1: Asteroid Mining

Commercial asteroid mining is coming now – lower costs and improving tech make it economically viable – and the legal basis is already in place in multiple countries– that helps acquire water for rocket fuel and rare earth metals

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Space exploration is back. after decades of disappointment, a combination of better technology, falling costs and a rush of competitive energy from the private sector has put space travel **front and center**. indeed, many analysts (even some with their feet on the ground) believe that commercial developments in the space industry may be on the cusp of starting the largest resource rush in history: **mining on the Moon**, Mars and **asteroids**.

While this may sound fantastical, some baby steps toward the goal have already been taken. Last year, NASA awarded contracts to four companies to extract small amounts of lunar regolith by 2024, effectively **beginning the era of commercial space mining**. Whether this proves to be the dawn of a gigantic adjunct to mining on earth — and more immediately, a key to unlocking cost-effective space travel — will turn on the answers to a host of questions ranging from what resources can be efficiently.

As every fan of science fiction knows, the resources of the solar system appear **virtually unlimited** compared to those on Earth. There are whole other planets, dozens of moons, thousands of massive asteroids and millions of small ones that doubtless contain humungous quantities of materials that are scarce and very valuable (back on Earth). Visionaries including Jeff Bezos imagine heavy industry moving to space and Earth becoming a residential area. However, as entrepreneurs look to harness the riches beyond the atmosphere, access to space resources remains tangled in the realities of economics and governance.

Start with the fact that space belongs to no country, complicating traditional methods of resource allocation, property rights and trade. With limited demand for materials in space itself and the need for huge amounts of energy to return materials to Earth, creating a viable industry will turn on major advances in technology, finance and business models.

That said, there's no grass growing under potential pioneers' feet. Potential economic, scientific and even security benefits underlie an emerging geopolitical competition to pursue space mining. The United States is rapidly emerging as a front-runner, in part due to its ambitious Artemis Program to lead a multinational consortium back to the Moon. But it is also a leader in **creating a legal infrastructure for mineral exploitation**. The United States has adopted the world's first spaceresources law, recognizing the property rights of private companies and individuals to materials gathered in space.

However, the United States is hardly alone. Luxembourg and the United Arab Emirates (you read those right) are racing to codify space-resources laws of their own, hoping to attract investment to their entrepot nations with business-friendly legal frameworks. China reportedly views space-resource development as a national priority, part of a strategy to challenge U.S. economic and security primacy in space. Meanwhile, Russia, Japan, India and the European Space Agency all harbor space-mining ambitions of their own. Governing these emerging interests is an outdated treaty framework from the Cold War. Sooner rather than later, we'll need new agreements to facilitate private investment and ensure international cooperation.

What's Out There

Back up for a moment. For the record, space is already being heavily exploited, because space resources include non-material assets such as orbital locations and abundant sunlight that enable satellites to provide services to Earth. Indeed, satellite-based telecommunications and global positioning systems have become indispensable infrastructure underpinning the modern economy. Mining space for materials, of course, is another matter.

In the past several decades, planetary science has confirmed what has long been suspected: celestial bodies are potential sources for dozens of natural materials that, in the right time and place, are **incredibly valuable**. Of these, water may be the most attractive in the near-term, because — with assistance from solar energy or nuclear fission — H2O can be split into hydrogen and oxygen to make **rocket propellant**, facilitating in-space refueling. So-called "**rare earth" metals** are also **potential targets** of asteroid miners intending to service Earth markets. Consisting of 17 elements, including lanthanum, neodymium, and yttrium, these critical materials (most of which are today mined in China at great environmental cost) **are required for electronics**. **And they loom as bottlenecks in making the transition from fossil fuels to renewables backed up by battery storage.**

Asteroids cause extinction- causes famines and economic decline

Higgins, 18 -- correspondent at Vox

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Asteroids are rocks that revolve around the sun and that occasionally collide with the Earth. An asteroid large enough to **cause a global catastrophe** hits Earth **every 120,000 years,** scientists estimate. It's likely what **killed the dinosaurs**, and if an asteroid even **one-tenth the size** of the one that **caused their extinction** hit Earth today, the results would be **devastating**. Scientists estimate it could **release enough particles** to **block the sun for months** and cause a **famine killing hundreds of millions**.

NASA announced in 2011 that it had mapped more than 90 percent of objects in space larger than 1 kilometer in diameter, and that none of them are likely to hit Earth. But there's **still a lot we don't know** about smaller objects that, while unlikely to cause a global catastrophe, could have a **big enough local impact** to **disrupt social and economic system**

2: Space Colonization

Property rights are key to space colonization

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]

Colonization might be **necessary** to **long-term** and far-reaching **development of space**. Additionally, colonization can help solve one of our most pressing problems: overpopulation of the Earth. There cannot be **viable**, **long-term** colonization if property law does not permit **ownership** -- and the **certainty it imparts** -- of the **territory on which the colony stands**.

Absent colonization, human extinction is inevitable

Tonn 9

[Bruce E., September 2009, Department of Political Science, U of Tennessee, "Obligations to Future Generations and AcceptableRisks of Human Extinction," Futures, 41:7, p. 427-435, http://www.sciencedirect.com/science/article/pii/S0016328709000020]

The litany of catastrophe-scale problems facing humanity is long and well known [1]. The set of catastrophic-scale events includes nuclear war, global climate change, massive volcanic eruptions, and collisions with near-earth objects [2]. Humanity is also plagued by myriad lesser risks that, when chained together, could equal or possibly even surpass risks posed by catastrophic events. Imagine the consequences of chaining to together the worst outcomes of terrorism, energy shortages, flu pandemics, HIV/AIDS, air and water pollution, water shortages, soil erosion, species extinction, and forest fire. Indeed, history has witnessed the collapse of many civilizations due to chains of less than catastrophicevents, usually anchored by the overutilization of natural resources [3]. Last but not least is the set of potential exotic catastrophic events, which includes out-of-control (grey goo) nanotechnologies [4], the emergence of threatening super computer intelligences [5], bombardment by gamma rays emanating from explosions of super novae[6] and [7] and the creation of earth-destroying tears in the fabric of space–time within new high-energy physics devices [8,9]. Because of the perceived weight of these threats, many knowledgeable people believe that the situationfacing humanity is extremely dire [10], so dire that human extinction not only seems quite possible but also very probable. For example, Rees [8] puts the chances of human civilization surviving another 100 years to be just 50–50. Bostrom [9] argues that the imminent chances of human extinction cannot be less than 25%. Leslie [11] estimates a 30% probability of human extinction during next five centuries. The Stern Review conducted for the United Kingdom Treasury assumes probability of human extinction during next century is 10%[12].

Contention 3: Appropriation Key

Property rights are key- it creates the most efficient system for the development of space- turns the case

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**. After investing countless hours in (or paying someone else for) a survey of the real estate, after setting up a mining colony at great expense, the pioneer would have **no recourse** if another party **took advantage** of the pioneer's research and began a **copycat mine** on the very same site. So the right to exclude must form a part of the new legal system.

Finally, the right to transfer must accompany the rights of **exclusion** and **perpetual possession**. The **Coase Theorem of economics** tells us that, in a **legal environment supportive of bargaining**, property rights will be allocated to the party who **values them most**, i.e. the **most efficient user of the property**.81 When transaction costs are high enough to prevent bargaining, property rights **only** end up in the **most productively efficient hands if** the law happens to **initially assign them that way**.82 Without any right to transfer, transaction costs are **infinite**, and **no bargaining can occur**. In order to avoid the **inevitably inefficient** solutions of a **command-and-control regime** of property usage, the right to transfer -- alienability -- must be a part of our system.83

All these rights together -- possession, use, exclusion, and transfer -- make up **ownership**. And it is ownership that the modem law of space real property needs.

Contention 4

Private companies are necessary – They have to be the ones in space to ensure continuous innovations.

Hamspson 17, [Joshua Hampson, Security Studies Fellow at the Niskanen Center, 1-25-2017, "The Future of Space Commercialization", Niskanen Center, https://republicans-science.house.gov/sites/republicans.science.house.gov/files/documents/TheFutureofSpaceCommercializationFinal.pdf/] DurhamSA

Innovation is generally hard to predict; some new technologies seem to come out of nowhere and others only take off when paired with a new application. It is difficult to predict the future, but **it is reasonable to expect that a growing space economy would open opportunities for technological and organizational innovation**. In terms of technology, **the difficult environment of outer space helps incentivize progress along the margins.** Because each object launched into orbit costs a significant amount of money—at the moment between $27,000 and $43,000 per pound, though that will likely drop in the future —each 19 reduction in payload size saves money or means more can be launched. At the same time, the ability to fit more capability into a smaller satellite opens outer space to actors that previously were priced out of the market. This is one of the reasons why small, affordable satellites are increasingly pursued by companies or organizations that cannot afford to launch larger traditional satellites. These small 20 satellites also provide non-traditional launchers, such as engineering students or prototypers, the opportunity to learn about satellite production and test new technologies before working on a full-sized satellite. **That expansion of developers, experimenters, and testers cannot but help increase innovation opportunities**. **Technological developments from outer space have been applied to terrestrial life since the earliest days of space exploration**. The National Aeronautics and Space Administration (NASA) maintains a website that lists technologies that have spun off from such research projects**. Lightweight** 21 **nanotubes**, useful in protecting astronauts during space exploration, **are now being tested for applications in emergency response gear and electrical insulation**. The need for certainty about the resiliency of materials used in space led to the development of an analytics tool useful across a range of industries. Temper foam, the material used in memory-foam pillows, was developed for NASA for seat covers. **As more companies pursue their own space goals, more innovations will likely come from the commercial sector. Outer space is not just a catalyst for technological development.** Satellite constellations and their unique line-of-sight vantage point **can provide new perspectives to old industries**. Deploying satellites into low-Earth orbit, as Facebook wants to do, can connect large, previously-unreached swathes of 22 humanity to the Internet. **Remote sensing technology could change how whole industries operate, such as crop monitoring, herd management, crisis response, and land evaluation, among others**. 23 While satellites cannot provide all essential information for some of these industries, they can fill in some useful gaps and work as part of a wider system of tools. **Space infrastructure, in helping to change how people connect and perceive Earth, could help spark innovations on the ground as well. These innovations, changes to global networks, and new opportunities could lead to wider economic growth.**

Stronger innovation decreases risks of extinction, and creates tangible improvements in the quality of life for the people.

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

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.