## 1

### Environment

#### Private ownership and appropriation encourage environmental preservation in space

Reinstein 99

Ezra J. Reinstein (JD, Associate at Kirkland & Ellis), Owning Outer Space, 20 Nw. J. Int'l L. & Bus. 59 (1999). JDN. https://scholarlycommons.law.northwestern.edu/njilb/vol20/iss1/7

Another way to solve the problem of space **environmental ruination** is by accepting the right of ownership into our system of space law. It would be a simple but effective step in the right direction. As Lawrence Roberts has written, the current law "is rather damaging from an environmental perspective," because "without a means to secure control of a resource in the ground," i.e. without ownership, "each individual developer will seek to maximize his or her own gain by extracting as much value as quickly as possible without regard to the effect on the communal resource.

Ownership creates a strong incentive to act with an environmentalist ethos. As owner of a site, SpaceCorp would want to maximize the site's value. This self-interest protects the environment in two related ways. First, because SpaceCorp is not just a squatter on a plot of celestial territory, because it will have more than an expiring usufructary interest, SpaceCorp will avoid wanton despoliation of the land. Despoliation would reduce the value of the property to a purchaser, and thus SpaceCorp's potential revenue. Poor land management might also harm SpaceCorp's current interests, if its actions contaminate its own site to the point that its settlement loses viability. Second, SpaceCorp will avoid ripping through the site; instead, it will either preserve materials it does not use to maximize the site's resale value, or it will itself use the site as fully and efficiently as possible. SpaceCorp will either use the site with preservationist techniques, sparing the site from wasteful destruction, or it will use the site as a conservationist, i.e. wholly and completely, sparing other sites from exploitation. The incentive to use space non-wastefully, discussed above in the context of economic efficiency, clearly has positive environmental repercussions. An owner has an interest in keeping his own site clean, as well as using it with minimal waste and maximum efficiency, because if he wants to eventually sell the property, any despoliation will devalue it. This carrot, because it is self-executing, is better than any stick.

Of course, the right of ownership would not make an environmental violation whose harm extends onto another site less likely -- but it wouldn't make it more likely, either. As under the current system, lawsuits should still be available to remedy harms. Hopefully the requirement of environmental review would act as a prior restraint to prevent these harms. And ownership, by creating an incentive to care about one's own property, protects the interests of others: both those nearby (who instantly feel the effects of more care given to, e.g., waste disposal and water management), and those who come later.

#### Noble materials such as platinum are necessary for future survival, yet they are of limited abundance on earth, while are abundant on asteroids.

Sun et al. 20 (Sun, Daoyuan, Dong, Longjun., Shu, W., & Li, Xibing (School of Resources and Safety Engineering, Central South University, Changsha, China), 3-2-2020, “Exploration: safe and clean mining on Earth and asteroids. Journal of Cleaner Production,” <https://www.sciencedirect.com/science/article/abs/pii/S095965262030946X> Accessed 7-13-21)

Some types of mineral resources are obligatory for an evolving future society, which have great differences in their abundances on Earth and asteroids (e.g., Elvis, 2014). For example, platinum, a noble metal with its total reserve of only about 14,000 tons on Earth, has been widely used in the fields of medicine (e.g., Barefoot, 2001), materials engineering and chemical engineering (e.g., Dong et al., 2015), while most of the platinum has been contained in the ultra-deep deposits as it has large density in the early stage of Earth formation (e.g., Holzheid et al., 2000). With the exhaustion of the limited platinum contained in the surface of Earth, we have to consume more energy and resources to extract the ultra-deep platinum. Hence, there is no doubt that the safe and clean extraction of the deep platinum will be an extremely difficult issue by utilizing current mining techniques and equipment. Meanwhile, it can be expected that the output of platinum on Earth will be scarce as its total reserve is short (Dong et al., 2015). However, the platinum is abundant in other asteroids such as the asteroid 2011 UW158, which was worth 5.4 trillion USD for the platinum that it contained (Gary, 2016). According to the surveys funded by NASA’s Near Earth Object (NEO) Observations Program, the total number of discovered near-Earth asteroids (NEAs) reached to 15,000 up to 13 October 2016 (NASA, 2016). As of January 2018, there were over 18,000 known NEOs, with an average discovery rate about 40 per week (NASA, 2018). Many of NEAs contain high concentrations of platinum group metals (PGMs) such as platinum, rhodium, iridium, and palladium, which are similar to the asteroid 2011 UW158 and can be classified as Metallic Asteroids (Blair, 2000). It can be inferred that the deposits of PGMs on the identified NEAs may exceed the total amount of that found on Earth. Evidently, offmining on asteroids provides new ways for the future society to access the rare and noble metals on Earth.

#### Asteroid mining enables solar power satellites – which limit the effects climate change

**Taylor 19** Chris Taylor is a veteran journalist. Previously senior news writer for Time.com a year later. In 2000, he was named San Francisco bureau chief for Time magazine. He has served as senior editor for Business 2.0, West Coast editor for Fortune Small Business and West Coast web editor for Fast Company. Chris is a graduate of Merton College, Oxford and the Columbia University Graduate School of Journalism. "How asteroid mining will save the Earth — and mint trillionaires." Mashable, 2019, mashable.com/feature/asteroid-mining-space-economy. [Quality Control]

The mission is essential, Joyce declares, to save Earth from its **major problems**. First of all, the fictional billionaire wheels in a fictional Nobel economist to demonstrate the actual truth that the entire global economy is sitting on a **mountain of debt**. It has to keep growing or it will **implode**, so we might as well take the majority of the **industrial growth off-world where it can’t do any more harm to the biosphere.**

Secondly, there’s the **climate change fix**. Suarez sees asteroid mining as the only way we’re going to build **solar power satellites.** Which, as you probably know, is a form of uninterrupted solar power collection that is theoretically more effective, inch for inch, than any solar panels on Earth at high noon, but operating 24/7. (In space, basically, **it’s always double high noon).**

The power collected is beamed back to large receptors on Earth with large, low-power microwaves, which researchers think will be harmless enough to let humans and animals pass through the beam. A space solar power array like the one China is said to be working on could reliably supply 2,000 gigawatts — or **over 1,000 times more power than the largest solar farm currently in existence.**

“We're looking at a 20-year window to **completely replace** human civilization's **power infrastructure,**” Suarez told me, citing the report of the Intergovernmental Panel on Climate Change on the coming catastrophe. Solar satellite technology “has existed since the 1970s. What we were missing is **millions of tons of construction materials** in orbit. **Asteroid mining can place it there.”**

The Earth-centric early 21st century can’t really wrap its brain around this, but the idea is not to bring all that building material and precious metals down into our gravity well. Far better to create a whole new commodities exchange in space. You mine the useful stuff of asteroids both near to Earth and far, thousands of them taking less energy to reach than the moon. That’s something else we’re still grasping, how relatively easy it is to ship stuff in zero-G environments.

#### Off- Earth mining reduces emissions.

Dallas, et al. 19 (Dallas, J.A. (Australian Centre for Space Engineering Research, School of Minerals and Energy Resources Engineering, Sydney, Australia) et al. November 2, 2019, "Mining beyond earth for sustainable development: Will humanity benefit from resource extraction in outer space?," *Acta Astronautica*, <https://www.sciencedirect.com/science/article/abs/pii/S0094576519313839>. Accessed 7-12-21)

Off-Earth mining has been hailed by some as the answer to many of the environmental issues associated with mining on Earth (e.g., MacWhorter, 2015), based on the idea that much of the mining that is carried out on Earth 2 could instead be done in space in a bid to reduce pressure on Earth’s environment. In a preliminary study comparing the greenhouse gas emissions resulting from mining platinum (Pt) on Earth compared to asteroids, Hein et al. (2018) found that mining Pt in space produced considerably less greenhouse gas emissions relative to Earth-based mining. However, this study compared greenhouse gas emissions resulting from 1 kg of mined Pt, and did not compare the impact on other areas of the environment. If asteroids were to supply Earth with all, or even most of the demand for Pt, the assumption can be made that this would require a number of space vehicles carrying materials required for mining infrastructure. While the greenhouse gas emissions associated with space launches may be relatively less than Pt mining on Earth, the cumulative impact of frequent space launches on other areas of the environment is likely to be considerable. Numerous studies have documented the environmental impact of space launches (e.g., Madsen, 1981; Malkin, 1978; Murray et al., 2013; NASA, 1983; Nauryzbaev et al., 2005; Ross et al., 2010), and of particular concern when discussing cumulative launches is depletion of the stratospheric ozone layer. Space rocket launches are the only source of ozone depleting substances deposited directly into Earth’s ozone layer, causing concern that an increase in the frequency of launches could have dire consequences for the ozone layer (Ross et al., 2009). Aside from global environmental concerns, both Earth-based mining and space launches impact the local environment, with both being associated with emissions to soil, air, and water. However, the scale of emissions from mining is much greater than those associated with space launches, and this would likely remain the case even with a large increase in the frequency of space launches. While more work is needed to quantify the local environmental impact of the Earth-based mining as well as the space launches associated with off-Earth mining, preliminary evidence suggests that space launches result in environmental impacts of a much smaller magnitude (e.g., Hein et al., 2018). MacWhorter (2015) suggests that the environmental benefits to Earth of moving mining for resources used on Earth to other celestial bodies will be so large that off-Earth mining should be incentivized through a legal framework that grants property rights in extracted minerals on a “first-in-time, first-in-right” basis

Emissions cause extinctions.

Spratt and Dunlop 19, David Spratt [Research Director for Breakthrough National Centre for Climate Restoration, Melbourne, and co-author of Climate Code Red: The case for emergency action] & Ian Dunlop [member of the Club of Rome. Formerly an international oil, gas and coal industry executive, chairman of the Australian Coal Association, chief executive of the Australian Institute of Company Directors, and chair of the Australian Greenhouse Office Experts Group on Emissions Trading 1998-2000], “Existential climate-related security risk: A scenario approach,” Breakthrough - National Centre for Climate Restoration, May 2019, pg. 8-10, beckert. Brackets in original text

2020–2030: Policy-makers fail to act on evidence that the current ​Paris Agreement path — in which global human-caused greenhouse emissions do not peak until 2030 — will lock in at least 3°C of warming. The case for a global, climate-emergency mobilisation of labour and resources to build a zero-emission economy and carbon drawdown in order to have a realistic chance of keeping warming well below 2°C is politely ignored. As projected by Xu and Ramanathan, by 2030 carbon dioxide levels have reached 437 parts per million — which is unprecedented in the last 20 million years — and warming reaches 1.6°C.18 2030–2050: Emissions peak in 2030, and start to fall consistent with an 80 percent reduction in fossil-fuel energy intensity by 2100 compared to 2010 energy intensity. This leads to warming of 2.4°C by 2050, consistent with the Xu and Ramanathan “baseline-fast” scenario.19 However, another 0.6°C of warming occurs — taking the total to 3°C by 2050 — due to the activation of a number of carbon-cycle feedbacks and higher levels of ice albedo and cloud feedbacks than current models assume. [It should be noted that this is far from an extreme scenario: the low-probability, high-impact warming (five percent probability) can exceed 3.5–4°C by 2050 in the Xu and Ramanathan scheme.] 2050: By 2050, there is broad scientific acceptance that system tipping-points for the West Antarctic Ice Sheet and a sea-ice-free Arctic summer were passed well before 1.5°C of warming, for the Greenland Ice Sheet well before 2°C, and for widespread permafrost loss and large-scale Amazon drought and dieback by 2.5°C. The “hothouse Earth” scenario has been realised, and Earth is headed for another degree or more of warming, especially since human greenhouse emissions are still significant.20 While sea levels have risen 0.5 metres by 2050, the increase may be 2–3 metres by 2100, and it is understood from historical analogues that seas may eventually rise by more than 25 metres. Thirty-five percent of the global land area, and 55 percent of the global population, are subject to more than 20 days a year of lethal heat conditions, beyond the threshold of human survivability. The destabilisation of the Jet Stream has very significantly affected the intensity and geographical distribution of the Asian and West African monsoons and, together with the further slowing of the Gulf Stream, is impinging on life support systems in Europe. North America suffers from devastating weather extremes including wildfires, heatwaves, drought and inundation. The summer monsoons in China have failed, and water flows into the great rivers of Asia are severely reduced by the loss of more than one-third of the Himalayan ice sheet. Glacial loss reaches 70 percent in the Andes, and rainfall in Mexico and central America falls by half. Semi-permanent El Nino conditions prevail. Aridification emerges over more than 30 percent of the world’s land surface. Desertification is severe in southern Africa, the southern Mediterranean, west Asia, the Middle East, inland Australia and across the south-western United States. Impacts: A number of ecosystems collapse, including coral reef systems, the Amazon rainforest and in the Arctic. Some poorer nations and regions, which lack capacity to provide artificially-cooled environments for their populations, become unviable. Deadly heat conditions persist for more than 100 days per year in West Africa, tropical South America, the Middle East and South-East Asia, contributing to more than a billion people being displaced from the tropical zone. Water availability decreases sharply in the most affected regions at lower latitudes (dry tropics and subtropics), affecting about two billion people worldwide. Agriculture becomes nonviable in the dry subtropics. Most regions in the world see a significant drop in food production and increasing numbers of extreme weather events, including heat waves, floods and storms. Food production is inadequate to feed the global population and food prices skyrocket, as a consequence of a one-fifth decline in crop yields, a decline in the nutrition content of food crops, a catastrophic decline in insect populations, desertification, monsoon failure and chronic water shortages, and conditions too hot for human habitation in significant food-growing regions. The lower reaches of the agriculturally-important river deltas such as the Mekong, Ganges and Nile are inundated, and significant sectors of some of the world’s most populous cities — including Chennai, Mumbai, Jakarta, Guangzhou, Tianjin, Hong Kong, Ho Chi Minh City, Shanghai, Lagos, Bangkok and Manila — are abandoned. Some small islands become uninhabitable. Ten percent of Bangladesh is inundated, displacing 15 million people. Even for 2°C of warming, more than a billion people may need to be relocated and In high-end scenarios, the scale of destruction is beyond our capacity to model, with a high likelihood of human civilisation coming to an end.21 National security consequences: For pragmatic reasons associated with providing only a sketch of this scenario, we take the conclusion of the ​Age of Consequences ‘Severe’ 3°C scenario developed by a group of senior US national-security figures in 2007 as appropriate for our scenario too: Massive nonlinear events in the global environment give rise to ​massive nonlinear societal events.​ In this scenario, nations around the world will be ​overwhelmed by the scale of change and pernicious challenges, such as pandemic disease. The internal cohesion of nations will be under great stress, including in the United States, both as a result of a dramatic rise in migration and changes in agricultural patterns and water availability. The flooding of coastal communities around the world, especially in the Netherlands, the United States, South Asia, and China, has the potential to challenge regional and even national identities.​ Armed conflict between nations over resources, such as the Nile and its tributaries, is likely and nuclear war is possible. The social consequences range from increased religious fervor to ​outright chaos.​ In this scenario, climate change provokes ​a permanent shift in the relationship of humankind to nature​’.22 (emphasis added) DISCUSSION This scenario provides a glimpse into a world of “outright chaos” on a path to the end of human civilisation and modern society as we have known it, in which the challenges to global security are simply overwhelming and political panic becomes the norm. Yet the world is currently completely unprepared to envisage, and even less deal with, the consequences of catastrophic climate change.23 What can be done to avoid such a probable but catastrophic future? It is clear from our preliminary scenario that dramatic action is required this decade if the “hothouse Earth” scenario is to be avoided. To reduce this risk and protect human civilisation, a massive global mobilisation of resources is needed in the coming decade to build a zero-emissions industrial system and set in train the restoration of a safe climate. This would be akin in scale to the World War II emergency mobilisation. There is an increasing awareness that such a response is now necessary. Prof. Kevin Anderson makes the case for a Marshall Plan-style construction of zero-carbon-dioxide energy supply and major electrification to build a zero-carbon industrial strategy by “a shift in productive capacity of society akin to that in World War II”.24 Others have warned that “only a drastic, economy-wide makeover within the next decade, consistent with limiting warming to 1.5°C”, would avoid the transition of the Earth System to the Pliocene-like conditions that prevailed 3-3.3 million years ago, when temperatures were ~3°C and sea levels 25 metres higher.25 It should be noted here that the 1.5° goal is not safe for a number of Earth System elements, including Arctic sea-ice, West Antarctica and coral reefs.

## 2

### Regulation CP

#### Counterplan text: The Committee on the Peaceful use of Outer Space ought to

#### establish an application system for property rights on celestial bodies. Applications and approval of property rights should be granted upon the condition of

#### open disclosure of data gathered in the exploration of a celestial body

#### Applications must be publicly announced

#### Property Rights will be made tradeable between private entities

#### Property Rights will be set to expire on the conclusion of a successful extraction mission

#### Private Entities will only be allowed one property right grant per celestial body and cannot have more than one grant at a time

#### The counterplan establishes international norms for safe extraction of resources on celestial bodies while increasing R&D in outer space.

**Steffen 21** [Olaf Steffen, Olaf is a scientist at the Institute of Composite Structures and Adaptive Sytems at the German Aerospace Center. 12-2-2021, "Explore to Exploit: A Data-Centred Approach to Space Mining Regulation," Institute of Composite Structures and Adaptive Systems, German Aerospace Center, [https://www.sciencedirect.com/science/article/pii/S0265964621000515 accessed 12/12/21](https://www.sciencedirect.com/science/article/pii/S0265964621000515%20accessed%2012/12/21)] Adam

4. The data-centred approach to space mining regulation

4.1. Core description of the regulatory regime and mining rights acquisition process

The data gathered in the exploration of a [celestial body](https://www.sciencedirect.com/topics/social-sciences/astronomical-systems) is not only of value for space mining companies for informing them whether, where and how to exploit resources from the body in question, but also for science. The irretrievability of information relating to the solar system contained in the body that will be lost during resource exploitation carries a value for humanity and future generations and can thus be assigned the characteristic of a common heritage for all mankind as invoked in the Moon Agreement. This characteristic makes exploration data an exceptional and unique candidate for use in a mechanism for acquiring mining rights because its preservation is of public interest and its disclosure in exchange for exclusive mining rights does not place any additional burden on the mining company. The following principles would form the cornerstones of the proposed regulatory regime and rights acquisition mechanism based on exploration data:

Without preconditions, no entity has a right to mine the resources of a celestial body.

An international regulatory body administers the existing rights of companies for mining a specific celestial body.

Mining rights to such bodies can be applied for from this international regulatory body, with applications made public. The application expires after a pre-set period.

Mining rights are granted on the provision and disclosure of exploration data on the celestial body within the pre-set period, proposedly gathered in situ, characterising this body and its resources in a pre-defined manner.

The explorer's mining right to the resources of the celestial body is published by the regulatory body in a mining rights grant.

The data concerning the celestial body are made public as part of the rights grant within the domain of all participating members of the regulatory regime.

The exclusive mining rights to any specific body are tradeable.

The scope of the regulatory body with respect to the granting of mining rights is not revenue-oriented.

The international regulatory body would thus act as a curator of a rights register and an attached database of exploration data. The concept is superficially comparable to patent law, where exclusive rights are granted following the disclosure of an invention to incentivise the efforts made in the development process. In the following section, the characteristics of such a regulatory regime are further discussed with respect to the formation of [monopolies](https://www.sciencedirect.com/topics/social-sciences/monopolies), market dynamics, conflict avoidance, inclusivity towards less developed countries and the viability of implementation.

4.2. Discussion and means of implementation

The proposed regulatory mechanism has advantages both from a business/investor and society perspective. First, it prevents already highly capitalised companies from acquiring exploitation rights in bulk to deny competitors those objects that are easiest to exploit or most valuable, which would otherwise be possible in any kind of pay-for-right mechanism and could result in preventing market access to smaller, emerging companies. Thus, early monopoly formation can be avoided.

The use of data disclosure for the granting of mining rights ensures the scientific community has access to this invaluable source of information. In this way, space mining prospecting missions can lead to a boost in research on small celestial bodies at a speed unmatchable by pure government/agency funded science probes. This usefulness to the scientific community could lead to sustained partnerships between prospecting companies and scientific institutions and could even provide a source of funding for the companies through R&D grants and public-private partnerships. The results of the exploration efforts contribute to research on the formation of planets and the history of the solar system and provide valuable insight for space defence against asteroids. The transition of exploration from a tailored mission profile with a purpose-built spacecraft to a standard task in space flight would also lead to a cost reduction of the respective exploration spacecraft through [economies of scale](https://www.sciencedirect.com/topics/social-sciences/economies-of-scale). This describes the very benefits Elvis [[24](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib24)] and Crawford [[25](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib25)] imagined as possible effects of a space economy. Thus, there is an immediate return for society from the exploitation rights grant. It also reconciles the adverse interests of space development and [space science](https://www.sciencedirect.com/topics/social-sciences/space-sciences) as laid out by Schwartz [[26](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib26)]. It ensures that, by exploitation, information contained in celestial bodies is not lost for future generations.The application period should not be set in a manner that creates a situation that can be abused through the potential for stockpiling inventory rights. Rather, it is intended to prevent conflict in the phase before exploration data gathered by a mission, as a prerequisite to the mining rights grant, is available. In other words, only one exploration effort at a time can be permitted for a specific body. The time frame between the application and the granting of mining rights (meaning: availability of the required exploration data set) should be tight and should only consider necessary exploration time on site, transit time and possibly a reasonable launch preparation and data processing markup. These contributors to the application period make it clear that the time frame could be dynamic and individualistic, depending on the exploration target (transit time and duration of exploration) and the technology of the exploration probe (transit time). After the expiration of the application period, applications for the exploration target would again be permissible. To prevent the previously mentioned stockpiling of inventory rights, credible proof of an imminent exploration intention would need to be part of the application process, for example, a fixed launch contract or the advanced build status of the exploration probe. Such a mechanism would not contradict the statement in the OST that outer space shall be free for both exploration and scientific investigation. Applications would not apply to purely scientific exploration. An application would only be necessary as a prerequisite for mining. Even resource prospecting could take place without an application (for whatever reason), with a subsequent application comprising in situ data already gathered. For such cases, the application process would need to provide a short period for objections to enable the secretive explorer to make their efforts public. The publication of the application for the mining rights, which is nothing more than a statement of intention to explore, thus provides a strong measure for avoiding conflict.

The transparency of where exploration spacecraft are located and, at a later stage, where mining activities take place, provides additional benefits for the sustainable use of space, trust building and deterrence against malign misuse of mining technology. Involuntary spacecraft collisions of competitors in deep space are prevented by the reduction of exploration efforts at the same destination through the application for mining rights by one applicant at a time. As pointed out by Newman and Williamson [[20](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib20)], this is relevant because space debris does not de-orbit in deep space as in the case of LEO. Deep space may be vast, but the velocities involved mean that small debris particles are no less dangerous. Considering NEO mining with fleets of small spacecraft, malfunctions and/or destructive events could create debris clouds crossing Earth's orbit around the sun on a regular basis, presenting another danger to satellites in Earth's own orbit. Thus, by effectively preventing the collision of two spacecraft, one source of debris creation can be mitigated through this regulation mechanism. With respect to Deudney's [[11](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib11)] scepticism of asteroid mining and the dual-use character of technology to manipulate orbits of celestial bodies, it has to be stated that this potential is truly inherent to asteroid mining. An asteroid redirect mission for scientific purposes was pursued by NASA [[49](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib49)] before reorientation towards a manned lunar mission. In one way or another, each type of asteroid mining will require the delivery of the targeted resource to a destination via a comparable technology as formerly envisioned by NASA, be it as a raw material or a useable resource processed in situ, even if this is not necessarily done through redirecting the whole asteroid and placing it in a lunar orbit. However, to be misused as a weapon, space mined resources would have to surpass a certain mass threshold to survive atmospheric entry at the target. This seems unfeasible for currently discussed mining concepts using small-scale spacecraft as described in this article. Redirecting larger masses or whole asteroids would require far more powerful mining vessels or small amounts of thrust over long periods of time. The continuous, (for a mining activity) untypical change in the orbit of an asteroid would make a redirect attempt with hostile intent easily identifiable, effectively deterring such an activity in the first place by ensuring the identification of the aggressor long before the projectile hits its target. The proposed database would provide a catalogue of asteroids with exploration and mining activities in place that should be tracked more closely because of their interaction with spacecraft. This would, in fact, be necessary per se as a precaution to avoid catastrophic mishaps, such as the accidental change of a NEO's orbit to intercept Earth by changing its mass through mining.

#### Space mining fails now due to profitability and unsafe tech which only the cp solves

**Steffen 21** [Olaf Steffen, Olaf is a scientist at the Institute of Composite Structures and Adaptive Sytems at the German Aerospace Center. 12-2-2021, "Explore to Exploit: A Data-Centred Approach to Space Mining Regulation," Institute of Composite Structures and Adaptive Systems, German Aerospace Center, [https://www.sciencedirect.com/science/article/pii/S0265964621000515 accessed 12/12/21](https://www.sciencedirect.com/science/article/pii/S0265964621000515%20accessed%2012/12/21)] Adam

* answers timeframe deficits
* creates solvency vs inequality/developing nation affs

The data-driven mechanism also addresses another potential risk of an emerging space-based resource economy: the reinforcing of the incontestable market positions of the market leaders based on an advantage in knowledge unattainable by new competitors. Explorations of celestial bodies will have a likelihood of failing from the perspective of the actual value of the explored object vs. the expected value. In this case, the costs of exploration would be a loss for the company, which could be significant and possibly ruinous considering the budgets needed for contemporary space agency-led exploration missions. Sanchez and McInnes [[5](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib5)] explicitly mention the uncertainties in object distribution models used in their asteroid distribution study and for the conclusions drawn concerning reachable object masses with certain delta-v capabilities of spacecraft. With an increasing number of exploration missions led by a company, the data collected may lead to better in-house models and a higher probability of exploring the ‘right’ body for the value/resources aimed at. This may even provide information on the best spacecraft designs for matching the targeted objects’ orbit distribution. This risk is known from the digital platform economy, where the companies that are now leading have an uncatchable advantage in user data compared with market newcomers, translatable to a more refined and comfortable user experience, attracting additional users and thus offering superior services to business customers. This also holds true for space mining companies. Through their lack of legacy mission data, market newcomers would have a higher risk of misallocating exploration missions, making investments in those companies riskier than in established companies. To avoid the preferred investment in a single or a few companies, the risk of the investment in emerging companies is reduced by the proposed mechanism by ensuring the equal access to data for market newcomers and established companies alike. From a prospecting risk perspective, the market entrance of a new company becomes progressively less risky for investors with increasing amounts of publicly available exploration data, promoting progressive and dynamic development.

The long lead times of asteroid mining ventures coincide with a long time frame for an ROI. The exclusive mining rights granted after the exploration phase give investors security half-way into their space mining endeavours. The proposed tradability of the rights offers an early chance of gaining investment proceeds. It also offers the possibility of new business models: the classical asteroid mining system concept, as shown by Andrews et al. [[43](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib43)], for example, covers exploration, exploitation and resource transfer. This maximises the investment needed to develop the technologies required for the entire process chain. Giving exploration a value could lead to a division of labour. Dedicated prospecting companies could emerge, providing mining companies with the data and mining rights to a body with the specific resource profile they are seeking. In this way, the investment needed for a successful mining endeavour is divided between different specialised companies. This considerably reduces the risk for investors as well as the investment needed for a company to meet their business goals, which are now aimed at just a particular part of the overall space mining endeavour. Third-party applications for mining rights should be possible to allow a mining company to subcontract to exploration companies. Such a regulatory mechanism design would also be more easily inclusive of less developed countries. They could simply contract exploration missions made affordable through economies of scale to become part of the emerging space mining economy as holders of tradeable mining rights. Through a wise selection of such missions’ targets, they could gain powerful positions of influence.

## Case

#### Private entities appropriating space can be a method of maintaining space through debris removal and traffic-management systems

**Moore 21** (Moore, Adrian. “It's Time For US To Get Serious About Cleaning Up Space Junk,”.” TheHill. July 27, 2021. Web. December 13, 2021. <https://thehill.com/opinion/technology/564945- its-time-for-us-to-get-serious-about-cleaning-up-space-junk>.)

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

#### Private entities empirically reduce debris.

**INN '20,** Innovation News Network, "Innovation in space: the private sector’s role in the 2020 space race", 6-11-2020, accessed 7-11-2021, <https://www.innovationnewsnetwork.com/innovation-in->space-the-private-sectors-role-in-the-2020-space-race/5490/ DHS//JL

SpaceX has paved the way for a new wave of commercial space technologies. However, **private actors have been influencing the space industry for many years.** In May 2003, Scaled Composites first launched SpaceShipOne, an experimental and reusable space plane that uses a hybrid rocket to achieve speeds of up to speeds of up to 900 m/s. SpaceShipOne completed the first crewed private spaceflight in 2004, which was then retired that year. In 2013, The Spaceship Company announced the first powered flight of SpaceShipTwo, another suborbital spaceplane designed for space tourism. Unfortunately, in October 2014, the first SpaceShipTwo VSS Enterprise crashed in the Mojave Desert. Further investigation suggested that the craft’s descent device deployed too early, killing the pilot, Michael Alsbury. Virgin Galactic plans to operate a fleet of five improved SpaceShipTwo spaceplanes in a private passenger-carrying service and has been taking bookings for some time, with a suborbital flight carrying an updated ticket price of $250,000. **SpaceX is responsible for some of the most innovative space technologies** produced in the last decade.SpaceX has created the most powerful rocket ever developed, Falcon Heavy, which can lift more than twice the payload of the next closest operational vehicle, the Delta IV Heavy. Although the nature is of the commercial space sector is competitive, many private companies share common goals.How can commercialisation reduce overcrowding in space? Almost 60 years of space activities and more than 5,450 launches have resulted in approximately 23,000 objects remaining in orbit. Around 24% of the catalogued objects are satellites. This catastrophic waste of technology can have a negative effect of future launches and it has been theorised that sending objects into Earth’s orbit could become impossible due the risk of collision. This debris must be removed from orbit if the space industry is to continue to grow. Many **private companies have taken on the burden of removing debris from Earth’s orbit.** Aviosonic Space Tech has pioneered the first Debris Collision Alert System (DeCAS) for the monitoring of space vehicles and satellites as they re-enter Earth’s atmosphere. Avisonic’s patented space debris management system, DeCAS, addresses the vital issue of protecting people and institutions across the globe through a precise, efficient, and cost-effective system which will make the world a safer place. Although the removal of space debris is an important step in sustainable space travel, many businesses are developing nanosatellites to reduce the volume of technology in orbit. Another benefit of developing nanosatellites is that they can do almost everything a conventional satellite does at a fraction of the cost, making this technology more popular in the commercial sector.