first to deploy such systems and the U.S. use the full extent of its influence internationally to avoid that outcome. Ultimately, a threat of retaliation is never more credible than the leader and the government that issues it. No declaratory policy can compensate for an irresolute commander in chief, one who is misinformed or badly served by his subordinates. An opponent will tend to judge the likelihood of retaliation not according to proclamations made months or years earlier, but according to the situation pertaining at the time – as Hitler did in Europe and Saddam did in the Middle East. What a President does in the run up to and conduct of a crisis will have far more to do with an adversaries decisions than libraries full of ultimatums and guarantees. Subordinates who doubt the resolution of a commander will try to limit his or her flexibility to respond other than in ways the subordinates think appropriate. A wise commander in chief, on the other hand, will strive to maintain flexibility, to approach a particular conflict in the context of wider responsibilities, to take account of factors which were unforeseen when the doctrine or battle plan was devised – in short, to balance one risk off against others. No bureaucratic arrangement, declaratory doctrine or weapon capability will compensate when such leadership is not present.