## NC

Alaska Model CP

#### Text: States ought to establish an international space body modeled on the International Seabed Authority. This new international space body ought to license outer space resources and levy a royalty on production and mandate that revenues are deposited in a Space Resource Fund that pays a yearly dividend to every citizen on Earth.

#### Solves inequality

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[Morgan, and Kevin Orrman-Rossiter, PhD candidate, History & Philosophy of Science, The University of Melbourne, "All of humanity should share in the space mining boom," Conversation, 4-17-16, https://theconversation.com/all-of-humanity-should-share-in-the-space-mining-boom-57740, accessed 6-25-21]

One solitary asteroid might be worth trillions of dollars in platinum and other metals. Exploiting these resources could lead to a global boom in wealth, which could raise living standards worldwide and potentially benefit all of humanity. There are already companies, such as Planetary Resources, hoping to make mining in space a reality. Peter Diamondis, co-founder of Planetary Resources and founder of the XPrize Grand Challenges, believes that the benefits to humanity give us a moral imperative to explore and utilise space. He has also declared “there are twenty-trillion-dollar checks up there, waiting to be cashed!” However, behind the utopian rhetoric and dazzling dreams of riches lie some very real problems. Ownership and the Outer Space Treaty The framework of international space law is given by the Outer Space Treaty (OST), which entered into force in 1967. Among its main principals, the OST includes these statements: the exploration and use of outer space shall be carried out for the benefit and in the interests of all countries and shall be the province of all mankind and, outer space is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means Because the OST is generally interpreted as preventing anything like private fee-simple ownership, it is sometimes claimed to be an obstacle to commercial ventures in space. But such claims simply do not hold water. There are numerous terrestrial examples where resources are profitably exploited in the absence of fee-simple ownership. Governments routinely licence companies to engage in timber extraction, mining, offshore oil exploration and other activities, receiving royalties payments on production. In the United States, revenues from such royalties totalled some US$13.5 billion dollars in 2014 from federally owned or managed lands alone. Nevertheless, some proponents of mining in outer space argue for serious modification or an end to the Outer Space Treaty and claim, against the evidence, that without fee-simple ownership, there is no incentive for commercial exploitation. The Unites States’ Space Act of 2015 was just one volley – and a deliberately vague one at that – in this ongoing international debate. A balanced approach? The riches exist, but how will humanity benefit from mining in outer space, or for that matter, other global commons such as the deep sea floor? Behind the lofty rhetoric of benefits to humanity, there is a dark shadow of voodoo economics, the shambling, walking dead figure of trickle down economics– and the possibility of a world where a few trillionaires enjoy the view from space while others barely eke a living on its surface. Yet we do suggest that commercial interests and profit seeking can be a healthy part of the exploration of outer space. Yet outer space is not the Wild West frontier of Frederick Jackson Turner, nor do we live in the Gold Rush days of Jack London’s tale of greed and death. In the common heritage of space, with multiple state and private actors engaging in exploration and potentially exploitation, international cooperation and oversight will benefit all. The Alaskan model There is a balanced, pragmatic approach that will promote commercial and profit driven activities, while also producing tangible benefits to all of humanity. Importantly, this pragmatic approach has a well established precedent that has existed for nearly 40 years. And this comes not from a social democracy or left-wing ideology, but was the brainchild of a libertarian, Republican governor of Alaska, Jay Hammond. That model is the Alaska Permanent Fund Corporation (APFC) created in 1976, and its unique “citizen’s dividend”. The APF is a resource wealth fund, which derives its revenue primarily from leases on oil fields. In 1977, Hammond suggested that “rather than permitting government to spend all public monies earned through the exploitation of the public’s resources for what government thinks best, let’s grant shares to Alaskans.” The first dividend payment was made in 1982, and in 2015 that payment amounted to US$2,072. Linking a citizen’s dividend to a sovereign wealth fund was unique, but the idea of a citizen’s dividend has a long and venerable tradition. One of the earliest advocates was no less than the political theorist and American Revolutionary, Thomas Paine. International body How would this work for outer space? We need an international body similar to the International Seabed Authority, which was established by the United Nations Convention on the Law of the Sea, or the International Telecommunications Union, which allocates satellite orbits. This would provide the stable business and investment environment that entrepreneurs seek by ensuring international law and obligations are met. This body could license outer space resources and levy a royalty on production, which is part of standard business practice between petroleum and other mining companies and governments here on Earth. In turn, these revenues, or a significant portion thereof, would be deposited in a Space Resource Fund, possibly under the aegis of the World Bank. And every single citizen on Earth, say aged 18 or above, would receive a dividend on a yearly basis as their rightful share as owners of the common province of humankind. Crucially, we are not suggesting redistribution, which has been an obstacle to the International Seabed Authority and the Moon Treaty in the past, but a fair share dividend of wealth that truly belongs to everyone. Our model doesn’t provide a handout, or a welfare cheque, or charity from a trillionaire philanthopist; it pays every owner in a global commons a share of what is rightfully theirs. Even tiny dividends by the standards of the world’s wealthy nations would make a difference for some developing world farmers. If there truly are trillions of dollars out there, then this might be something fundamentally world changing. We accept that Larry Page and Sir Richard Branson – founding investors and advisors in Planetary Resources – and its founders Eric Anderson and Peter Diamandis, truly want humanity to benefit from outer space, and that they truly believe in corporate social responsibility and a sustainable future. We would encourage them to embrace the idea that the sky really does belong to all of us, as the common “province of all mankind”. By paying rent for the right to exploit resources in space and royalties on production, the same way oil companies pay to exploit oil in the Gulf of Mexico, they’ll be engaging in business as usual. They will have bought the right to make a potentially enormous profit and prove they really are responsible global citizens. And they’d get a citizen’s dividend cheque too.

## NC

Mining CP

#### Counterplan: The appropriation of resources from asteroids constrained by “beneficial use” in outer space by private entities is just.

#### Preserving international mechanisms for dispute management and coop solves a tragedy of the commons BUT appropriation is key to incentivizing asteroid mining

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[Jack, "Space, the Final Frontier of Enterprise: Incentivizing Asteroid Mining Under a Revised International Framework, 40 Mich. J. Int'l L. 189, 2018, <https://repository.law.umich.edu/mjil/vol40/iss1/5>, accessed 6-24-21]

III. A New International Framework to Govern the Space Economy

Asteroid mining creates tension within the OST as an activity that is prohibited by the treaty’s terms but largely in line with the treaty’s purpose. As such, the OST should be modified to allow for greater certainty and predictability with respect to asteroid mining. The possibility that asteroid mining could be illegal under international law likely disincentivizes entry into this new endeavor by adding risk and uncertainty. This section outlines what a revised framework should look like. First, the law governing space should remain international in nature to further the interests of peaceful cooperation and facilitate dispute resolution. Second, this framework should present minimal regulatory barriers for entry given the benefits that asteroid mining could bring to all mankind. The development of whaling law provides a use-ful historical example of how norms and rules for the asteroid mining industry could evolve in a way that facilitates efficient governance of this endeavor.

A. The Desirability of an International Framework

The preservation of space as a zone governed by international law, in contrast to a system predicated on national jurisdiction, is desirable in that it promotes peace, facilitates dispute resolution, and allows for more coordinated efforts in addressing issues relevant to all entities operating in space.98 As illustrated by the recent legislative activity in the United States and Luxembourg, the risk of inaction is the resultant domination of the extraterrestrial environment by individual nations rather than by international agreement.99 It would take only minor changes to the OST to resolve some of the ambiguities in the status quo and help bring the benefits of asteroid mining to humanity as a whole. A revision of this treaty rather than a wholesale abandonment of the agreement—whether that abandonment is in fact or merely in practice—would better maintain the international character of space.

The OST reflects Cold War era concerns about the militarization of space.100 Private companies, now ascendant in the growing space economy, simply do not have the military capacity or intention of sovereign governments. In short, the factual backdrop for the signing of the OST has changed. One straightforward means of authorizing private companies to extract space resources would be to revise the OST to clarify that the language in Article II prohibiting national appropriation does not apply to private companies. This could be achieved by simply adding a sentence to the end of Article VI: Under the revised treaty, companies shall remain under the supervision of the countries in which they are based but are not capable of national appropriation by use or occupation. This revision would create something of a line-drawing problem given the partnerships between sovereign space agencies and private companies,101 as well as a possible loophole by which unscrupulous nations could take advantage of the corporate form. Additional safeguards might be necessary to prevent this possibility. This revision could, however, promote peaceful coexistence and uniformity in space law, as well as create certainty as to the legality of asteroid mining by private companies.

Another possibility is to create a new set of international rules for extraction of space resources. Assignment of such property rights could take the form of a first-come, first-served system102 or it could depend on an Earth-side registration process.103 Arguably, extraction is different than the forbidden uses enumerated in the OST in that it is a temporary occupation and not inherently an exercise of military might or the flexing of sovereign muscle.104 While the United States and Luxembourg both interpret asteroid mining to be legal under the existing treaty,105 the promulgation of rules governing the endeavor would add clarity as to the legality of the enterprise. This approach would have the advantage of treating sovereign actors and private companies alike, but would require more substantial revision of the OST, or a new international agreement altogether.

An amended OST or a new treaty governing the extraction of space resources would have the benefit of maintaining the peaceful order of space. While admittedly the product of a different era, the post-national and peaceable foundation of the OST is still desirable in an international environment where many nations are armed to the proverbial nuclear teeth. Peaceful use of outer space is a laudable objective and one served most effectively by international agreement rather than by competing national claims of sovereignty.106

An international system would also facilitate dispute resolution. In a borderless and extra-jurisdictional realm like outer space, a system predicated on national sovereignty and ownership is not instructive as to whose laws—or whose choice of law rules—would control in the event of disputed title of an asteroid or the commission of a tort between two actors from different nations.107 The United Nations Convention on the Law of the Sea (the “UNCLOS”) established the International Tribunal for the Law of the Sea (the “ITLOS”) as a means of providing a venue in which similar disputes could be adjudicated between actors with conflicting legal regimes.108 Outer space has a great deal of similarity to the high seas: both are vast, both are easily treated as a non-appropriable international commons, and both are an in-between space in the sense of existing between bodies of terra firma. 109 An international mechanism like ITLOS ought to be established for resolving space disputes such that parties can seek a neutral arbiter to resolve conflict and laws can be uniformly applied to all entities irrespective of their country of origin.110

Finally, an international system could more easily allow for cooperation between nations and private entities in addressing issues that affect the spacefaring community as a whole. The emergence of space debris and the use of nuclear power sources in space are examples of developing issues that bear on the ease and safety of space travel for all.111 Left to national governments or individual corporations, it seems plausible that lack of oversight could result in a tragedy of the commons.112 By contrast, an international framework is well-suited to consider the problems of the space ecosystem in a way that transcends national boundaries. The UNCLOS Preamble, for example, demonstrates an awareness that “problems of ocean space are closely interrelated and need to be considered as a whole.”113 The compelling interests of peace, uniformity, and cooperation in outer space illustrate the desirability of an international framework to govern asteroid mining; to tweak rather than jettison the existing law. The resulting clarity and predictability would incentivize asteroid mining through reducing legal risk and uncertainty.

A counterproposal to an international framework is a system in which nations assign property rights according to domestic law. It would be possible to take a terra nullius approach to property rights relating to celestial bodies.114 In the Western Sahara advisory opinion, the International Court of Justice defined terra nullius as “a legal term of art employed in connection with ‘occupation’ as one of the accepted legal methods of acquiring sovereignty over territory.”115 For a nation to peaceably acquire sovereignty through occupation, the land must be “terra nullius—a territory belonging to no-one—at the time of the act alleged to constitute the ‘occupation[.]’ ”116 This legal approach was prevalent during the colonial era: explorers and emigrants acting in the name of European sovereigns declared ownership of territory by right of discovery and occupation.117 By authorizing U.S. citizens to extract materials from asteroids through the Commercial Space Launch Competitiveness Act, the United States has started down a path in which property rights in space flow from the jurisdiction of individual sovereign nations.118 Luxembourg has taken a similar approach through its own legislation.119

There are some notable advantages to this approach. The absence of an international policing or enforcement mechanism in space arguably points in favor of regulation by nations with spaceflight capacity. Given the generally acknowledged challenges of enforcing international law,120 one might wonder whether domestic governments might be better positioned to monitor and control private entities based within their borders. A nation-centric approach would also likely incentivize investment in asteroid mining, prompting countries and private actors to invest more aggressively so as not to lose the new space race.121 Assuming, as this Note does, that the development of the asteroid mining industry is in the interest of humanity as a whole, this approach has some appeal.

However, a nation-centric, first possession framework has drawbacks that highlight the desirability of an international governance regime for asteroid mining. First, the experience of colonization was one that prompted conflict between colonizers.122 The peaceful character of space is one of the great achievements of the OST, and it should not be jettisoned. Second, a regime characterized by national actors could spark a race to the bottom with respect to domestic regulation, leading to the same “flags of convenience” problem present in the maritime context as asteroid mining and spaceflight companies relocate to avoid taxes, labor and safety standards, and tort liability.123 An international framework, by contrast, could more easily prevent this problem by facilitating the creation of uniform standards for labor, safety, and liability, making relocation to under-regulated states a less attractive prospect. The drawbacks of a system governed by individual nations, in conjunction with the advantages of a global system illustrated above, point to the desirability of a revised framework governing asteroid mining that is international in character.

B. A System with Minimal Regulatory Barriers to Entry

Whatever approach is chosen to resolve the ambiguities in the OST ought not to be overly restrictive or create burdensome regulatory obstacles for private asteroid mining companies. Substantial regulation could discourage investment and hamper the development of an already capital-intensive and high-risk industry.124 The ideal regulatory system for asteroid mining should maintain an international character for the reasons described in the previous section but should not impose cumbersome regulation on asteroid mining companies at this stage in their development. Rather, allowing norms to develop over time through the resolution of disputes between asteroid mining companies would likely result in the most efficient regulatory system and would be more attractive to companies and nations that might be tempted to disregard the treaty.

The development of whaling custom offers insight into the extent to which “property rights may arise anarchically out of social custom.”125 The analogy to asteroid mining is strong in that both are extractive, high-risk, and capital-intensive industries that take place in what is effectively mare liberum (free sea).126 Herman Melville in Moby-Dick suggests the whaling industry was not governed by a “formal whaling code,” but rather that the “fishermen have been their own legislators and lawyers in this matter.”127 Over time, the custom developed that “I. A Fast-Fish belongs to the party fast to it [and] II. A Loose-Fish is fair game for anybody who can soonest catch it.”128 While Melville concedes that “the commentaries of the whalemen themselves sometimes consist in hard words and harder knocks—the Coke-upon-Littleton of the fist,”129 he also notes that this code is “universal, undisputed law applicable to all cases”130 that prevents “vexatious and violent disputes [arising] between the fishermen.”131 By and large, whalers were able to govern themselves by crafting norms over time that suited their needs.

Robert Ellickson, in his Hypothesis of Wealth-Maximizing Norms, cited the development of whaling norms as supporting the idea that, “when people are situated in a close-knit group, they will tend to develop for the ordinary run of problems norms that are wealth-maximizing.”132 Ellickson defines wealth-maximizing norms as those that minimize the sum of transaction costs and deadweight losses that the members of a group objectively incur.133 Those involved in the group activity are likely to develop rules in a utilitarian manner, preferring “bright-line rules that would eliminate arguments to fuzzy rules that would prolong disputes.”134 The few asteroid mining companies currently in existence are not only a close-knit group under Ellickson’s definition,135 but are best positioned to create rules that will give rise to greater clarity and reduce transaction costs due to their proximity to and soon-to-be-developed experience with the business of asteroid mining. Rules like these would incentivize asteroid mining through greater legal clarity and predictability, thus facilitating the delivery of asteroid mining’s benefits to all mankind.

The UNCLOS ratification debate helps illustrate why a more substantial regulatory regime might prove counterproductive for the international community. One of the primary reasons cited by American opponents of ratification is that accession to the treaty would subject American mining companies “to the whims of an unelected and unaccountable bureaucracy and would force them to pay excessive fees to the International Seabed Authority for redistribution to developing countries.”136 While other commentators have dismissed these concerns as “pure nonsense,” noting that these same companies favor accession to the treaty for the sake of having a clear legal claim to mined minerals,137 it is easy to imagine that a similar scheme of bureaucratic redistribution in the context of asteroid mining might be disregarded by the United States. A decision by nations leading the way on asteroid mining to opt out of a treaty would for all practical purposes cripple future treaty efforts. A key advantage of the proposed regulatory framework described in this Note is a practical one: it would offer the attractive prospect of legal clarity without an international bureaucratic bogeyman, making it more likely that key national stakeholders like the United States would sign on.

Conclusion

Maintaining the international character of outer space while allowing private companies to develop their own governing norms under a slightly revised OST would preempt the outbreak of a new race by sovereign governments to colonize space; create greater certainty for those undertaking the enterprise of asteroid mining; and permit the development of an efficient system tailored to maximize returns on celestial investment. The asteroid mining industry has the potential to confer benefits on all mankind as a means of facilitating space travel, spurring the development of science and technology, mitigating the potential for a calamitous asteroid impact, and facilitating climate change mitigation efforts. As such, it is in the interest of all nations to revise the OST to allow greater certainty in this endeavor. While the “entire unimaginable infinity of creation”138 is still out of reach based on our existing physics and engineering capabilities, asteroid mining is a critical step in beginning to harness celestial resources and more fully explore the intricacies of the universe around us.

#### Asteroids cause extinction

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[Seth, Risk-Risk Tradeoff Analysis of Nuclear Explosives for Asteroid Deflection, Risk Analysis, vol. 39, no. 11, November 2019, p. 2427-2442, <https://doi.org/10.1111/risa.13339>, accessed 1-8-22]

4.3 Severity of Asteroid Collision and Violent Nuclear Conflict

Both asteroid collisions and nuclear weapons detonations involve explosions. Their effects are likewise similar. A primary difference is the absence of ionizing radiation from asteroid collisions.

The standard physical measure for the severity of asteroid collisions and nuclear detonations is the amount of energy released, in units of tons (T), kilotons (KT), or megatons (MT) of TNT equivalent.10 The 2013 Chelyabinsk asteroid collision was about 20m in diameter and 500KT (Brown et al., 2013). This is about double the smallest size believed to be able to cause damage on Earth’s surface; smaller collisions explode harmlessly in the upper atmosphere (Harris et al., 2015). The Chicxulub impactor was an estimated 10km and 108MT (Chapman & Morrison, 1994). Nuclear weapons have been made as small as around 10T (the U.S. W54 weapon) and as large as 50MT (the Soviet Tsar Bomba). There is no physical limit to how large of a nuclear weapon can be built. Common nuclear weapon yields are tens to hundreds of KT, and some have yields of several MT (Kristensen and Norris, 2018a, 2018b, 2018c).

The extent of the damage depends on the amount of energy released and the location on Earth. The 1908 Tunguska collision caused ecological damage across a wide area of Siberia but no significant human harm, though if it had collided four hours later it could have hit Saint Petersburg (Longo, 2007). The locations of asteroid collisions are essentially random, so most occur at ocean locations. The locations of nuclear weapons explosions are not random. In military planning, most nuclear weapons are targeted at either cities or military installations, while test explosions are conducted in remote locations or underground to minimize harm.

The local harms from asteroid collisions and nuclear weapons explosions are relatively simple and well understood. The immediate vicinity is disturbed or destroyed. The Hiroshima and Nagasaki bombings provide indicative data. They were hit with bombs of 15-20KT yield detonated at altitudes around 500-600m (to maximize damage) over the center city. Fatalities were about 120,000 people in Hiroshima and 60,000 in Nagasaki; the Hiroshima number is likely larger due to flatter terrain and drier conditions that enabled the blast and accompanying firestorm to spread (Toon et al., 2007). Nuclear detonations with higher yields and at larger cities could bring many times more fatalities.

In comparison, local effects from asteroid collisions could be larger than single nuclear detonations due to their potential for larger event energies. However, local effects from asteroid collisions would typically see less human harm due to their occurrence at random locations, which are likely to be uninhabited or sparsely populated. Asteroid risk analyses commonly calculate local severity based on the population within a 2 to 4 psi blast overpressure damage area (Canavan, 1993, 1994; Garrick, 2008; Mathias, 2017; Stokes et al., 2003), which is based on studies of nuclear weapons (Glastone, 1962; Glastone & Dolan, 1977).

A sufficiently large asteroid collision at an ocean would cause a tsunami. The current literature lacks consensus on how severe the tsunami would be. Gusiakov et al. (2010) propose that several massive asteroid-caused tsunamis have occurred in recent millennia, but this proposition is hotly disputed (Bourgeois & Weiss, 2009; Goff et al., 2010; Pinter & Ishman, 2008). Other studies suggest that asteroid-caused tsunamis are much less severe (Gisler, Weaver, & Gittings, 2011; Korycansky & Lynett, 2005).

The most severe asteroid collisions and nuclear wars can cause global environmental effects. The core mechanism is the transport of particulate matter into the stratosphere, where it can spread worldwide and remain aloft for years or decades. Large asteroid collisions create large quantities of dust and large fireballs; the fire heats the dust so that some portion of it rises into the stratosphere. The largest collisions, such as the 10km Chicxulub impactor, can also eject debris from the collision site into space; upon reentry into the atmosphere, the debris heats up enough to spark global fires (Toon, Zahnle, Morrison, Turco, & Covey, 1997). The fires are a major impact in their own right and can send additional smoke into the stratosphere. For nuclear explosions, there is also a fireball and smoke, in this case from the burning of cities or other military targets.

While in the stratosphere, the particulate matter blocks sunlight and destroys ozone (Toon et al., 2007). The ozone loss increases the amount of ultraviolet radiation reaching the surface, causing skin cancer and other harms (Mills, Toon, Turco, Kinnison, & Garcia, 2008). The blocked sunlight causes abrupt cooling of Earth’s surface and in turn reduced precipitation due to a weakened hydrological cycle. The cool, dry, and dark conditions reduce plant growth. Recent studies use modern climate and crop models to examine the effects for a hypothetical IndiaPakistan nuclear war scenario with 100 weapons (50 per side) each of 15KT yield. The studies find agriculture declines in the range of approximately 2% to 50% depending on the crop and location.11 Another study compares the crop data to existing poverty and malnourishment and estimates that the crop declines could threaten starvation for two billion people (Helfand, 2013). However, the aforementioned studies do not account for new nuclear explosion fire simulations that find approximately five times less particulate matter reaching the stratosphere, and correspondingly weaker global environmental effects (Reisner et al., 2018). Note also that the 100 weapon scenario used in these studies is not the largest potential scenario. Larger nuclear wars and large asteroid collisions could cause greater harm. The largest asteroid collisions could even reduce sunlight below the minimum needed for vision (Toon et al., 1997). Asteroid risk analyses have proposed that the global environmental disruption from large collisions could cause one billion deaths (NRC, 2010) or the death of 25% of all humans (Chapman, 2004; Chapman & Morrison, 1994; Morrison, 1992), though these figures have not been rigorously justified (Baum, 2018a).

The harms from asteroid collisions and nuclear wars can also include important secondary effects. The food shortages from severe global environmental disruption could lead to infectious disease outbreaks as public health conditions deteriorate (Helfand, 2013). Law and order could be lost in at least some locations as people struggle for survival (Maher & Baum, 2013). Today’s complex global political-economic system already shows fragility to shocks such as the 2007- 2008 financial crisis (Centeno, Nag, Patterson, Shaver, & Windawi, 2015); an asteroid collision or nuclear war could be an extremely large shock. The systemic consequences of a nuclear war would be further worsened by the likely loss of major world cities that serve as important hubs in the global economy. Even a single detonation in nuclear terrorism would have ripple effects across the global political-economic system (similar to, but likely larger than, the response prompted by the terrorist attacks of 11 September 2001).

It is possible for asteroid collisions to cause nuclear war. An asteroid explosion could be misinterpreted as a nuclear attack, prompting nuclear attack that is believed to be retaliation. For example, the 2013 Chelyabinsk event occurred near an important Russian military installation, prompting concerns about the event’s interpretation (Harris et al., 2015).

The ultimate severity of an asteroid collision or violent nuclear conflict use would depend on how human society reacts. Would the reaction be disciplined and constructive: bury the dead, heal the sick, feed the hungry, and rebuild all that has fallen? Or would the reaction be disorderly and destructive: leave the rubble in place, fight for scarce resources, and descend into minimalist tribalism or worse? Prior studies have identified some key issues, including the viability of trade (Cantor, Henry, & Rayner, 1989) and the self-sufficiency of local communities (Maher & Baum, 2013). However, the issue has received little research attention and remains poorly understood. This leaves considerable uncertainty in the total human harm from an asteroid collision or nuclear weapons use. Previously published point estimates of the human consequences of asteroid collisions12 and nuclear wars (Helfand, 2013) do not account for this uncertainty and are likely to be inaccurate.

Of particular importance are the consequences for future generations, which could vastly outnumber the present generation. If an asteroid collision or nuclear war would cause human extinction, then there would be no future generations. Alternatively, if survivors fail to recover a large population and advanced technological civilization, then future generations would be permanently diminished. The largest long-term factor is whether future generations would colonize space and benefit from its astronomically large amount of resources (Tonn, 1999). However, it is not presently known which asteroid collisions or nuclear wars (if any) would cause the permanent collapse of human civilization and thus the loss of the large future benefits (Baum et al., 2019). Given the enormous stakes, prudent risk management would aim for very low probabilities of permanent collapse (Tonn, 2009).

#### “Beneficial use” solves every deficit AND provides incentives- appropriation is key

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[Ross, "The doctrine of appropriation and asteroid mining: Incentivizing the private exploration and development of outer space", Oregon Review of International Law 17, 2015, 183-204, accessed 1-9-22]

THE CURRENT INTERNATIONAL TREATIES THAT REGULATE THE OWNERSHIP OF ASTEROIDS FAIL TO INCENTIVIZE THE DEVELOPMENT AND EXPLORATION OF OUTER SPACE

Currently, there are two outdated international treaties that attempt to adjudicate the use and exploration of space. The first treaty, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (1968), is an archaic but influential agreement ratified by nearly all of the world nations that have successfully launched a shuttle into space.47 The second treaty, The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (1979), was an attempt to reform some of the principles from the Outer Space Treaty that failed to garner popular acceptance because it was not signed by any nations with national space programs.48 While both treaties attempt to deal with many issues, including the ownership of celestial bodies, both fail to allow for the ownership and development of asteroids by government or private entities. Because they were written during the space race in a period of international distrust, it makes sense that these treaties would be concerned with tempering the race to establish sovereign control over celestial bodies. However, as space exploration shifts from being financed and controlled by national governments to being financed by private industry, these concerns may be less important.49

NASA (National Aeronautics and Space Administration), the U.S. space program, was once a well-funded program. It was the focus of the American people in 1961 when President John F. Kennedy announced before a joint session of Congress the ambitious goal of sending a man to the moon.50 The funding for NASA has dwindled in modern times, and the organization now gets around 0.5% of the federal budget, which is the lowest it has been since Kennedy’s 1961 speech.51

Despite a decrease in national space program funding, corporate space missions are on the rise. In 2010, President Obama proposed that NASA exit the business of flying astronauts from Earth to low Earth orbit and move it to private companies.52 Several companies have stepped up to bat, and corporate space programs now include space tourism, supply missions, and in one case a one-way colonization mission to Mars.53 Corporate interest in space tourism and development demonstrates a strong private commercial interest in space as an industry, which could serve to finance the exploration of space in a period where national governments do not have an active financial interest in space. However, under current international treaties, the ownership of asteroids is prohibited, preventing corporations willing to invest in asteroid mining from having a secure claim.

A. The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (1967) Prohibits Commercial Property Claims

The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Outer Space Treaty of 1967), is currently the most influential source of international legislation regarding space law.54 Ratified in 1967 by most of the U.N. nations that had successfully launched a shuttle into space, the Outer Space Treaty of 1967 carries much more weight than the subsequent “Moon Treaty” of 1978.

The Outer Space Treaty of 1967 addresses many different issues, including the military development of space,55 the commission of aid to distressed astronauts,56 international liability for damage caused by space objects,57 and the guaranteed cooperation between state-actors in space.58 While the agreement does an admirable job dealing with many of these issues, it fails to grant any kind of ownership claims over celestial bodies.

Under the Outer Space Treaty of 1967, both government and private entities are prohibited from claiming ownership over celestial bodies. Article II of the agreement explicitly states that, “Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”59

While this statement seems reasonable for preventing a government from, say, claiming the moon, it makes no distinction between the moon and asteroids, planets, meteorites, comets, or other celestial bodies. By preventing the ownership of celestial bodies, even those that have no utility beyond the resources they contain, the treaty effectively destroys the financial gain that could motivate corporations to explore and develop space.

B. The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (1979) Also Fails to Recognize the Need to Provide Ownership Rights in Celestial Bodies

The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies of 1979 (The Moon Treaty) also fails to create property rights in celestial bodies in a way that would incentivize space travel.60 Widely considered a failure, the Moon Treaty was an attempt to reform the Outer Space Treaty of 1967, but it was not ratified by any nation that had successfully launched a shuttle into space.

The Moon Treaty took an idealistic approach to international space law, and if it were more effective it would have established an international regime to carry out its goals.61 The stated goals of the regime were to develop the natural resources of the moon and other celestial bodies, rationally manage those resources, and expand opportunities for parties to use and share the resources.62

While the creation of said regime never occurred, it is clear the drafters of the Moon Treaty clearly foresaw the need for international agreement regarding space resources. Among other things, the Moon Treaty prohibits state parties from developing a military presence on the moon or any other celestial body,63 or excluding other state parties from scientific investigation in space.64 The Moon Treaty also attempts to require that any scientific discoveries useful to mankind be shared with the Secretary-General of the United Nations as well as the public and the international scientific community.65 Unlike the Outer Space Treaty of 1967, the Moon Treaty calls for the U.N. to maintain control over space, and has numerous provisions that call for approval by the Secretary-General of the United Nations before a state party can act.

The Moon Treaty was an attempt to rationally manage space resources by creating an international regime to oversee space development. It fell short, however, by failing to grant substantive commercial rights that would incentivize space travel, making no distinction between planets, comets, asteroids, or space debris with respect to its provisions (like the Outer Space Treaty), and by applying its provisions exclusively to state parties with few references to private action.66

Article 11, paragraph 2 of The Moon Treaty states that “[t]he moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any means.”67 Thus, under the Moon Treaty, no entity can lay claim of ownership upon anything in space, regardless of the purpose of the claim. The agreement goes further to say explicitly that the surface, subsurface, and the natural resources in place on the moon will not become property of any state; international intergovernmental or nongovernmental organization; national organization or nongovernmental entity; or of any natural person.68 Put differently, the Moon Treaty explicitly prohibits both private and government actors from making commercial claims over the moon, and since the treaty is meant to apply to any celestial body within the solar system, it follows that the same rule applies to space resources like those found on asteroids. While protecting space resources for science is certainly a laudable goal, the Moon Treaty prevents commercial claims in space, effectively stonewalling space’s development. One can hardly imagine a corporation spending the tremendous amount of money necessary to launch a space mission if the only payoff would be the chance to do research that would ultimately have to be shared with the public, including the corporation’s competitors.

Like the Outer Space Treaty of 1968, the shortcomings of the Moon Treaty demonstrate the need for new international legislation regarding the right to own and use space resources like asteroids. The exploration and development of space could be incentivized and facilitated by a new international treaty that affords property rights to private and government entities in asteroids. The doctrine of appropriation would be a logical governing rule.

III THE APPLICATION OF THE DOCTRINE OF APPROPRIATION TO ASTEROID MINING WOULD INCENTIVIZE CORPORATE SPACE EXPLORATION WHILE PREVENTING WASTE AND ABSTRACT CLAIMS

Like water during the expansion of the American West, the exploration of space can be financed and incentivized by granting rights in resources to those who secure new resources and put them to beneficial use. Some legal scholars have suggested the traditional rule of capture be applied to asteroids,69 or that rights to asteroids be purchased directly from an international agency and owned as chattel.70 However, like water during America’s westward expansion, asteroids are not easily classified under traditional property regimes. Thus, a doctrine of appropriation would be more appropriate for asteroids than a traditional rule of capture or a chattel system, because a system based on the traditional rule of capture or chattel would result in waste, abstract claims, and complicated legal issues.

First, asteroid claims cannot be adjudicated under the traditional rule of capture, or as chattel, because such systems would be incredibly wasteful. As of now, scientists have observed approximately 450,000 asteroids in our solar system.71

But only a fraction of the observable bodies will be cost effective to mine. While it might one day be possible for a single entity to finance several mining missions at once, current costs associated with such a venture would limit almost any space-mining program to one or two asteroids, at least initially.72 The traditional rule of capture could allow an entity to quickly claim multiple asteroids merely by landing on them and planting a flag, without requiring the entity to show it can reasonably use the resources they have claimed. Even worse would be a system where the same corporation could claim asteroids simply by discovering their existence and registering the claim. Allowing this type of unregulated claim would incentivize larger corporations capable of space travel to quickly claim reachable asteroids, but the claims could easily outpace those entities’ realistic expectations on what they could use. Under a traditional rule of capture system, the solar system could be divvied up long before the resources could conceivably be mined. A rule similar to the doctrine of appropriation used for water claims in the United States would alleviate this concern by limiting claims to those where a claimant can show a reasonable beneficial use for the resource.

Another concern posed by the traditional rule of capture or chattel system would be the creation of abstract claims. Some legal scholars have advocated for a system where asteroids would be categorized as chattel, and rights in asteroids would be granted to an entity that could identify an asteroid and register ownership of it with an international agency.73 The advantage of such a system would be that it would allow an international agency to keep track of asteroids, and it would allow for the mapping of the reachable solar system. The problem with this approach, however, is that it would result in abstract claims. If an entity could claim the rights to an asteroid without actual possession, there is nothing to prevent that company from claiming ownership long in advance of any real possibility of landing on it. One of the reasons for creating the doctrine of appropriation was to limit abstract claims over resources that were not being used in any reasonable way. Just as the plaintiffs in Hague had no recourse against the third party who wasted the natural gas reserve, there would be no cause of action against an entity that has the rights to an asteroid, but chooses not to exercise them.74 This may be particularly harmful to society because asteroids contain volatiles that may be essential to creating rocket fuel in space, which, in turn, may be crucial to deep space exploration.

Using asteroid-bound volatiles to make rocket fuel would reduce the cost and increase the range of space exploratory missions, possibly improving the human race’s ability to explore and develop space. Under a system were entities could claim asteroids without actual possession, those entities could exclude others from landing on the asteroids and using such resources, even when such resources are languishing unused in space. To prevent the creation of such abstract claims over asteroids, the doctrine of appropriation could be modified as to only grant rights only to entities who are able to demonstrate both actual possession and beneficial use. This would ensure that asteroids claims are limited to those where the resources are actually being used, thus, maximizing the utility of such celestial bodies to society.

Finally, asteroids cannot be adjudicated under the traditional rule of capture or a chattel system because their unique propensity to collide with other celestial bodies would result in vexing legal issues. Pop culture has popularized the notion of an asteroid crashing into the surface of Earth in movies and books, but interspace collisions may be a real concern. Asteroids are constantly moving through space, and they often crash into other asteroids or space debris, and sometimes onto the surface of planets. So real is the concern that space agencies regularly keep track of NEOs, or Near Earth Objects, which include around 10,000 asteroids large enough to be tracked in space.75 Imagine the scenario in the popular movie Armageddon, where society wrestles with the mechanics of destroying a huge asteroid that is headed straight for Earth.76 It would be strange, indeed, if the situation were further complicated by an entity owning the asteroid. Would the Earth have to compensate the company for the loss of resources, or would the company be forced to assume liability for the damage caused by the collision? What if the asteroid, rather than crashing into Earth, crashed instead into another asteroid owned by different entity? It makes sense that a company with actual possession of an asteroid should have a claim for actual mining equipment destroyed, but it seems unreasonable to treat the entire rock as the entity’s chattel. By limiting asteroid claims under a doctrine of appropriation-like system, society will be saved the headache of attempting to adjudicate such absurd situations.

Because the traditional rule of capture or a chattel system for the ownership of asteroids would result in waste, abstract claims, and absurd legal dilemmas, a modified doctrine of appropriation should replace existing outdated international space law relating to asteroids.

CONCLUSION

The doctrine of appropriation is a reasonable rule for adjudicating asteroid claims, and it could easily be modified to apply to asteroid mining. In the context of water rights, the doctrine of appropriation requires that the claimant be a landowner in order to claim the right to use a water source. It does not make sense, however, for the international community to grant complete ownership over asteroids toa single entity, so the landowner requirement of the rule should be removed. A similar modification would need to be made to the "beneficial use" language of the doctrine.

In the context of water rights, an appropriator obtains rights only to water that he or she can reasonably put to beneficial use. The metals contained in asteroids have a high level of marketability. For that reason, a mining entity could potentially put any amount of obtained metal to beneficial use, in the sense that the resources can be sold. This, however, would defeat the purpose of the rule, which is to limit such unreasonable claims. To ameliorate this problem, the doctrine of appropriation could be modified to define "beneficial use "constructively by providing that beneficial use is assumed for any resources that have been removed from the asteroid that the mining entity can reasonably hope to transport to market in a return journey. With the astronomical cost of undertaking a trip to such an asteroid, this modification would limit mining entities to only what they can carry back, thereby leaving the untapped resources available to other entities capable of making the same trip. Considering the size and profitability of metal deposits on asteroids, this modification to the doctrine of appropriation would not be overly burdensome to corporate interests. At the same time, it would satisfy the economic imperative of promoting the rapid development of asteroid resources.

By changing the landowner requirement, and qualifying the “beneficial use" language, the doctrine of appropriation would be essentially ready for application to asteroid mining claims. The only other changes necessary would be some additional requirements that are common to other space related provisions, like those found in the Outer Space Treaty of 1968. For example, a reporting requirement or clause guaranteeing asylum for other astronauts. A functional rule might read something like this:

State parties or private entities may, upon actual possession, lay claim to natural resources found on or below the surface of asteroids. Rights to appropriate are given in order of seniority, starting with the first party to land on the surface of the asteroid and establish control over the resources, be it water, methane, metal, or any other beneficial substances. A party will be said to have established control over a resource once he has mined the substance and removed it from the asteroid. A senior appropriator may use as much of the asteroid's resources as he can take from the asteroid and put to beneficial use, and may continue to enlarge his share until another junior appropriator begins to appropriate resources from source for beneficial use. For the purposes of this Agreement, "beneficial use “refers to the amount of resources that an appropriator has removed from the asteroid that the actor may reasonably hope to bring home in a return voyage. Resources in excess of what an appropriator can reasonably hope to transport to market in a single voyage do not qualify as having a beneficial use, and are therefore not yet claimed. This means that the extraction of metal from an asteroid does not serve to provide ownership if the appropriator plans on letting the resources languish until another voyage is undertaken to secure the resources and bring them back to Earth. Junior appropriators receive rights in the source of resources (the asteroid) as they find it, and may prevent the senior appropriator from enlarging his share to the junior appropriator’s detriment under a no-injury rule. No state party will attempt to hinder other parties from landing on or using the asteroid, and parties will assist other entities on an asteroid, should they need emergency assistance. Mining claims on asteroids will be reported to the Secretary-General of the United Nations, and state parties agree to release the location of the asteroid, and any scientific findings to the United Nations, the general public, and the scientific community. In the event that the asteroid is on a collision course with any other celestial body, all state parties agree to follow the course of action suggested by the United Nations. Should the United Nations decide the asteroid must be destroyed, no state party may claim liability for resources contained within the asteroid, but not yet captured. This provision applies only to asteroids as classified by the scientific community, and does not apply to planets, comets, meteorites, or any other celestial body not mentioned.

There is no doubt that asteroids may be extremely beneficial to mankind, both as a source of resources and as a jumping-off point to far off locations in space. The human-race has progressed scientifically and technologically to the point that space travel is within commercial reach, and the need for new international laws governing the ownership of space has never been more apparent. The Outer Space Treaty of 1968 made great strides in developing rational rules for space and many of its provisions should be maintained in their original form. However, by allowing ownership of asteroids under the doctrine of appropriation, the international community can incentivize the exploration and development of space in a way that reflects the needs of society in general, without vesting an absolute monopoly in a single entity. The doctrine of appropriation helped drive American westward expansion, and its application to space mining would help drive the human race in its expansion into the space, the final frontier.

#### Even pricing in the costs of mining, the economic benefits outweigh- the counterplan jumpstarts a space economy that spills over to tech innovation, planetary defense, and climate change

Heise, 18 -- Managing Notes Editor, Michigan Journal of International Law

[Jack, "Space, the Final Frontier of Enterprise: Incentivizing Asteroid Mining Under a Revised International Framework, 40 Mich. J. Int'l L. 189, 2018, <https://repository.law.umich.edu/mjil/vol40/iss1/5>, accessed 6-24-21]

A casual Internet search for asteroid mining is likely to turn up sky-high dollar value estimates of asteroids. From Neil deGrasse Tyson saying that asteroid mining will make the first trillionaire,12 to a Goldman Sachs note stating that a single asteroid could contain $25–$50 billion worth of platinum relative to a $2.6 billion cost of an asteroid-grabbing spacecraft,13 to reports that NASA is sending a probe to an asteroid worth $10,000 quadrillion, the profit element of this enterprise is not lost on observers.14 However, these estimates depend on the extraction of metals like platinum, their return to Earth, and sale at the current market price, which, as the aforementioned Goldman Sachs note concedes, would “crater the global price of platinum . . . .”15

Instead of attempting to mine metals, the initial step in asteroid mining proposed by Planetary Resources, the most prominent asteroid mining company in existence today, is to mine asteroids for water.16 By making propellant available in space, asteroid mining “increases the payload capacity of rockets, enables the creation of a space highway with fuel depots located at various points of need throughout the Solar System, and allows spacecraft to travel much farther.”17 In other words, the business of asteroid mining, at least in its infancy, is not about harvesting valuable metals and returning them to Earth,18 but rather about providing raw materials to enable the growth of the space economy.

The impetus to provide in-space materials to the space economy is a matter of physics. Launching an object into space is expensive: SpaceX’s Falcon 9—with the capacity to carry just over 50,000 pounds of payload into low Earth orbit19—costs an estimated $36.7 million to launch and uses between $200,000 and $300,000 in fuel each trip.20 If asteroid mining companies were able to provide some of the propellant in space, that would not only reduce fuel costs, but would reduce the overall launch weight, freeing up more space for payload.21

In sum, should asteroid mining companies be able to provide fuel in space, it could dramatically reduce the costs of transporting rockets and cargo into space—both into low Earth orbit and to more distant targets, like Mars. Having this infrastructure in place could also reduce the long-term costs of the asteroid mining business itself, given that the business model involves launching objects into space. While a 2012 study estimated the total cost of an asteroid retrieval mission at $2.6 billion,22 a substantial reduction in launch costs would result in meaningful savings.23 This model of asteroid mining as a provider of in-space resources, then, can facilitate the growth of the space economy: future forays into space would have their costs greatly reduced by a “space highway with fuel depots.”24

B. Public and Private Actors in the Asteroid Mining Space

Both private companies and the space agencies of sovereign governments bear mentioning in a full discussion of asteroid mining. The role of the private sector in space has expanded substantially in the past decade, leading some commentators to suggest that the private sector has eclipsed the public sector in this arena.25 The asteroid mining industry, as detailed above, both depends upon and tends to facilitate this development. Sovereign space agencies, by contrast, conduct a waning share of activity in space and increasingly operate by way of public-private partnerships as an investor in the space economy.26 This marks an important shift from the factual backdrop of the original OST in that private, independent companies are increasingly taking the wheel.

As explored above, the asteroid mining business facilitates the growth of the space economy by reducing launch costs. However, the future of asteroid mining as a lucrative industry also depends upon the existence and growth of a robust space economy. The symbiotic relationships that could develop between private companies deserves emphasis. The viability of asteroid mining depends on a space economy to which asteroid mining companies can sell fuel and metals: the lack of a current market in asteroid resources should resolve itself “when the space population hits critical mass, demanding infrastructure.”27 For spaceflight companies,28 a crucial component to reduce costs is access to propellant in space.29

Sovereign governments continue to play a significant, albeit declining, role in the space economy. NASA’s share of the national budget decreased from 4.4% in 1966 to 0.5% in 2014.30 Its current strategy centers on partnership with the private space economy: “NASA helps mitigate financial risk, while the private sector conducts research and innovation more efficiently than NASA can . . . .”31 Similarly Luxembourg, which lacks its own space agency,32 opened a 200 million Euro fund in 2016 to bring asteroid mining companies to the country.33 Planetary Resources has availed itself of opportunities offered by both NASA and Luxembourg, performing contract work with the former and securing funding from the latter.34

While sovereign governments do hold some of the purse strings relevant to asteroid mining companies and the space economy as a whole, private companies are increasingly displacing national space agencies.35 A private space economy that is increasingly independent from sovereign governments tends to undermine the factual framework upon which the original OST relied.36 Specifically, Article VI assigns responsibility for nongovernmental entities to national governments, the implicit assumption likely being that private entities would be acting at the behest of a sovereign.37 This concern is increasingly unsubstantiated in an environment in which private, independent companies are ascendant.38

C. Global Benefits of Asteroid Mining

Asteroid mining has the potential to facilitate space travel, an outcome the OST holds to be in the interest of humanity as a whole.39 The potential of asteroid mining to reduce the cost of spaceflight, moreover, could facilitate the growth of the space economy. Asteroid mining thus aligns with another stated purposes of the OST in the sense that an expanded space economy could provide substantial benefits to all mankind.40 First, in seeking to face the challenges posed by space travel, the public sector space race gave rise to numerous technological innovations, ranging from LEDs to emergency blankets to memory foam.41 It seems likely that the private space race would result in a similar degree of innovation, the products of which could benefit people across the globe.

Second, a successful mission to Mars could provide benefits beyond a mere sense of interplanetary accomplishment. NASA suggests that, given the parallels between the formation and evolution of Mars and Earth, a voyage there could help “us learn more about our own planet’s history and future.”42 The scientific advancements from such a mission cannot currently be anticipated and are difficult to predict, but “expand[ing] the frontiers of knowledge” in this manner could well bring benefits to all mankind.43

Third, the development of asteroid mining technology could also help advance asteroid diversion tactics. The development of the technology required to conduct successful asteroid mining operations could “help us to divert any incoming asteroids.”44 This is of great importance since NASA recently eliminated its Asteroid Redirect Mission due to funding cuts;45 NASA’s project was hailed by some scientists as a “critical step in demonstrating we can protect our planet from a future asteroid impact . . . .”46 Asteroid mining could step in and fill an important void. While the probability of an Armageddon-causing impact is low, the effects of an impact would be extremely severe.47 Even some mitigation of this risk as a byproduct of asteroid mining would be a benefit to humanity as a whole.

Finally, reduced launch costs could facilitate measures to combat global climate change. One proposed solution for canceling out predicted increases in average worldwide temperature is to “prevent[] . . . about 1% of incoming solar radiation—insolation—from reaching the Earth. This could be done by scattering into space from the vicinity of Earth an appropriately small fraction of total insolation.”48 Asteroid mining could facilitate such measures in that “[t]echnologies that could greatly decrease the cost of space-launch could make a telling difference in the practicality of all types of spacedeployed scattering systems of scales appropriate to insolation modulation.”49 There are certainly intermediate measures to combat climate change that ought to be taken first, but asteroid mining would facilitate this expedited solution. While some of the benefits of asteroid mining would doubtless accrue primarily to those nations with asteroid mining companies within their borders, the benefits noted in this section—space exploration as a general proposition, technological and scientific development, improvement of asteroid diversion technology, and facilitated means of swiftly countering climate change—would inure substantially to the benefit of all mankind.

## NC

Satellites DA

#### Private company focus on satellites key for improved internet connection

**Russon 21** – Technology of Business Reporter, BBC News

[Mary-Ann Russon, “Satellite boom attracts technology giants,” BBC News, 1-29-21, <https://www.bbc.com/news/business-55807150>]

**Sir Richard Branson's rocket company Virgin Orbit has joined a growing list of private companies that can launch satellites into orbit.** Earlier this month, [**10 payloads were lofted**](https://www.bbc.co.uk/news/science-environment-55699262) on the Virgin Orbit rocket, which was launched from under the wing of one of the entrepreneur's old 747 jumbos. Sir Richard is hoping to tap into what is a growing market for small, lower-cost satellites. Space has traditionally had a high barrier to entry. Today, just seven firms make up 75% of the industry, according to Scott Campbell, director at Deloitte Ventures. The space industry is worth $380bn (£285bn), and 60% of that is commercial. But previously, virtually all investment into space was by governments, he says. The first real shift came in 2011 when US President Barack Obama opened up space to businesses, and now more disruption is coming. "The new space race and start-up scene is almost entirely based around space applications: what can I do with data from space?" says Mr Campbell. Traditionally, building and launching a satellite to collect data or enable communications costs hundreds of millions of dollars. The satellites weighed up to six tonnes, were the size of a bus, and would be sent up into geostationary orbit - 35,786km (22,236 miles) above the Earth. But today, you could send up a so-called nanosat weighing just 25-50kg into low-Earth orbit (160-1,000km above Earth) for between $100,000 and $1m. Launch prices are also falling because technology giants are driving demand, says Mark Boggett, chief executive of British venture capital firm Seraphim Capital. "Because tech firms need to launch their own satellites in the thousands [for space internet networks], this further drives down the cost of launch and storage for everyone else," he says. "Whole new industries of businesses can benefit from using this data, essentially democratising space." And of course, if more data is being transmitted back to Earth, someone will need to process it. As a result, Deloitte's Scott Campbell has seen "an explosion of businesses around space". In 2011, there were 234 space-related firms in the UK, rising to 948 companies in 2018. As for satellites, today there are fewer than 9,000 in orbit, according to Seraphim. OneWeb, SpaceX, Planet, Spire and Amazon have put up 10% of these satellites since 2016, but there are 200 smaller firms behind them who are projected to launch 25,000 satellites over the next four years. One smaller firm is nanosat manufacturer NanoAvionics, which announced plans in October to create 400 new jobs in the UK. The firm saw revenues soar 300% in the last year. "In the old days, we launched one satellite that had lots of sensors on it. But today, we've launched hundreds of satellites that have the same one sensor, and that's a much cheaper, repeatable way to do it with more consistent data," says Robin Sampson, head of operations at NanoAvionics UK. PWC UK's space lead Dinesh Patel says the nanosat market is worth only £1.8bn today, but annual growth rates of 20% are projected. Satellites have traditionally been used for communications, TV services and tracking the weather, but new cheaper options are attracting tech giants with **big plans**. Late last year Microsoft announced it was teaming up with Elon Musk's SpaceX. Their partnership, Azure Space, [**plans to combine**](https://news.microsoft.com/transform/azure-space-partners-bring-deep-expertise-to-new-venture/#:~:text=our%20partners%20below.-,SpaceX,via%20SpaceX's%20Starlink%20satellite%20network.) Microsoft's cloud computing services with a global network of satellites. Tom Keane, corporate vice president at Microsoft Azure, tells the BBC that space makes it possible to "move computing to the edge", which means processing data much closer to users' devices than ever before. "The edge could be anywhere - on a device... you're wearing, it could be something you're carrying, it could be in your car," he says. "Space allows you to connect all of that infrastructure together, and then you can use artificial intelligence [like] predictive analytics to gain insights over things that were previously not connected together." Ground stations, which receive data from satellites, are also potential money makers for IT giants. Microsoft Azure's Tom Keane plans to revolutionise ground stations, which are currently "expensive and often monolithic devices" and hook them up to Microsoft's data centres. "Today, in many cases, data [from ground stations] may not be used, or it's certainly not used as broadly as it could be. By connecting that ground station, you take the data from space... to solve problems that you can't solve today." Another opportunity is to connect the **3.8 billion people** in rural areas who **still** do not have an internet connection. SpaceX in particular [**has been launching batches of small satellites**](https://www.bbc.co.uk/news/science-environment-55775977) into orbit since 2018 to form a huge constellation, with the aim of providing **instant broadband anywhere on Earth**. Other businesses will hope to make money by collecting data from nanosats, processing it with artificial intelligence, and using it in innovative ways to solve problems. Firms are looking to collect Earth observation data like weather, heat signatures and atmospheric gas composition to help farmers, for example, and to monitor things like flood defences, traffic and construction sites.

#### Better connection required for telehealth – access suffers without it

**Balasubramanian 20** – M.D, J.D

[ Sai Balasubramanian, “Elon Musk’s Starlink May Potentially Revolutionize Healthcare,” Forbes, 11-27-2020, <https://www.forbes.com/sites/saibala/2020/11/27/elon-musks-starlink-may-potentially-revolutionize-healthcare/?sh=37c89b241e03>]

One of Elon Musk’s relatively recent and most successful ventures is [SpaceX](https://www.spacex.com/mission/), an advanced aerospace technology company with a mission of “Making Humanity Multiplanetary.” The company has celebrated some incredible milestones thus far, from its successful transportation of astronauts into space, to its valiant strides in making rocket technology reusable, and therefore, more cost-efficient. One interesting sub-division of SpaceX is Starlink, which is Musk’s venture into increasing global connectivity. Starlink’s [mission](https://www.starlink.com/) is to use a global network of low Earth orbit satellites to eventually “deliver high speed broadband internet to locations where access has been unreliable, expensive, or completely unavailable.” While satellite internet itself is not a novel concept, most of the traditional systems use **dated technology** that have far less capabilities with regards to internet speed, connectivity, and sustainability. Starlink’s goal is to provide high-speed broadband internet, using cutting-edge satellite systems that will also **not add to** the space pollution created by traditional systems. As of now, the company states that it “is targeting service in the Northern U.S. and Canada in 2020, rapidly expanding to near global coverage of the populated world by 2021.” For many, high-speed broadband internet has incredible implications for connectivity.

One of the most important potential benefits of this technology may be its impact on healthcare and access-to-care in **underserved areas**. For decades, it has been a well-recognized fact that [rural sites in America](https://www.npr.org/sections/health-shots/2019/05/21/725118232/the-struggle-to-hire-and-keep-doctors-in-rural-areas-means-patients-go-without-c) have **poor access** to healthcare. This has not been helped by the rising trend of burnout in healthcare professions, in addition to an ever-growing physician shortage. Experts have articulated that the rise of telemedicine may be one possible solution to help with this issue. Digital platforms that can effectively and safely deliver healthcare without regard to distance or location can potentially provide a viable solution to connecting underserved populations with the care they need. The Covid-19 pandemic has been a great test of this technology. As stay-at-home and social distancing orders became the norm this year due to coronavirus, many healthcare systems, and in-turn patients, often had to rely on telehealth for their care needs. Of course, as telehealth services continue to grow, regulators, healthcare professionals, and innovators will need to keep a close eye on many issues that will inevitably emerge, including data-storage concerns, cybersecurity problems, and most importantly, how best to protect patient privacy and information. The latter is especially concerning, given the growing trends in healthcare [cybersecurity breaches](https://www.forbes.com/sites/saibala/2020/10/17/healthcare-cybersecurity-continues-to-be-a-major-concern/) in the past decade. However, if the appropriate oversight bodies can indeed resolve the issues that telemedicine entails, there is significant opportunity for this technology to make an impact. The market has been receptive of this as well, with telehealth companies gaining massive amounts of utilization and market share just this year alone. In fact, [studies indicate](https://www.globenewswire.com/news-release/2020/07/29/2069575/0/en/Telehealth-Market-to-Exhibit-25-2-CAGR-till-2027-Rising-Preference-for-E-visits-Owing-to-Their-Cost-effectiveness-will-Boost-Growth-Fortune-Business-Insights.html) that the telehealth market is poised for a 25.2% CAGR (compound annual growth rate) and a valuation of nearly $559.5 billion by 2027. Nonetheless, one of the most important limiting factors for telemedicine is connectivity. Due to the same degree of distance that causes healthcare shortages in rural areas, these locations often also lack reliable and high-speed internet connections—the kind that is needed to support stable telemedicine applications and platforms.

This is where Starlink could potentially become a game-changer. If the Starlink service can indeed provide high-speed broadband internet services to rural populations, it may **resolve** yet another piece of the puzzle in increasing access-to-care in underserved communities. Furthermore, the applications of this technology are **endless** and go **far beyond** the American paradigm of rural healthcare. Starlink’s concept, if proven to be scalable and effective, may be able to one day provide internet worldwide, providing the opportunity for underserved communities across the globe to receive much needed medical attention.

#### Telehealth communications solve pandemics

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[Elham Monaghesh and Slireza Haajizadeh, “ The role of telehealth during COVID-19 outbreak: a systematic review based on current evidence,” BMC Public Health, 08-01/2020, <https://link.springer.com/article/10.1186/s12889-020-09301-4>]

Coronaviruses, a genus of the coronaviridae family, may cause illness in animals or humans [[1](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR1), [2](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR2)]. In humans, several coronaviruses are known to cause infections of respiratory ranging from the common cold to more serious diseases. The most recently discovered coronavirus causes coronavirus disease-19 (COVID-19) [[1](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR1)]. The disease originated in Wuhan, China and has kept spreading widely to other regions of the world [[3](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR3)]. Primitive symptoms of COVID-19 contain fever, dry cough, breathing difficulty, and boredom [[4](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR4), [5](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR5)]. Elderly people and those with underlying medical problems such as hypertension, heart problems, and diabetes are more susceptible to develop the disease in its form of most intensive [[1](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR1)]. This universal event has been announced a pandemic by the World Health Organization (WHO) [[6](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR6)]. A **significant factor** in slowing down the transmission of the virus is the “social gap” or social distancing that is made possible by the reduction of person-to-person contact [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7), [8](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR8)]. To reduce transmission, travel restrictions have been appointed and enforced around the world, and most cities have been quarantined [[9](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR9)]. However, people who are not infected with the COVID-19, especially those who are at greater risk of developing the disease (e.g. Elderly people and those with underlying diseases), should receive daily care without the risk of exposure to other patients in the hospital [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7)]. Moreover, under strict infection control, unnecessary personnel such as clinical psychiatrists strongly refuse to enter COVID-19 patient’s ward [[10](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR10), [11](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR11)]. Natural disasters and epidemics pose many challenges in providing health care [[12](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR12)]. As a result, unique and innovative solutions are needed to address both the critical needs of patients with COVID-19 and other people who need healthcare service. In this respect, technological advances provide new options [[13](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR13)]. Although the ultimate solution for COVID-19 will be multifaceted, it is one of the effective ways to use existing technologies to facilitate optimal service delivery while minimizing the hazard of direct person-to-person exposure [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7), [14](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR14)]. The use of telemedicine at the time of epidemic conditions (COVID-19 pandemic) has the potential to improve research of epidemiological, control of disease and management of clinical case [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7), [14](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR14), [15](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR15)]. The use of telehealth technology is a twenty-first century approach that is both patient-centered and protects patients, physicians, as well as others [[16](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR16), [17](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR17)]. Telehealth is the delivery of health care services by health care professionals, where distance is a critical factor, through using information and communication technologies (ICT) for the exchange of valid and correct information [[18](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR18)]. Telehealth services are renderdusing real-time or store-and-forward techniques [[19](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR19)]. With the rapid evolution and downsizing of portable electronics, most families have at least one device of digital, such as smartphones [[20](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR20)] and webcams that provide communication between patient and healthcare provider [[21](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR21)]. Video conferencing and similar television systems are also used to provide health care programs for people who are hospitalized or in quarantine to reduce the risk of exposure to others and employees [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7)]. Physicians who are in quarantine can employ these services to take care of their patients remotely [[8](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR8), [22](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR22)]. In addition, covering multiple sites with a tele-physician can address some of the challenges of the workforce [[8](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR8), [23](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR23)]. There are various benefits in using technology of telehealth, especially in non-emergency / routine care and in cases where services do not require direct patient-provider interaction, such as providing psychological services [[24](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR24)]. Remote care **reduces** the use of resources in health centers, improves access to care, while **minimizing** the risk of direct transmission of the infectious agent from person to person [[25](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR25)]. In addition to being beneficial in keeping people safe, including the general public, patients and health workers, another important advantage is providing widely access to care givers [[12](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR12)].. Therefore, this technology is an attractive, **effectual and affordable option** [[14](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR14), [26](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR26), [27](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR27)].

Patients are eager to use telehealth, but hindrances still exist [[28](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR28), [29](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR29)]. The barriers of implementing these programs also largely depend on accreditation, payments systems, and insurance [[8](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR8)]. Furthermore, some physicians are concerned about technical and clinical quality, safety, privacy, and accountability [[23](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR23), [30](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR30)]. Telehealth can become a basic need for the general population, health care providers, and patients with COVID-19, especially when people are in quarantine, enabling patients in real time through contact with health care provider for advice on their health problems. Thus, the aim of this review was to identify and systematically review the role of telehealth services in preventing, diagnosing, treating, and controlling diseases during COVID-19 outbreak. We recognized eight studies that presented precious data on telehealth regarding the status of people infected with COVID-19. Telehealth has the capability to incorporate several organizations and situations of health care into one virtual network, led by the central clinic. This network can contain physical locations in different region: central and remote clinics, prevention centers, private clinics, and, private offices of physicians, centers of rehab state and all registered patients within their locations. By using virtual care for very regular, essential medical care, and deferring elective procedures or yearly checkups, we can free up medical staff and equipment required for those who become seriously ill from COVID-19.

Additionally, by not congregating in small spaces like waiting rooms, the ability of the coronavirus to transmission from one person to another were thwart. Keeping people discrete is called “social distancing”. Keeping healthcare staffs discrete from patients and other providers is “medical distancing”. In present time the Telehealth is one strategy to help us carry out this. Telehealth can mobilize all aspects of healthcare potentials to decrease transmission of disease, conduct people to the right level of health care, ensure safety for provide health services online, protect patients, clinicians, and the community from exposure to infection, and finally diminish the burden on the healthcare providers and health system. Some of the telehealth usage cases for patients were control and triage during the outbreak of COVID-19 pandemic, self and distance monitoring, treatment, patients after discharge in health centers (follow-ups) and implementation of online health services. These methods have the potential to **reduce morbidity and mortality during pandemic**. For all healthcare workers and clinicians with mild symptoms can still work remotely with patients, facilitate quick access to medical decision making, seek second opinion for severe cases of patients, exchange cross-border experiences, and offer teleradiology and online trainings for health workers. To provide continued access to necessary health services, telehealth should be a **key weapon** in the fight against the COVID-19outbreak.

#### Next pandemic causes extinction

Bhadelia, 21 -- Center for Emerging Infectious Diseases Policy & Research founding director

[Nahid, MD, MALD, "What do we need to build resilience against the next pandemic?," Center for Emerging Infectious Diseases Policy & Research, 5-18-2021, https://www.bu.edu/ceid/2021/05/18/placeholder-blog-post/, accessed 10-18-2021]

What do we need to build resilience against the next pandemic?

We have lost close to 3.4 million souls to COVID-19 globally over the last year. By some estimates, the real number may be much higher than that because the excess deaths this year are closer to between 7 and 13 million, after accounting for those who died without a diagnosis and those who died because they could not receive timely care for another medical condition. And the pandemic, despite the receding cases in high-resource countries, is nowhere near its end.

Lives lost are the tip of iceberg. We cannot quantify the pain felt by family members remaining behind. Livelihoods and businesses have been devastated. The pandemic’s impact reaches into all recesses of our personal and public lives. It has and will continue to undo decades of work globally on reducing poverty, improving education and health, and empowering women. An IMF study last year showed how, in the five years after major epidemics, income inequality continues to increase in affected countries. Similar trends are already being seen in five countries with the heaviest death tolls from COVID-19. As communities around the world deal with the wreckage of their economies, 95 million more people have been pushed into extreme poverty, with another 200 million predicted to be at risk between now and the year 2030. And this does not even cover the multidimensional impact of poverty. How long will it take for us to recover from this pandemic? How do we take stock and pandemic-proof our communities?

More urgently, COVID-19 may not be the last pandemic we face in our lifetimes. The existential threat of pandemics doesn’t decrease because we are already facing one. In fact, this pandemic worsens the risk for new threats because our effort and resources are depleted, and our surveillance and healthcare systems are overstretched. And because the risk of new infectious diseases seeping into the human population from animal reservoirs is going to continue to grow as we see grow in numbers, require more land, raise more animals, put down more roads, use up more wetlands, and close the gap between us and natural habitats where yet undiscovered viruses lurk. How can we ensure that economically devastated communities coming out of this pandemic recover without worsening the tenuous balance we have with the world around us?

Within our own lifetimes, we have seen the impact of climate change, another existential crisis, transition from something we heard about in news reports to something we experience in our personal lives in the form of changing weather patterns, health effects, increased risk of natural disasters, and rising sea levels. Over the next decades, these factors will exponentially increase the incidence of many infections and change the distribution of others.

And as we tackle these complex problems, new challenges are arising: despite becoming ever more globally connected, our perceptions of reality continue to be disparate. In the deluge of digital data, many among us are falling prey to misinformation and disinformation. The urgency of outbreaks, the shifting scientific knowledge base that comes from tackling emerging pathogens, and political interference have all contributed to the signal getting lost in the noise. The role of disinformation is only going to expand in future emergencies. How do we share timely information in crisis? How do we, in government, science, and public health, earn and build the trust of our communities so ours is the voice they listen to during the fray? How do we listen more carefully to them? How do we involve them in making us all safer?

We can no longer ignore infectious threats on the other side of the world, and we can no longer practice isolationist policies. Because COVID-19 painfully instructed us that outbreaks aren’t just something that happen on the news in distant communities, but instead, they can reach into our homes and rip away our loved ones.

There are moments in history when our actions require collective metacognition and urgency. This has to be one of those moments.

The Center for Emerging Infectious Diseases (CEID) Policy & Research was founded because the time is now for collective transdisciplinary research and response. Every step of the way in this pandemic, the questions haven’t been just scientific, they have also been legal, economic, cultural, and ethical. CEID’s mission is to tug at the threads of all the complex systems that leave us vulnerable to new epidemics and help us answer some of the questions posed above. Through research, collaborative action, community engagement, and training, we hope to find ways to secure us against future global threats. I hope you will reach out with ideas, collaborate with us, and check back often to see where our work is taking us.

We are not rudderless as we head into this future. The COVID-19 pandemic, like recent Ebola virus disease outbreaks and other recent emergencies, has shown that investment in sciences, global collaboration, public health, and health-systems readiness can decrease our vulnerability. We need not only to invest in diagnostics, vaccines, and therapeutics but also find a new way of approaching the problems. My own experience serving as an outbreak responder in multiple emergencies has underscored for me again and again that epidemics fracture us along lines of existing weakness. Because at the terminus of all international surveillance for outbreaks are many communities that do not have access to care. When families can’t access care, we can’t stop cases from becoming clusters, which then become outbreaks. When communities can’t equitably access vaccines, it makes it harder for them to recover, and we continue to suffer collectively from the global economic impact and through the appearance of new variants. When structural racism keeps parts of our communities from being protected, diagnosed, and cared for, all of us are at risk. When it comes to infectious diseases outbreaks, health inequity is a threat to all our survival.

At the launch of our center, we asked public health experts and scientists, “What do we need to do to build resilience against the next pandemic?” Over the next few months, we will continue asking this question to different disciplines, covering those working on health and economic equity, lawmakers, the business community, artists and musicians, and those in media and journalism. Because the solutions, like the questions, require all of us.

## NC

Innovation DA

#### Private companies solve best for innovation – reducing costs, investment, and high risk-tolerance. Regulation and lack of property rights kills

Weinzierl and Elbling 2021

(“The Commercial Space Age Is Here,” Matt Weinzierl is the Joseph and Jacqueline Elbling Professor of Business Administration at HBS and a Research Associate at the NBER, Mehak Sarang is a Research Associate at Harvard Business School and the Lunar Exploration Projects Lead for the MIT Space Exploration Initiative, February 12, 2021, <https://hbr.org/2021/02/the-commercial-space-age-is-here>, accessed 1-15-2022)

In 2019, 95% of the estimated $366 billion in revenue earned in the space sector was from the space-for-earth economy: that is, goods or services produced in space for use on earth. The space-for-earth economy includes telecommunications and internet infrastructure, earth observation capabilities, national security satellites, and more. This economy is booming, and though research shows that it faces the challenges of overcrowding and monopolization that tend to arise whenever companies compete for a scarce natural resource, projections for its future are optimistic. **Decreasing costs for launch and space hardware in general have enticed new entrants into this market, and companies in a variety of industries have already begun leveraging satellite technology and access to space to drive innovation and efficiency in their earthbound products and services.** In contrast, the space-for-space economy — that is, goods and services produced in space for use in space, such as mining the Moon or asteroids for material with which to construct in-space habitats or supply refueling depots — has struggled to get off the ground. As far back as the 1970s, research commissioned by NASA predicted the rise of a space-based economy that would supply the demands of hundreds, thousands, even millions of humans living in space, dwarfing the space-for-earth economy (and, eventually, the entire terrestrial economy as well). The realization of such a vision would change how all of us do business, live our lives, and govern our societies — but to date, we’ve never even had more than 13 people in space at one time, leaving that dream as little more than science fiction. Today, however, there is reason to think that we may finally be reaching the first stages of a true space-for-space economy. SpaceX’s recent achievements (in cooperation with NASA), as well as upcoming efforts by Boeing, Blue Origin, and Virgin Galactic to put people in space sustainably and at scale, mark the opening of a new chapter of spaceflight led by private firms. These firms have both the intention and capability to bring private citizens to space as passengers, tourists, and — eventually — settlers, opening the door for businesses to start meeting the demand those people create over the next several decades with an array of space-for-space goods and services. Welcome to the (Commercial) Space Age In our recent research, we examined how the model of centralized, government-directed human space activity born in the 1960s has, over the last two decades, made way for a new model, in which public initiatives in space increasingly share the stage with private priorities. Centralized, **government-led space programs will inevitably focus on space-for-earth activities that are in the public interest,** such as national security, basic science, and national pride. This is only natural, as expenditures for these programs must be justified by demonstrating benefits for citizens — and the citizens these governments represent are (nearly) all on earth. **In contrast to governments, the private sector is eager to put people in space to pursue their own personal interests, not the state’s** — and then supply the demand they create. This is the vision driving SpaceX, which in its first twenty years has entirely upended the rocket launch industry, securing 60% of the global commercial launch market and building ever-larger spacecraft designed to ferry passengers not just to the International Space Station (ISS), but also to its own promised settlement on Mars. Today, the space-for-space market is limited to supplying the people who are already in space: that is, the handful of astronauts employed by NASA and other government programs. While SpaceX has grand visions of supporting large numbers of private space travelers, their current space-for-space activities have all been in response to demand from government customers (i.e., NASA). **But as decreasing launch costs enable companies like SpaceX to leverage economies of scale and put more people into space, growing private sector demand** (that is, tourists and settlers, rather than government employees) could turn these proof-of-concept initiatives into a sustainable, large-scale industry. This model — of selling to NASA with the hopes of eventually creating and expanding into a larger private market — is exemplified by SpaceX, but the company is by no means the only player taking this approach. For instance, while SpaceX is focused on space-for-space transportation, another key component of this burgeoning industry will be manufacturing. Made In Space, Inc. has been at the forefront of manufacturing “in space, for space” since 2014, when it 3D-printed a wrench onboard the ISS. Today, the company is exploring other products, such as high-quality fiber-optic cable, that terrestrial customers may be willing to pay to have manufactured in zero-gravity. But the company also recently received a $74 million contract to 3D-print large metal beams in space for use on NASA spacecraft, and future private sector spacecraft will certainly have similar manufacturing needs which Made In Space hopes to be well-positioned to fulfill. Just as SpaceX has begun by supplying NASA but hopes to eventually serve a much larger, private-sector market, Made In Space’s current work with NASA could be the first step along a path towards supporting a variety of private-sector manufacturing applications for which the costs of manufacturing on earth and transporting into space would be prohibitive. **Another major area of space-for-space investment is in building and operating space infrastructure such as habitats, laboratories, and factories.** Axiom Space, a current leader in this field, recently announced that it would be flying the “first fully private commercial mission to space” in 2022 onboard SpaceX’s Crew Dragon Capsule. Axiom was also awarded a contract for exclusive access to a module of the ISS, facilitating its plans to develop modules for commercial activity on the station (and eventually, beyond it). **This infrastructure is likely to spur investment in a wide array of complementary services to supply the demand of the people living and working within it.** For example, in February 2020, Maxar Technologies was awarded a $142 million contract from NASA to develop a robotic construction tool that would be assembled in space for use on low-Earth orbit spacecraft. Private sector spacecraft or settlements will no doubt have need for a variety of similar construction and repair tools. And of course, the private sector isn’t just about industrial products. **Creature comforts also promise to be an area of rapid growth, as companies endeavor to support the human side of life in the harsh environment of space.** In 2015, for example, Argotec and Lavazza collaborated to build an espresso machine that could function in the zero-gravity environment of the ISS, delivering a bit of everyday luxury to the crew. To be sure, people have dreamt of using the vacuum and weightlessness of space to source or make things that cannot be made on earth for half a century, and time and again the business case has failed to pan out. Skepticism is natural. Those failures, however, have been in space-for-earth applications. For example, two startups of the 2010s, Planetary Resources, Inc. and Deep Space Industries, recognized the potential of space mining early on. For both companies, however, the lack of a space-for-space economy meant that their near-term survival depended on selling mined material — precious metals or rare elements — to earthbound customers. When it became clear that demand was insufficient to justify the high costs, funding dried up, and both companies pivoted to other ventures. These were failures of space-for-earth business models — but the demand for in-space mining of raw building material, metals, and water will be enormous once humans are living in space (and are therefore far cheaper to supply). In other words, when people are living and working in space, we are likely to look back on these early asteroid mining companies less as failures and more as simply ahead of their time. Seizing the Space-for-Space Opportunity The opportunity presented by the space-for-space economy is huge — but it could easily be missed. To seize this moment, policymakers must provide regulatory and institutional frameworks that will enable the risk-taking and innovation necessary for a decentralized, private-sector-driven space economy. There are three specific policy areas we believe will be especially important: 1. **Enabling private individuals to take on greater risk than would be tolerable for government-employed astronauts.** First, **as part of a general shift to that more decentralized, market-oriented space sector, policymakers should consider allowing private space tourists and settlers to voluntarily take on more risk than states would tolerate for government-employed astronauts.** In the long run, ensuring high safety levels will be essential to convince larger numbers of people to travel or live in space, but in the early years of exploration, too great an aversion to risk will stop progress before it starts. An instructive analogy can be found in how NASA works with its contractors: In the mid-2000s, NASA shifted from using cost-plus contracts (in which NASA shouldered all the economic risk of investing in space) to fixed-price contracts (in which risk was distributed between NASA and their contractors). **Because of private companies’ greater tolerance for risk, this shift catalyzed a burst of activity in the sector** — sometimes referred to as “New Space.” A similar shift in how we approach voluntary risk-taking by private-sector astronauts may be necessary in order to launch the space-for-space economy. 2. Judiciously implementing government regulation and support. Second, as with most markets, developing a stable space economy will depend on judicious government regulation and support. NASA and the U.S. Commerce and State Departments’ recent recommitment to “create a regulatory environment in [low-Earth orbit] that enables American commercial activities to thrive” is a good sign that the government is on a path of continued collaboration with industry, but there’s still a long way to go. Governments should start by clarifying how property rights over limited resources such as water on Mars, ice on the Moon, or orbital slots (i.e., “parking spots” in space) will be governed. Recent steps — including NASA’s offer to purchase lunar soil and rocks, last April’s Executive Order on the governance of space resources, and the 2015 Commercial Space Launch Competitiveness Act — indicate that the U.S. government is interested in establishing some form of regulatory framework to support the economic development of space. In 2017, Luxembourg became the first European country to establish a legal framework securing private rights over resources mined in space, and similar steps have been taken at the domestic level in Japan and the United Arab Emirates. Moreover, nine countries (though Russia and China are notably missing) have signed the Artemis Accords, which lay out a vision for the sustainable, international development of the Moon, Mars, and asteroids. These are important first steps, but they have yet to be clearly translated into comprehensive treaties that govern the fair use and allocation of scarce space resources among all major spacefaring nations. In addition, governments should continue to fill the financial gaps in the still-maturing space-for-space economic ecosystem by funding basic scientific research in support of sending humans to space, and by providing contracts to space startups. Similarly, while excessive regulation will stifle the industry, some government incentives, such as policies to reduce space debris, can help reduce the costs of operating in space for everyone in ways that would be difficult to coordinate independently. 3. Moving beyond geopolitical rivalries. Finally, the development of the space-for-space economy must not be undermined by earthly geopolitical rivalries, such as that between the United States and China. These conflicts will unavoidably extend into space at least to some extent, and military demand has long been an important source of funding for aerospace companies. But if not kept in check, such rivalries will not only distract attention and resources from borderless commercial pursuits but also create barriers and risks that hamper private investment. On earth, private economic activity has long tied together people whose states are at odds. The growing space-for-space economy offers exceptional potential to be such a force for unity — but **it’s the job of the world’s governments not to get in the way**. A collaborative, international approach to establishing — and enforcing — the rule of law in space will be essential to encouraging a healthy space-for-space economy. Visions of a space-for-space economy have been around since the dawn of the Space Age in the 1960s. Thus far, those hopes have gone largely unmet — but this moment is different. **For the first time in history, the private sector’s capital, risk tolerance, and profit motive are being channeled into putting people in space. If we seize this opportunity, we will look back on 2020 as the year when we started the truly transformational project of building an economy and a society in space, for space.**

#### Innovation solves every existential threat

Dylan **Matthews 18**. Co-founder of Vox, citing Nick Beckstead @ Rutgers University. 10-26-2018. "How to help people millions of years from now." Vox. <https://www.vox.com/future-perfect/2018/10/26/18023366/far-future-effective-altruism-existential-risk-doing-good>

If you care about improving human lives, you should overwhelmingly care about those quadrillions of lives rather than the comparatively small number of people alive today. The 7.6 billion people now living, after all, amount to less than 0.003 percent of the population that will live in the future. It’s reasonable to suggest that those quadrillions of future people have, accordingly, hundreds of thousands of times more moral weight than those of us living here today do. That’s the basic argument behind Nick Beckstead’s 2013 Rutgers philosophy dissertation, “On the overwhelming importance of shaping the far future.” It’s a glorious mindfuck of a thesis, not least because Beckstead shows very convincingly that this is a conclusion any plausible moral view would reach. It’s not just something that weird utilitarians have to deal with. And Beckstead, to his considerable credit, walks the walk on this. He works at the Open Philanthropy Project on grants relating to the far future and runs a charitable fund for donors who want to prioritize the far future. And arguments from him and others have turned “long-termism” into a very vibrant, important strand of the effective altruism community. But what does prioritizing the far future even mean? The most literal thing it could mean is preventing human extinction, to ensure that the species persists as long as possible. For the long-term-focused effective altruists I know, that typically means identifying concrete threats to humanity’s continued existence — like unfriendly artificial intelligence, or a pandemic, or global warming/out of control geoengineering — and engaging in activities to prevent that specific eventuality. But in a set of slides he made in 2013, Beckstead makes a compelling case that while that’s certainly part of what caring about the far future entails, approaches that address specific threats to humanity (which he calls “targeted” approaches to the far future) have to complement “broad” approaches, where instead of trying to predict what’s going to kill us all, you just generally try to keep civilization running as best it can, so that it is, as a whole, well-equipped to deal with potential extinction events in the future, not just in 2030 or 2040 but in 3500 or 95000 or even 37 million. In other words, caring about the far future doesn’t mean just paying attention to low-probability risks of total annihilation; it also means acting on pressing needs now. For example: We’re going to be better prepared to prevent extinction from AI or a supervirus or global warming if society as a whole makes a lot of scientific progress. And a significant bottleneck there is that the vast majority of humanity doesn’t get high-enough-quality education to engage in scientific research, if they want to, which reduces the odds that we have enough trained scientists to come up with the breakthroughs we need as a civilization to survive and thrive. So maybe one of the best things we can do for the far future is to improve school systems — here and now — to harness the group economist Raj Chetty calls “lost Einsteins” (potential innovators who are thwarted by poverty and inequality in rich countries) and, more importantly, the hundreds of millions of kids in developing countries dealing with even worse education systems than those in depressed communities in the rich world. What if living ethically for the far future means living ethically now? Beckstead mentions some other broad, or very broad, ideas (these are all his descriptions): Help make computers faster so that people everywhere can work more efficiently Change intellectual property law so that technological innovation can happen more quickly Advocate for open borders so that people from poorly governed countries can move to better-governed countries and be more productive Meta-research: improve incentives and norms in academic work to better advance human knowledge Improve education Advocate for political party X to make future people have values more like political party X ”If you look at these areas (economic growth and technological progress, access to information, individual capability, social coordination, motives) a lot of everyday good works contribute,” Beckstead writes. “An implication of this is that a lot of everyday good works are good from a broad perspective, even though hardly anyone thinks explicitly in terms of far future standards.” Look at those examples again: It’s just a list of what normal altruistically motivated people, not effective altruism folks, generally do. Charities in the US love talking about the lost opportunities for innovation that poverty creates. Lots of smart people who want to make a difference become scientists, or try to work as teachers or on improving education policy, and lord knows there are plenty of people who become political party operatives out of a conviction that the moral consequences of the party’s platform are good. All of which is to say: Maybe effective altruists aren’t that special, or at least maybe we don’t have access to that many specific and weird conclusions about how best to help the world. If the far future is what matters, and generally trying to make the world work better is among the best ways to help the far future, then effective altruism just becomes plain ol’ do-goodery.\*

# ON

## General

#### Turn -Commercial mining solves extinction from scarcity, o-pop, climate change, terror, war, shortages, inequality, war, and disease- timeframe is mere decades- only mining solves BUT now is key

Pelton, 17 -- a member of the Executive Board of the International Association for the Advancement of Space Safety

[Dr. Joseph N., former Chairman of the Board of Trustees and Vice President and Dean of the International Space University as well as the Director Emeritus of the Space and Advanced Communications Research Institute (SACRI) at George Washington University, The New Gold Rush: The Riches of Space Beckon!, Springer, 2017, accessed 1-9-22]

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. These 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 float 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 technologies 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. Thus 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 airplanes, 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. This 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 traffic control and management, international banking, search and rescue and much, much more depend on application satellites. Those that would doubt the importance of satellites to the global economy might wish to view on You Tube the video “If There 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-first 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, artificial intelligence 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 first 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 different 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. They, 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. The 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. This 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 efforts which we and others call New Space are today being forged by imaginative and resourceful commercial entrepreneurs. These twenty-first 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 redefine wealth, change our views of work and employment and upend almost everything we think we know about economics, wealth, jobs, and politics. These 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.

## Debris

#### No ‘space war’ – Insurmountable barriers and everyone has an interest in keeping space peaceful

**Dobos 19**

[(Bohumil Doboš, scholar at the Institute of Political Studies, Faculty of Social Sciences, Charles University in Prague, Czech Republic, and a coordinator of the Geopolitical Studies Research Centre) “Geopolitics of the Outer Space, Chapter 3: Outer Space as a Military-Diplomatic Field,” Pgs. 48-49] TDI

Despite the theorized potential for the achievement of the terrestrial dominance throughout the utilization of the ultimate high ground and the ease of destruction of space-based assets by the potential space weaponry, the utilization of space weapons is with current technology and no effective means to protect them far from fulfilling this potential (Steinberg 2012, p. 255). In current global international political and technological setting, the utility of space weapons is very limited, even if we accept that the ultimate high ground presents the potential to get a decisive tangible military advantage (which is unclear). This stands among the reasons for the lack of their utilization so far. Last but not the least, it must be pointed out that the states also develop passive defense systems designed to protect the satellites on orbit or critical capabilities they provide. These further decrease the utility of space weapons. These systems include larger maneuvering capacities, launching of decoys, preparation of spare satellites that are ready for launch in case of ASAT attack on its twin on orbit, or attempts to decrease the visibility of satellites using paint or materials less visible from radars (Moltz 2014, p. 31). Finally, we must look at the main obstacles of connection of the outer space and warfare. The first set of barriers is comprised of **physical obstructions**. As has been presented in the previous chapter, the outer space is very challenging domain to operate in. Environmental factors still present the largest threat to any space military capabilities if compared to any man-made threats (Rendleman 2013, p. 79). A following issue that hinders military operations in the outer space is the predictability of orbital movement. If the reconnaissance satellite's orbit is known, the terrestrial actor might attempt to hide some critical capabilities-an option that is countered by new surveillance techniques (spectrometers, etc.) (Norris 2010, p. 196)-but the hide-and-seek game is on. This same principle is, however, in place for any other space asset-any nation with basic tracking capabilities may quickly detect whether the military asset or weapon is located above its territory or on the other side of the planet and thus mitigate the possible strategic impact of space weapons not aiming at mass destruction. Another possibility is to attempt to destroy the weapon in orbit. Given the level of development for the ASAT technology, it seems that they will prevail over any possible weapon system for the time to come. Next issue, directly connected to the first one, is the utilization of weak physical protection of space objects that need to be as light as possible to reach the orbit and to be able to withstand harsh conditions of the domain. This means that their protection against ASAT weapons is very limited, and, whereas some avoidance techniques are being discussed, they are of limited use in case of ASAT attack. We can thus add to the issue of predictability also the issue of easy destructibility of space weapons and other military hardware (Dolman 2005, p. 40; Anantatmula 2013, p. 137; Steinberg 2012, p. 255). Even if the high ground was effectively achieved and other nations could not attack the space assets directly, there is still a need for communication with those assets from Earth. There are also ground facilities that support and control such weapons located on the surface. Electromagnetic communication with satellites might be jammed or hacked and the ground facilities infiltrated or destroyed thus rendering the possible space weapons useless (Klein 2006, p. 105; Rendleman 2013, p. 81). This issue might be overcome by the establishment of a base controlling these assets outside the Earth-on Moon or lunar orbit, at lunar L-points, etc.-but this perspective remains, for now, unrealistic. Furthermore, **no contemporary actor will risk full space weaponization in the face of possible competition and the possibility of rendering the outer space useless.** No actor is dominant enough to prevent others to challenge any possible attempts to dominate the domain by military means. To quote 2016 Stratfor analysis, "(a) war in space would be devastating to all, and preventing it, rather than finding ways to fight it, will likely remain the goal" (Larnrani 20 16). This stands true unless some space actor finds a utility in disrupting the arena for others.

#### Risks are overestimated

**Wattles 19**

[ Jackie Wattles – Reporter, “Space junk poses terrifying threats. Here’s what that means for SpaceX’s megaconstellation,”: CNN Business, 05-30-2019, <https://www.cnn.com/2019/05/30/tech/spacex-starlink-space-junk-debris/index.html>]

SpaceX fired [60 small satellites](http://www.cnn.com/2019/05/15/tech/spacex-starlink-internet-satellites-first-launch/index.html) into orbit last week, the first installment of an internet-beaming [megaconstellation](http://www.cnn.com/2019/05/23/business/spacex-starliner-revenue-business-case/index.html) that the company hopes will grow to include thousands of satellitesin just a few years. Elon Musk’s space company is just one of several with its eyes on beaming broadband to Earth from space. Companies including Amazon [(AMZN)](https://money.cnn.com/quote/quote.html?symb=AMZN&source=story_quote_link) and [OneWeb](http://www.cnn.com/2019/03/13/tech/oneweb-space-debris-junk-low-earth-orbit/index.html) also have similar plans. Looking ahead, [a lot could go wrong for them](http://www.cnn.com/2019/05/23/business/spacex-starliner-revenue-business-case/index.html) — financially or technologically. The most nightmarish calamity, however unlikely, wouldn’t just impact their businesses. It could set back all of human civilization. Imagine this scenario: A single satellite loses power and smashes, uncontrolled, into anothersatellite. They explode, sending plumes of junk charging through space at [23 times](https://www.nasa.gov/mission_pages/station/news/orbital_debris.html) the speed of sound. A piece of that debris slams into another satellite, and it sets off a chain reaction that obliterates everything orbiting in nearby altitudes. In low-Earth orbit, that could include multibillion-dollar networks like Starlink, the [International Space Station](https://www.nasa.gov/mission_pages/station/news/orbital_debris.html), spy satellites and [Earth-imaging](https://www.cnn.com/2015/03/12/tech/mci-planet-labs-doves/index.html) technology. Nothing would remain except an impenetrable graveyard of rubbish that could ground rocket launches for years, maybe even [centuries](https://www.nasa.gov/news/debris_faq.html). In the rarest of situations, [all satellite technology](http://www.bbc.com/future/story/20130609-the-day-without-satellites) could be done for. GPS services wouldcut out; weather tracking technology would be lost, potentially grounding commercial flights worldwide; satellite television and phone service would be gone; the loss in bandwidth couldclog ground-based systems and jam up internet and phone services. From there, [economies](https://phys.org/news/2017-05-space-junk-satellites-economies.html) could be crippled. Such a scenario remains **highly, *highly* unlikely**. Space is huge and satellites are still far from “crowded” up there. But the price of space travel is plummeting, meaning loads of new satellites are going up each year, while the risk of collisions climbs exponentially higher, explains Jonathan McDowell, an astronomer at the Harvard-Smithsonian Center for Astrophysics. “If you put up 10 times the [current total] number of satellites, the risk isn’t just ten times as big — it’s 100 times bigger,” McDowell told CNN Business, describing the risk of a collision. While a single crash might not lead to a doomsday scenario, any incident can create problems. Musk, for his part, says SpaceX takes the problem very seriously: “We are taking great pains to make sure there’s not an orbital debris issue,” he told reporters during a recent conference call. Each active Starlink satellite will be able to automatically dodge traceable pieces of debris headed their way, Musk said. The satellites will also save enough fuel at the end of their lives so that they can intentionally plunge back toward Earth to get out of the way of new devices, SpaceX says. Even if a satellite unexpectedly dies, it’ll be in such a low altitude that gravity will naturally pull it out of orbit in one-to-five years, according to the company. The Federal Communications Commission, which approves satellites for launch, approved of SpaceX’s designs and [said](https://docs.fcc.gov/public/attachments/DA-19-342A1.pdf) its Starlink satellites have “**zero, or near zero” risk of collision** while operational. The first 60 Starlink satellites have now been in orbit about a week, and everything seems to be going smoothly. **No** malfunctioning satellites or failed propulsion systems have been reported.

SpaceX’s debris mitigation plan **matches or exceeds** expert guidelines on best practices. SpaceX competitor OneWeb also has [plans](https://www.cnn.com/2019/03/13/tech/oneweb-space-debris-junk-low-earth-orbit/index.html) to ensure its satellites don’t become spaceborne garbage.With spaceflight growing cheaper and more common, however, businesses with all types of [goals](https://www.nbcnews.com/mach/science/startup-wants-put-huge-ads-space-not-everyone-board-idea-ncna960296) (and little stake in whether or not space stays safe) can afford to send something into orbit. Yet no formal international rules or punishments exist to hold satellite operators accountable for debris creation or general carelessness in space. Some countries, [including the United States](https://www.fcc.gov/document/fcc-launches-review-rules-mitigate-orbital-space-debris), are considering stricter regulations. For now, companies and organizations mostly have to take it upon themselves to research and invest in being good patrons of space. “It’s like any kind of environmental stewardship,” Kelso said. There isn’t always a business incentive to do the right thing, but “you don’t want to reach the point where you’re saying, ‘Gee, I wish we did this earlier.’”

#### No debris cascades—This ev answers all aff warrants

Fange 2017 (Daniel Von Fange, 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/)

Kessler Syndrome is overhyped. A chorus of online commenters great any news of upcoming low earth orbit satellites with worry that humanity will to lose access to space. I now think they are wrong.

What is Kessler Syndrome?

Here’s the popular view on Kessler Syndrome. Every once in a while, a piece of junk in space hits a satellite. This single impact destroys the satellite, and breaks off several thousand additional pieces. These new pieces now fly around space looking for other satellites to hit, and so exponentially multiply themselves over time, like a nuclear reaction, until a sphere of man-made debris surrounds the earth, and humanity no longer has access to space nor the benefits of satellites.

It is a dark picture.

Is Kessler Syndrome likely to happen?

I had to stop everything and spend an afternoon doing back-of-the-napkin math to know how big the threat is. To estimate, we need to know where the stuff in space is, how much mass is there, and how long it would take to deorbit.

The orbital area around earth can be broken down into four regions.

Low LEO

- Up to about 400km. Things that orbit here burn up in the earth’s atmosphere quickly - between a few months to two years. The space station operates at the high end of this range. It loses about a kilometer of altitude a month and if not pushed higher every few months, would soon burn up. For all practical purposes, Low LEO doesn’t matter for Kessler Syndrome. If Low LEO was ever full of space junk, we’d just wait a year and a half, and the problem would be over.

High LEO - 400km to 2000km. This where most heavy satellites and most space junk orbits. The air is thin enough here that satellites only go down slowly, and they have a much farther distance to fall. It can take 50 years for stuff here to get down. This is where Kessler Syndrome could be an issue.

Mid Orbit - GPS satellites and other navigation satellites travel here in lonely, long lives. The volume of space is so huge, and the number of satellites so few, that we don’t need to worry about Kessler here.

GEO - If you put a satellite far enough out from earth, the speed that the satellite travels around the earth will match the speed of the surface of the earth rotating under it. From the ground, the satellite will appear to hang motionless. Usually the geostationary orbit is used by big weather satellites and big TV broadcasting satellites. (This apparent motionlessness is why satellite TV dishes can be mounted pointing in a fixed direction. You can find approximate south just by looking around at the dishes in your northern hemisphere neighborhood.) For Kessler purposes, GEO orbit is roughly a ring 384,400 km around. However, all the satellites here are moving the same direction at the same speed - debris doesn’t get free velocity from the speed of the satellites. Also, it’s quite expensive to get a satellite here, and so there aren’t many, only about one satellite per 1000km of the ring. Kessler is not a problem here.

How bad could Kessler Syndrome in High LEO be?

Let’s imagine a worst case scenario.

An evil alien intelligence chops up everything in High LEO, turning it into 1cm cubes of death orbiting at 1000km, spread as evenly across the surface of this sphere as orbital mechanics would allow. Is humanity cut off from space?

I’m guessing the world has launched about 10,000 tons of satellites total. For guessing purposes, I’ll assume 2,500 tons of satellites and junk currently in High LEO. If satellites are made of aluminum, with a density of 2.70 g/cm3, then that’s 839,985,870 1cm cubes. A sphere for an orbit of 1,000km has a surface area of 682,752,000 square KM. So there would be one cube of junk per .81 square KM. If a rocket traveled through that, its odds of hitting that cube are tiny - less than 1 in 10,000.

So even in the worst case, we don’t lose access to space.

Now though you can travel through the debris, you couldn’t keep a satellite alive for long in this orbit of death. Kessler Syndrome at its worst just prevents us from putting satellites in certain orbits.

In real life, there’s a lot of factors that make Kessler syndrome even less of a problem than our worst case though experiment.

* Debris would be spread over a volume of space, not a single orbital surface, making collisions orders of magnitudes less likely.
* Most impact debris will have a slower orbital velocity than either of its original pieces - this makes it deorbit much sooner.

#### Turn – only new private tech can solve for space debris

**Giordano 21**

[ David Giordano – Staffer, “Space Debris: Another Frontier in the Commercialization of Space,” Columbia Journal of Transnational Law, 10-31-2021, <https://www.jtl.columbia.edu/bulletin-blog/space-debris-another-frontier-in-the-commercialization-of-space>]

In the Summer of 2021, we got a glimpse of what some hope will be commonplace in the future: space tourism. [While it might be billionaires and their associates for now](https://apnews.com/article/jeff-bezos-space-e0afeaa813ff0bdf23c37fe16fd34265), if this technology is to follow the arc of many other advancements previously reserved for the rich ([cell phones](http://www.cnn.com/2010/TECH/mobile/07/09/cooper.cell.phone.inventor/index.html) and [air travel](https://www.travelandleisure.com/airlines-airports/history-of-flight-costs), for example), eventually there may come a time in the future where space tourism is a realistic financial goal for those of more restricted means. As humanity broaches this great commercial frontier, it will have to clear the great and neglected hurdle of “space junk,” and current trends appear to indicate that industry will shape not only the technology designed to solve the problem, but the policy as well. As satellites and other projectiles blast into orbit, upon collision they can disintegrate into shards, sometimes just centimeters wide, that remain in orbit, risking further collision. Hollywood captured the potential perils of fairly large pieces of space debris in the opening minutes of the 2013 film [Gravity](https://www.warnerbros.com/movies/gravity), where space junk threatens the lives of astronauts on a mission.

Outside the realms of fictional space-thrillers, even the smallest pieces of space junk can present real danger. In 2016, a tiny piece of space junk, believed to be a paint chip or a piece of metal no more than a few thousandths of a millimeter across, [cracked the window of the International Space Station](https://www.popsci.com/paint-chip-likely-caused-window-damage-on-space-station/). In May 2021, a piece of space debris [punctured](https://www.nbcnews.com/science/space/space-junk-damages-international-space-stations-robotic-arm-rcna1067) the robotic arm of the International Space Station. This is seriously concerning, as, [according to the European Space Agency](https://www.esa.int/Safety_Security/Clean_Space/How_many_space_debris_objects_are_currently_in_orbit), there are 670,000 pieces of space debris larger than 1cm and 170,000,000 between 1mm and 1cm in width. Unfortunately, public action and policy struggles to keep up with these risks. International law affords little clarity on the problem, as its control is a novel, [emerging field](https://www.technologyreview.com/2021/08/23/1032386/space-traffic-maritime-law-ruth-stilwell/) with many technical [tracking](https://www.space.com/space-situational-awareness-house-hearing-february-2020.html) and [removal](https://www.scientificamerican.com/article/space-junk-removal-is-not-going-smoothly/#:~:text=There%20is%20no%20doubt%20that,antisatellite%20weapon%2C%E2%80%9D%20she%20says.) challenges. **None** of the existing space treaties [directly tackle the issue](https://oxfordre.com/planetaryscience/view/10.1093/acrefore/9780190647926.001.0001/acrefore-9780190647926-e-70), rendering [responsibility for it](https://scholarship.law.upenn.edu/jil/vol41/iss1/6/) ambiguous. Absent such responsibility, [legal incentives are non-existent](https://www.courthousenews.com/lack-of-space-law-complicates-growing-debris-problem/). [Guidelines are occasionally issued](https://www.unoosa.org/pdf/limited/l/AC105_2014_CRP14E.pdf) by international governing bodies, but provide little legal significance and are [more targeted at the practicalities of tracking and removal](https://scholarship.law.upenn.edu/jil/vol41/iss1/6/). The nation best positioned to notify space actors of collision risks is the United States, and the burden of that task currently falls on the [Department of Defense](https://www.govexec.com/media/d1-mission-space.pdf). However, the Trump administration issued a [directive in 2018](https://www.cnbc.com/2018/06/18/national-space-council-trump-signs-space-debris-directive.html), shifting the responsibility from the DoD to the Department of Commerce, and the [transition has yet to materialize](https://www.govexec.com/media/d1-mission-space.pdf), leaving DoD struggling to keep pace [with increasing commercial activity](https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/look-out-below-what-will-happen-to-the-space-debris-in-orbit). In the face of public paralysis, addressing the problem through industry looks more and more attractive. This has led some to call for a new legal order that still leaves room for government, but reframes who the rules exist to serve. Rather than our current, rudimentary treaty regime designed to [prevent international conflict](https://www.theverge.com/2017/1/27/14398492/outer-space-treaty-50-anniversary-exploration-guidelines), [commentators](https://space.nss.org/wp-content/uploads/NSS-Position-Paper-Space-Debris-Removal-2019.pdf) have called for an additional regime resembling [maritime law](https://www.technologyreview.com/2021/08/23/1032386/space-traffic-maritime-law-ruth-stilwell/) that preserves the interests of a more diverse set of stakeholders, including those in the future that can bring technology and interests to space that may not yet exist. These commentators shun the common conception that space regulation should resemble air-traffic control, which is suited to a narrower set of uses (transport). Under such a “maritime” regime, the light touch of central regulatory bodies, and perhaps their non-existence, is preferred, just as it has been on the seas. This way, individual nations have a degree of flexibility in instituting controls they see fit while leaving room for industry to address problems and introduce new uses for space.

Furthermore, governments seem ready and willing to construct the legal and incentive framework in concert with such private action. [In a joint statement this summer](https://www.gov.uk/government/news/g7-nations-commit-to-the-safe-and-sustainable-use-of-space), G7 members expressed **openness** to resolving the technical aspects of the debris problem with private institutions, and there is some **promising progress**. Apple co-founder [Steve Wozniak](https://www.space.com/apple-cofounder-steve-wozniak-space-junk-company) signaled his plans to address the problem through a new company with a telling name: Privateer Space. Astroscale, a UK-based company, successfully launched a pair of satellites in the Spring of 2021 [that will remove certain space debris from orbit](https://astroscale.com/astroscale-celebrates-successful-launch-of-elsa-d/). Astroscale also [stated their desire](https://astroscale.com/space-sustainability/) to work with governments and international governing bodies to craft policy with private efforts to control the problem top of mind. In light of public policy’s silence on space debris, the initiative of actors like Astroscale involving themselves in policy may be advised, as it could [promote further private investment](https://docs.google.com/document/d/1NCO5Vvjf-kgoZLNfgaOn4bDj_CAfyD1Qhz2oW3TrcHc/edit) in technology for space debris removal. A popular [policy recommendation](https://reason.org/policy-brief/u-s-space-traffic-management-and-orbital-debris-policy/) among experts is the establishment of public-private partnerships, and Astroscale has entered several such agreements including with [Japan](https://www.satellitetoday.com/in-space-services/2021/07/27/space-clean-up-company-astroscale-signs-partnerships-with-mhi-and-japanese-government/) and the [European Space Agency](https://spacenews.com/astroscale-clearspace-aim-to-make-a-bundle-removing-debris/).

## Corporate Colonialism

#### Neoliberalism isn’t powerful enough to be universally deceptive

Franks, 7 -- Glasgow political philosophy lecturer

(Benjamin, “Who Are You to tell me to Question Authority?”, Variant issue 29, 2007, <http://www.variant.org.uk/29texts/Franks29.html>)

Potentially stronger criticisms of Giroux’s text lie precisely in his underlying hypothesis concerning the totalising power of neo-conservatism. Giroux shares with the members of the Frankfurt School, who he approvingly cites, a pessimistic and almost wholly determined account of future social developments, in which the prognosis for alternatives to dominant powers looks bleak. Giroux, like Adorno and Marcuse, fears that we are approaching a one-dimensional future composed of intellectually stunted individuals, who are manipulated by the cultural industries, endorse militarised social hierarchies and engage in relationships conceived of only in terms of market-values. This grim dystopia is subject to continual monitoring by an evermore technologically-equipped police and legitimised by an increasingly subservient, partisan and trivial media. However, whilst Giroux’s account of growing authoritarianism is convincingly expressed, it is potentially disempowering, as it would suggest little space for opposition. It is not simply wishful thinking to suggest that the existing power structures are neither as complete nor as impervious as Giroux’s account would suggest. Whilst the old media of radio, film and television are increasingly dominated by a few giant corporations (p.46), new technologies have opened access to dissident voices and created new forms of communication and organisation. Whilst the military are extending their reach into greater areas of social and political life, and intervening in greater force throughout the globe, resistance to military discipline is also arising, with fewer willing to join the army in both the US and UK.7 Bush’s long term military objectives look increasingly unfeasible as Peter Schoomaker, the former US Chief of Staff, told Congress on December 15, 2006 that even the existing deployment policy is looking increasingly ‘untenable’.8 The ‘overstretch’ of military resources is matched by an economy incapable of fulfilling its primary neo-conservative goals of low taxation, sound national finances and extensive military interventions. Whilst this is not to suggest that the US is on the point of financial implosion, the transition to a fully proto-fascist state is unlikely to be seamless or certain. Giroux’s preferred form of resistance is radical education. The photographs from Abu Ghraib were iconic not just in their encapsulation of proto-fascism, but in their public pedagogic role. Their prominence highlighted the many different sites of interpretation, as Giroux rightly stresses, there is no single way to interpret a photograph, however potent the depiction. The ability to interpret an image requires an ongoing process by a critical citizenry capable of identifying the methods by which a picture’s meanings are constructed (p. 135). Giroux’s critical pedagogy overtly borrows from Adorno’s essay ‘Education After Auschwitz’, and proposes “modes of education that produce critical, engaging and free minds” (p. 141). But herein lies one of the flaws with the text: Giroux never spells out what sorts of existing institutions and social practices are practical models of this critical pedagogy. Thus, he does not indicate what methods he finds appropriate in resisting the proto-fascist onslaught nor how merely interpreting images critically would fundamentally contest hierarchical power-relationships. Questions arise as to the adequacy of his response to the totalising threat he identifies in the main section of the book. Clearly existing academic institutions in the US are barely adequate given the campaigns against dissident academics led by David Horowitz (p.143). Giroux recounts in the final chapter, an interview conducted by Sina Rahmani, his own flight from the prestigious Penn State University to McMaster University in Canada because of managerial harassment following his public criticisms of Penn’s involvement in military research (p. 186). But whilst Giroux recognises that education is far wider than what takes place in institutions of learning there is no account of what practical forms these take. Nor does Giroux give an account of why a critical pedagogy would take priority over informed aesthetic or ethical practices. Such a concentration on education would appear to prioritise those who already have (by virtue of luck or social circumstance) an already existing expertise in critical thinking, risking an oppressive power-relationship in which the expert drills the student into rigorous assessment. This lapse into the role of the strident instructor demanding the correct form of radical response, occasionally appears in Giroux’s text: “within the boundaries of critical education, students have to learn the skills and knowledge to narrate their own stories [and] resist the fragmentation and seductions of market ideologies” (p. 155). Woe betide the student who prefers to narrate the story of the person sitting next to them, or fails to measure up to the ‘educators’ standard of critical evaluation.

#### No root cause. Their argument describes a correlation not a causation. They can’t solve their impacts.

Larrivee 10 – (John Larrivee is professor of economics at Mount St. Mary’s University with a masters from Harvard Kennedy School and Phd in economics from Wisconsin., 10-1-10, <http://www.teacheconomicfreedom.org/files/larrivee-paper-1.pdf> /DOA: 6/28/2018)//JDi

The Second Focal Point: Moral, Social, and Cultural Issues of Capitalism Logical errors abound in critical commentary on capitalism. Some critics observe a problem and conclude: “I see X in our society. We have a capitalist economy. Therefore capitalism causes X.” They draw their conclusion by looking at a phenomenon as it appears only in one system. Others merely follow a host of popular theories according to which capitalism is particularly bad. 6 The solution to such flawed reasoning is to be comprehensive, to look at the good and bad, in market and non-market systems. Thus the following section considers a number of issues—greed, selfishness and human relationships, honesty and truth, alienation and work satisfaction, moral decay, and religious participation—that have often been associated with capitalism, but have also been problematic in other systems and usually in more extreme form. I conclude with some evidence for the view that markets foster (at least some) virtues rather than undermining them. My purpose is not to smear communism or to make the simplistic argument that “capitalism isn’t so bad because other systems have problems too.” The critical point is that certain people thought various social ills resulted from capitalism, and on this basis they took action to establish alternative economic systems to solve the problems they had identified. That they failed to solve the problems, and in fact exacerbated them while also creating new problems, implies that capitalism itself wasn’t the cause of the problems in the first place, at least not to the degree theorized.

#### Capitalism is self-correcting and sustainable---war and environmental destruction are not profitable and innovation solves their impacts

Kaletsky 11 – (Anatole, editor-at-large of *The Times* of London, where he writes weekly columns on economics, politics, and international relations and on the governing board of the New York-based Institute for New Economic Theory (INET), a nonprofit created after the 2007-2009 crisis to promote and finance academic research in economics, Capitalism 4.0: The Birth of a New Economy in the Aftermath of Crisis, p. 19-21 /DOA: 6/28/2018)//JDi

Democratic capitalism is a system built for survival. It has adapted successfully to shocks of every kind, to upheavals in technology and economics, to political revolutions and world wars. Capitalism has been able to do this because, unlike communism or socialism or feudalism, it has an inner dynamic akin to a living thing. It can adapt and refine itself in response to the changing environment. And it will evolve into a new species of the same capitalist genus if that is what it takes to survive. In the panic of 2008—09, many politicians, businesses, and pundits forgot about the astonishing adaptability of the capitalist system. Predictions of global collapse were based on static views of the world that extrapolated a few months of admittedly terrifying financial chaos into the indefinite future. The self-correcting mechanisms that market economies and democratic societies have evolved over several centuries were either forgotten or assumed defunct. The language of biology has been applied to politics and economics, but rarely to the way they interact. Democratic capitalism’s equivalent of the biological survival instinct is a built-in capacity for solving social problems and meeting material needs.

## 1NC Appropriation Key

#### The “commons” cannot capture any negative impact- ONLY appropriation is key

#### 1. Property rights are key to effective space development- it creates the most efficient system for the development of space

Reinstein, 99 -- JD, Associate, Kirkland & Ellis

[Ezra J., Owning Outer Space, 20 Nw. J. Int'l L. & Bus. 59, 1999, <https://scholarlycommons.law.northwestern.edu/njilb/vol20/iss1/7>, accessed 7-10-21]

IV. PROPOSAL: APPROPRJATIVE OWNERSHIP OF REAL PROPERTY

The ideal legal regime should create maximum incentives for efficient development of space, in recognition of the fact that the potential wealth in space will not drop into our laps.

But as much as commercial development of space would benefit all mankind, it is just as important that the development be controlled. We must learn from mistakes of the past. Any legal regime should guard against inefficient exploitation, waste, and environmental despoliation. Furthermore, space should not become the next Wild West. Destruction and sabotage must be discouraged.

My proposal, which will be developed throughout this essay, is to maximize incentives by giving developers comprehensive property rights. Humanity's welfare demands that we alter the current law to allow real estate ownership -- not just usufructary rights -- to those who would best develop land in space.7 The potential wealth of outer space, in the form of minerals, energy, living space, etc., doesn't do us any good unless we are able to harness it. And, as Jeffrey Kargel, a planetary scientist at the U.S. Geological Survey, has written, "if you want to cross the bridge into the 21st century of space [development], then space must pay its way and give private investors a handsome early return on investment.' 75

What do we mean by "ownership?" Property is commonly recognized as being a "bundle" of disparate rights regulating relations between people with respect to things. The bundle of rights can be unpacked. It includes: the right to possess, the right to use, the right to exclude, and the right to transfer.76 These rights are not on/off affairs; they can each be limited or expanded along a continuum. I use the term "ownership" to describe a state of affairs wherein a person has all four of these rights to their maximum extent with respect to a piece of property.

Current space law ostensibly respects the right to use real property in space and to collect and own its fruits. Historically, this has been known as the usufructary right.77 But the current law doesn't even provide this right freely; it seems to be limited by several clauses of the Outer Space Treaty (e.g. use "for the benefit...of all countries").78

Nor does the OST recognize the right to exclude, as is evidenced by article I's prohibition on appropriating what it recognizes as being "the province of all mankind," the guarantee in the same article of "free access to all areas of celestial bodies," and article XII's requirement that "[a]ll stations [and] installations...shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity." Likewise, as illuminated in the SpaceCorp hypothetical, the prohibition on appropriation seems to negate a long-term right of possession. Without the right to exclude or pos- sess, of course, a legal system need not provide the right to transfer real estate. Anyone else may simply help themselves. In sum, the OST demands that "[n]o State can obtain such possessions as will entitle it to claim ownership or sovereignty over them... There can be no exclusive appro- priation of [celestial bodies] and any part thereof as a result of their 'use'..." 79 Under current law, space cannot be owned.

A new law of space real property must enliven and support all four rights that comprise ownership.

First, there must be a right to permanent possession: barring some ex- traordinary circumstance or the enforcement of a judgment, no one should face dispossession of his real estate on Earth or in space. This rule supplies a needed measure of certainty, in two ways: (1) it's a definite rule and almost any such rule is better than the fogginess of the current regime, and (2) it moves the presumption away from public conversion of private lands, and therefore makes it clear that the OST's statement, that space development must be "for the benefit...of all countries," is a moral exhortation and not a loophole through which the United Nations can dispossess a private party of his site.

Second, I suggest that the right to use be unlimited, except by environmental regulations and the developer's domestic law. This rule is a recognition that humanity's fortune is best enhanced not by a centralized command-and-control system, but by private development making market driven decisions.

Like the right to perpetual possession, the third right -- the right to exclude -- creates the certainty vital to an optimal investment environment. As noted, the current system precludes such a right, for it would certainly run afoul of the prohibition on appropriation and the requirement that there be "free access to all areas of celestial bodies. 80 Without the right to exclude, however, pioneer investors would be at the mercy of free riders.

#### 2. Ownership both reduces wasteful use and allows firms to internalize its positive externalities- AND private ownership is the best way to fulfill the common heritage principle

Reinstein, 99 -- JD, Associate, Kirkland & Ellis

[Ezra J., Owning Outer Space, 20 Nw. J. Int'l L. & Bus. 59, 1999, <https://scholarlycommons.law.northwestern.edu/njilb/vol20/iss1/7>, accessed 7-10-21]

A. Three Arguments for Ownership

Space is an international zone, and so is, in a sense, the heritage of all humanity. We must not forget, when considering the governance of outer space, that the rules should first and foremost attempt to maximize the benefit to all humankind. So, ideally, celestial bodies should be put to the uses most beneficial to humanity. This is guaranteed by a system that puts land in the hands of those for whom the territory is most profitable. It is a matter of elementary economic theory. Whoever can use a site to humanity's greatest benefit will be the one who can profit most from the site; whoever can profit most from the site will be the one for whom the site is most valuable. Thus the person who can put a site to humanity's greatest benefit will be the one willing to spend the most to own the site.84 This is the bargain theory of economics, and will form the basis for all that follows.

1. Ownership will reduce wasteful use

Ownership, and the attendant right of alienability, would promote the efficient use of space resources.

Again, a hypothetical will help illustrate: a Martian site has been identified as being rich with manganese and silicon. Manganese Mining Co. ("M.M.Co."), interested in the manganese and the manganese alone, decides to send up a team of miners. They begin operations, develop shipping routes, and build a sustainable mining colony.

Without the right of ownership, M.M.Co. has no reason not to blast through and obliterate silicon deposits in order to more quickly uncover the manganese. Furthermore, once the manganese is depleted, there is no reason for them to leave the colony's structures and life support systems intact.

If, on the other hand, space law grants ownership to M.M.Co., then M.M.Co. has incentive to act with greater over-all efficiency. There is incentive to preserve the silicon deposits, because silicon will increase the amount for which Silicon Mining Co. ("S.M.Co.") is willing to purchase the site from M.M.Co. Along similar lines, there is also incentive to preserve the shipping routes and the colony structures and life support systems.

So M.M.Co. receives the benefit of the manganese deposits, and is further rewarded for developing the mining colony and transportation routes, and for preserving the silicon deposits and the colony itself when it sells the site. Because M.M.Co. owned the site, there would be reason for it to prospect for silicon and advertise its presence to interested parties, even though M.M.Co. did not itself have an interest in mining the silicon. Thus S.M.Co. receives the benefit of M.M.Co.'s mineralogical research. S.M.Co. also need not waste resources setting up new routes, mines, and colonies; it could purchase them intact.

Under such a system, people are better rewarded for pioneering efforts and pioneers have incentive to research and preserve that which they find and build. The second-comers receive the benefit of the pioneers' efforts; they need not reinvent the wheel. And, in the end, people on Earth receive the benefit of plentiful manganese and silicon, instead of, as would result in a non-ownership system, just manganese.

## 1NC Solvency

#### Global commons fails-

#### 1. The common heritage principle is an impossible ideal that doesn’t match human psychology

Buxton 4

Carol R. Buxton (Administrative Lawyer). “Property in Outer Space: The Common Heritage of Mankind Principle vs. the First in Time, First in Right, Rule of Property.” 69 Journal of Air, Law, and Commerce, 689 (2004). JDN. https://scholar.smu.edu/jalc/vol69/iss4/3

Despite the fierce intent of the international community, full acceptance of the common heritage principle will come slowly, if at all. Though evolution shapes life, such progression requires time. Life on earth shows that physical evolution results when a need arises. However, man's broad acceptance of a common heritage approach to land and its resources demands a psychological evolution rather than a physical change mandated by his environment. Man seems incapable of such change; consequently, psychological evolution will require intense, long-lasting global effort.

The international community cannot reverse thousands of years of behavior in one generation. Ancient, nomadic man fought over land resources when permanent occupation of a single area proved impossible due to the essential pursuit of food. Later, when farming and agriculture replaced nomadic existence, man fought over the land itself-as well as its resources. As technology advances, this pattern will continue into space and other previously uninhabitable areas on earth.

## 1NC Circumvention

#### Aff gets circumvented-

#### 1. Pseudo-appropriation through occupation

Tjandra 21

Jonathan Tjandra (Legal Research Officer, High Court of Australia). “The Fragmentation of Property Rights in the Law of Outer Space.” 46(3) Air & Space Law 373. 2021. JDN. https://papers.ssrn.com/sol3/papers.cfm?abstract\_id=3840765

Conversely, it may be possible to derive a right to exclude from the right to usein the context of outer space. In the Roman classification, the seashore was classified as res communis omnium, and much like outer space is now, means that it could not be the object of private property rights. Individuals could use the seashore but could not exclude others from using it. Recall, however, an exception existed: a person could place a building on the seashore and have exclusive occupation and use of that building as long as it did not unduly restrict others’ rights and for as long as the building stood. Grotius quotes Seneca and likens it to a theatre seat in Rome – seats are available to any person who cares to watch the theatre, yet the seat a one person occupies becomes theirs while they are seated on it.90 The same principle could be applied to outer space, if one places a physical structure on the Moon’s surface, no one else can place anything else in the exact same location purely because it is already physically occupied. As the French delegate recognized in the Outer Space Treaty negotiations, international law had to distinguish between acts of appropriation and mere occupation in the exploitation of resources.91 States might well have the sole, despotic dominion over installations they put in outer space or on celestial bodies if no one else can displace them. This is because States retain jurisdiction and control over their objects sent to space, meaning no State can interfere with another’s space objects.9

#### 2. Appropriation will happen now, on first-come first-serve- that’s worse by every metric

Buxton 4

Carol R. Buxton (Administrative Lawyer). “Property in Outer Space: The Common Heritage of Mankind Principle vs. the First in Time, First in Right, Rule of Property.” 69 Journal of Air, Law, and Commerce, 689 (2004). JDN. https://scholar.smu.edu/jalc/vol69/iss4/3

In Article 11 of the Moon Treaty, the common heritage of mankind language surfaces, and the article states, "[t]he moon and its natural resources are the common heritage of mankind . . ." and states may explore and use the moon without discrimination.64 The Article continues by requiring the future establishment of an international regime "to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible,' 65 reminiscent of the regime established to regulate exploitation of the seabed. Unfortunately, no such regime yet exists; the Moon Treaty only provides that one shall exist in the future. 66

The United States, along with many other nations, refused to sign the treaty, in large part due to the common heritage ideal.67 If the United States' behavior in dealing with the International Seabed Authority indicates its future actions, the United States likely will enact its own system governing the exploitation of celestial bodies.