### 1

#### States ought to apply the public trust doctrine to outer space while allowing limited private property rights through a system of tradeable development credits.

#### CP solves 100% of the aff while encouraging the sustainable and equitable development of space.

#### Permutations are either severance or prove the aff is not topical since the CP requires private appropriation.

Babcock 21 [Hope M. Babcock (professor of law, Georgetown), “Using the Public Trust Doctrine to Manage Property on the Moon,” The Cambridge Handbook of Commons Research Innovations , pp. 264 – 272 (2021).] CT

There are various ways to manage property in outer space, which might work in a private or common property regime. However, any approach would have to allow the profitable development of outer space equitably and sustainably, as well as be efficient, fair, cost effective, and easy to implement and enforce. Above all, it must not run afoul of international law.

One idea is to establish economic development zones. Under this approach, international organizations would allocate areas on celestial bodies to various countries for the construction of structures, from which exclusive economic zones would radiate.54 Alternatively, an international organization might divide celestial bodies into shares for each country to exploit. Separating incompatible land uses in outer space might avoid negative spillovers from the co-location of conflicting uses,55 and could be used to exclude entities which might over-consume a common resource, leaving other users worse off. This latter feature of the proposal, however, conflicts with the OST’s free exploration and use principles.56

The proposal also requires an international institution to administer the system, which would be expensive to create and maintain.57 Spending money to create a new administrative authority, which might otherwise have helped poorer countries develop the capacity to participate in outer space. Additionally, it would be technically difficult to monitor and enforce what happens within these distant zones. And, depending on the perceived “fairness” of the zones and the allocation process, the proposal could lead to “discord“ among various countries, straining any civility norms previously established among spacefaring nations.

Having a lottery or an auction of “ownership rights,” or establishing a system of tradable credits might lessen the equity and technical problems with the economic zone management proposal. While an auction theoretically would open up the market in development rights to non spacefaring nations, in practice, only the wealthy nations would be able to effectively bid on and secure those rights.58 However, the idea of tradable credits might work.59

Under an outer space trading system, participant nations, regardless of their space faring capacity, would be allotted a fixed number of resource development credits, allowing the credit holder to extract a certain tonnage of materials or develop a fixed amount of celestial surface, during a specified time period.60 The credits could apply to the amount of the resource a participant was allowed to extract, regardless of location, or could be tied to a particular area of a celestial body. Participants could buy credits from and sell them to other participants.61 The proposal would allow developing nations to benefit from space exploration and exploitation, and participants would run the market reducing the need for an administering international agency.

Even though market participants would run the market, an international institution will be needed to allocate tradable credits and devise an allocation methodology that assures non-spacefaring nations receive some benefit. International oversight also will be needed to ensure that nations do not exceed their allotted credits. And tradable credits would need to be anchored by some form of authorization, like a permit, creating another need for a central administrative body.

While the idea of tradable development credits is consistent with international law, could assure equitable distribution of the benefits of space development, and provide sufficient incentives for development of these resources, the approach may be too administratively encumbered.

The public trust doctrine offers another approach for managing an open access commons. 62 Under this doctrine, the sovereign holds certain common properties in trust in perpetuity for the free and unimpeded use of the general public. The public’s right of access to and use of trust resources is never lost, and neither the government nor private individuals can alienate or otherwise adversely affect those resources unless for a comparable public purpose. Showing its adaptability, supporters of the doctrine are currently arguing in court that it applies to the atmosphere.63

The doctrine places on governments an affirmative, ongoing duty to safeguard the perpetual preservation of trust resources for the benefit of the general public, limiting the sovereign’s power on behalf of both present and future entities. It directs the government not to manage them for private gain and applies to private as well as public resources. Uses of trust resources that are inconsistent with the doctrine can be rescinded. The doctrine effectively places a permanent easement over trust resources that burdens their ownership with an overriding public interest in their preservation. Thus, the public trust doctrine protects the “people’s common heritage,”64 just as the Moon Treaty protects outer space as part of the common heritage of mankind.

A doctrine that imposes an enforceable perpetual duty on the sovereign to preserve trust resources, prevents their alienation for private benefit, and assures public access to them seems a particularly apt property management tool in outer space. The fact that public access to trust resources is so central to the doctrine65 is consistent with international space law’s open access principles. It avoids the problems of alienation and exclusion associated with private property management approaches and does not require the creation of a new administrative authority, as anyone can invoke the doctrine. Of all the management approaches discussed, the public trust doctrine seems the most suited to managing property in outer space.

However, the doctrine provides no incentives for development of trust resources.66 Its traditional use has been to curtail development, making it potentially a counter productive solution to the beneficial development of outer space. Allowing limited use of private property management approaches, like tradable development credits, might buffer that effect – a form of overlapping hybridity 67 between one type of property, a commons, and a management regime from another, private property, enabled by application of the public trust doctrine. This approach might allow development of outer space, while assuring that it will not just be profitable for a few; rather, space’s development will be sustainable and equitable, ideally for all.

Conclusion

Guided by the insights of Elinor Ostrom, this chapter proposes that viewing outer space as a commons will lead to a durable, equitable management regime where the wealthy are neither able to accumulate nor control the resources that space has to offer nor over exploit them. Using the public trust doctrine, supplemented by tradable development credits, as the preferred management approach will help assure that result and allow the development of space for the “benefit of all mankind.”

### 2

#### Current law is not a barrier to space settlement.

Gesl 18 [Paul M. Gesl (Maj, USAF JD), “PREPARING FOR THE NEXT SPACE RACE: Legislation and Policy Recommendations for Space Colonies,” A Research Report Submitted to the Faculty In Partial Fulfillment of the Graduation Requirements for the Degree of MASTER OF OPERATIONAL ARTS AND SCIENCES (April 2018). <https://apps.dtic.mil/sti/pdfs/AD1053024.pdf>] CT

Existing Legal Framework for Space Colonies

In 1967, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (OST) entered into force.43 This document, which is over 50 years old, was drafted when space issues were very different, yet it is still the primary binding international law on space activities. The OST places several limitations on potential colonization; however, it does not forbid the activity.

The first hurdle to a potential colony is Article II of the OST. “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.”44 One could argue that this would prevent any colonization. In fact, some do just that. Attorney Michael Listner, who founded Space Law and Policy Solutions, views this article as a non-starter for colonization efforts. “When a private citizen makes a claim to private, real property, basically, that’s saying the United States is making a claim as well, because of that continuing jurisdiction, the U.S. government always has.”45 The publication theoutline.com, relying on an interview with Listner,took this one step further, arguing that this means “any base or settlement on Mars would have to be free to use by anyone who can travel there. A person can’t just set up a colony, claim independence, and create rules that restrict access to it.”46 However, Lister’s interpretation is incorrect as it is too strict an interpretation of the language. Theoutline.com appears to take the interpretation to an untenable conclusion that is not supported by the evidence. Even though this position is not credible, it is important to discuss because as the United States moves towards colonization, it will face similar criticisms from opponents. Article II of the OST was not written to ban establishing a colony on a celestial body. Instead it was written to prevent a country from claiming a celestial body, such as the moon, as their own sovereign territory. This more permissive interpretation is supported by other provisions of the OST.

The OST contains language that supports establishing colonies. Article IV, while generally a prohibitive Article, states, “The use of any equipment or facility necessary for peaceful exploration of the Moon and other celestial bodies shall also not be prohibited.”47 If this leaves any doubt, Article XII likely clears up the confusion.

All stations, installations, equipment and space vehicles on the Moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity. Such representatives shall give reasonable advance notice of a projected visit, in order that appropriate consultations may be held and that maximum precautions may be taken to assure safety and to avoid interference with normal operations in the facility to be visited.48

This Article establishes two important facts under the treaty. First, space colonization is acceptable under the OST. A colony easily fits within the definition of a station or installation. Quite simply, if the drafters of the OST intended to prevent States from establishing colonies, they would have most certainly done so in uncertain terms. Second, a State can establish a colony either unilaterally, or with a selected group of international partners. The visits discussed in Article XII would not be necessary if every colony needed to be open to the international community. This also eviscerates claims like those cited by theoutline.com, discussed above. If any colony were open to any party that could reach it, the visits by representatives in Article XII would be nonsensical. Looking at these details in the language of the entire treaty is important, because without it, one could argue that Article I in the OST would prevent a State from establishing a colony. If a space colony established by a single State would deny other states free access to an area of a celestial body (namely the area where the colony is established), then facilities would be banned outright. However, Article XII directly undercuts this weak argument.

It is important to note that the OST equally applies to commercial entities. Private corporations are currently leading the way in planning for space colonization. A company that did not sign, or even exist when the OST was signed, is still bound by its provisions. Article VI establishes that these entities have to conform to the treaty, and more importantly that “the appropriate State Party to the Treaty” must both authorize and supervise these companies. 49 While not binding, the United Nations has spoken on the matter.

Space activities should require authorization by a competent national authority; such authority or authorities, as well as the conditions and procedures for granting, modifying, suspending and revoking the authorization, should be set out clearly within the regulatory framework; States might employ specific procedures for the licensing and/or for the authorization of different kinds of space activities.”50

These two citations together indicate that the United States must authorize and supervise the activities of commercial companies operating in space. If those activities include colonization, then legislation must appropriately supervise it.

#### But eliminating away property rights for asteroid mining scares investors away and spills over to other space activities. Freeland 05

Steven Freeland (BCom, LLB, LLM, University of New South Wales; Senior Lecturer in International Law, University of Western Sydney, Australia; and a member of the Paris-based International Institute of Space Law). “Up, Up and … Back: The Emergence of Space Tourism and Its Impact on the International Law of Outer Space.” Chicago Journal of International Law: Vol. 6: No. 1, Article 4. 2005. JDN. <https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=1269&context=cjil>

V. THE NEED FOR CELESTIAL PROPERTY RIGHTS? ¶ The fundamental principle of "non-appropriation" upon which the international law of outer space is based stems from the desire of the international community to ensure that outer space remains an area beyond the jurisdiction of any state(s). Similar ideals emerge from UNCLOS (in relation to the High Seas) as well as the Antarctic Treaty, 42 although in the case of the latter treaty, it was finalised after a number of claims of sovereignty had already been made by various States and therefore was structured to "postpone" rather than prejudice or renounce those previously asserted claims.43 In the case of outer space, its exploitation and use is expressed in Article I of the Outer Space Treaty to be "the province of all mankind," a term whose meaning is not entirely clear but has been interpreted by most commentators as evincing the desire to ensure that any State is free to engage in space activities without reference to any sovereign claims of other States. This freedom is reinforced by other parts of the same Article and is repeated in the Moon Agreement (which also applies to "other celestial bodies within the solar system, other than the earth")." Even though both the scope for space activities and the number of private participants have expanded significantly since these treaties were finalised, it has still been suggested that the nonappropriation principle constitutes "an absolute barrier in the realization of every kind of space activity., 4 ' The amount of capital expenditure required to research, scope, trial, and implement a new space activity is significant. To bring this activity to the point where it can represent a viable "stand alone" commercial venture takes many years and almost limitless funding. From the perspective of a private enterprise contemplating such an activity, it would quite obviously be an important element in its decision to devote resources to this activity that it is able to secure the highest degree of legal rights in order to protect its investment. Security of patent and other intellectual property rights, for example, are vital prerequisites for private enterprise research activity on the ISS, and these rights are specifically addressed by the ISS Agreement between the partners to the project and were applicable to the experiments undertaken by Mark Shuttleworth when he was onboard the ISS.46

#### Space Settlement is coming now and prevents inevitable extinction. Settlement requires private industry and rule of law.

Gesl 18 [Paul M. Gesl (Maj, USAF JD), “PREPARING FOR THE NEXT SPACE RACE: Legislation and Policy Recommendations for Space Colonies,” A Research Report Submitted to the Faculty In Partial Fulfillment of the Graduation Requirements for the Degree of MASTER OF OPERATIONAL ARTS AND SCIENCES (April 2018). <https://apps.dtic.mil/sti/pdfs/AD1053024.pdf>] CT

Why the United States Needs to Think About Space Colonization Now

The United States’ space policies under the previous two Presidential administrations have not matched the ambition of the commercial sector. The author has criticized the National Space Policies of both President Obama and George W. Bush as being too “Earth-Centric.”6 Based on the current state of technologies, it is easy to dismiss space colonization as, at best, a problem to worry about tomorrow and, at worst, mere science fiction. This is irresponsible. Reaching space is difficult. Colonizing it will be even more difficult; however, we cannot overlook it as a likely possibility. NASA viewed space colonization as an endeavor within humanity’s reach in the 1970s.7 Now it is beginning to take shape as a reality. In 2015 at the Pioneering Space National Summit, policy makers, industry leaders and advocates agreed that “The long term goal of the human spaceflight and exploration program of the United States is to expand permanent human presence beyond low-Earth orbit in a way that will enable human settlement and a thriving space economy. This will be best achieved through public-private partnerships and international collaboration (emphasis in original).”8 Additionally, there have been several attempts in Congress to pursue space settlement.9 Private industry appears to be taking the lead in this race. Elon Musk, the CEO of SpaceX intends to establish a colony of a million settlers on the surface of Mars.10 SpaceX is targeting the first manned missions to make this a reality to launch in 2024.11 Mr. Musk envisions the full colonization to take 40-100 years.12 Even if this timeline misses its ambitious deadline by a decade, humanity will be a multi-planetary species in many readers’ lifetimes. It is important to note that Mr. Musk recently stated that SpaceX is “building the first Mars, or interplanetary ship, and I think we’ll be able to do short trips, flights by first half of next year.”13 Even though he joked that the company might miss their timeline, his comments highlight that colonization is an issue that is fast approaching.14 Another factor to consider is that a legal framework needs to be developed before a Martian colony is at its full capacity. Mr. Musk envisions using SpaceX’s BFR to send approximately 100 people per flight to Mars.15 Additionally, SpaceX appears to be planning for humans living on the lunar surface in their Moon Base Alpha.16 SpaceX is not alone in their ambitions. United Launch Alliance (ULA) published their plans to expand the population of humans living and working in space. Their Cis-lunar 1,000 framework is a 30-year plan to develop the cis-lunar economy and grow the population of humans living and working in space from six to 1,000.17 Space colonization is more important to our species than the economic benefits of a space economy and the conquests of exploration. The current world population is 7.4 billion people.18 According to the World Wildlife Foundation and the Global Footprint Network, “the equivalent of 1.7 planets would be needed to produce enough natural resources to match our consumption rates and a growing population.”19 The problem will likely grow worse as the population of the planet continues to grow. According to the United Nations, the Earth’s population will grow to over 11 billion people by 2100.20 Based partially on this, “Prof [Stephen] Hawking said it was only a matter of time before the Earth as we know it is destroyed by an asteroid strike, soaring temperatures or over-population.”21 Hawking further stated that, “When we have reached similar crisis in or (sic.) history there has usually been somewhere else to colonise (sic.). Columbus did it in 1492 when he discovered the new world. But now there is no new world. No Eutopia (sic.) around the corner. We are running out of space and the only places to go are other worlds.”22 The late Professor Hawking is not alone in his view, the National Space Society observed the benefits of expanding into space. “Outer space holds virtually limitless amounts of energy and raw materials, which can be harvested for use both on Earth and in space. Quality of life can be improved directly by utilization of these resources and also indirectly moving hazardous and polluting industries and/or their waste products off planet Earth.”23 These are just several of the many compelling reasons to colonize space advocated by groups such as the National Space Society and the Space Frontier Foundation.24 ULA appears to be taking steps to meet their ambitions for the future. ULA announced the first step towards making their Cis-lunar 1,000 vision a reality. In October 2017, they announced a partnership with Bigelow Aerospace to launch a habitat to low lunar orbit.25 The launch is expected to be completed before the end 2022.26 Some feel that colonization is going to happen, no matter what governments do.27 If colonization is going to happen, then it is in the United States’ best interest to develop a legal framework that supports the efforts and protects our citizens who will travel to and live in these habitats. This is important for several reasons. First, private corporations appear to have an interest in colonizing space, so it is in humanity’s future whether the government is involved nor not. However, governments can take actions that will accelerate things.28 Second, it is in the best interest of the United States’ economy to support commercial companies that are expanding into space. Third, if the United States does not create a favorable legal framework for space colonization, someone else will. Finally, as humanity expands away from the surface of the Earth, it is important to create a free society based on the principles of the Rule of Law rather than some other form of government, or an anarchistic company town.

#### **An extinction event is inevitable, unpredictable, and the risk is growing. Space settlement is the only solution and it requires a thriving private space industry including orbital installations, mining, and tourism.**

Hertzler and Rench 16 [Kevin Hertzler and Rebecca McCauley Rench (PhD), “GLOBAL EXTINCTION or a Space-Industrial Complex,” Potomac Institute for Policy Studies (2016). <https://www.potomacinstitute.org/steps/images/PDF/Articles/HertzlerSTEPS_2016Issue3.pdf>] CT

Yet, the bigger existential threat of annihilation of all humanity, by nuclear holocaust or natural forces, is currently considered too remote to be taken seriously. The geological record has preserved the rise and decline of many species throughout earth’s history, whether their extinctions were the result of asteroid impacts, volcanic activity, solar flares, or gamma ray bursts from distant star systems. To think humanity above the historical trends of the universe is conceited and illogical. Perhaps it is time to reconsider the annihilation threat and to entertain the need for an off-Earth sustainable colony.

Humanity might not get a second chance at survival. The idea of an extinction event has long been fuel for science fiction writers, and is exemplified in the novel by Neal Stephenson entitled Seveneves. 3 In Seveneves, humanity will be wiped out on Earth within two years unless nations collaborate to put a small group of astronauts and scientists on the International Space Station in hopes they survive and repopulate the planet. Science fiction has been known to become science fact, both in ways that are beneficial to society, and in ways that have negative consequences. A study of threats and a dystopian future is also inculcated into academia, with Niklas Bostrom, the founder of the “Future of Humanity Institute,” as a recognized leader. While the risk in any given year might be quite small, there is almost certainly an eventual global extinction event. With a growing population and the speed of destructive technological advancements, the annual risk of humanity’s downfall may be increasing. When the inevitable is presented as a certain future, or happens before we can react, what will be humanity’s last collective thought? Given our current technological prowess, perhaps the time to take action is now. During a Wall Street Journal All Things Digital conference,4 Elon Musk said:

Either we spread Earth to other planets, or we risk going extinct. An extinction event is inevitable and we’re increasingly doing ourselves in.

World renown physicist Steven Hawking agrees and recently told a gathering at the Big Think:5

I believe that the long-term future of the human race must be in space. It will be difficult enough to avoid disaster on planet Earth in the next hundred years, let alone the next thousand, or million. The human race shouldn’t have all its eggs in one basket, or on one planet. Let’s hope we can avoid dropping the basket until we have spread the load.

The timing and the nature of this event remains truly unknown. Predictions suggest an existential event may come from space or be the product of our own hand, but we will likely remain ignorant of the cause until its near arrival. What we do know is that if humanity is still inhabiting only one planet, our unique life stories will be tragically and permanently erased. Thus, we confront the realization of the likelihood of a global extinction event that we have absolutely no control over, that we currently have no defense for, and no plans to escape from. We are deluded into believing that since an extinction event is rare, it can not occur in our lifetime. Consider the attitude expressed in the Jet Propulsion Laboratory’s Near Earth Object program’s website6 which states:

On an average of every several hundred thousand years or so, asteroids larger than a kilometer could cause global disasters … No one should be overly concerned about an Earth impact of an asteroid or comet. The threat to any one person from auto accidents, disease, other natural disasters and a variety of other problems is much higher than the threat from [Near Earth Objects] NEOs. Over long periods of time, however, the chances of the Earth being impacted are not negligible so that some form of NEO insurance is warranted. At the moment, our best insurance rests with the NEO scientists and their efforts to first find these objects and then track their motions into the future. We need to first find them, then keep an eye on them.

However, what will our response be if we find an NEO larger than a kilometer that is on a collision course with Earth? A database is not an insurance policy and leaves open the issue of an appropriate response. Currently, our only real hope lies with mitigation strategies predicated on intercepting7 or redirecting8 NEO objects. The former suggests using a robotic spacecraft that is weighted or carries a nuclear explosive and the latter will redirect the NEO object with a robotic spacecraft. However, as NASA states in their “Asteroid and Comet Watch” website9 a response requires decades of warning time if the NEO object is larger that a few hundred meters.

We needed Sputnik to motivate our resolve for the domination of space. The mental contrast of one day dreaming about space travel through science fiction, and then seeing it live on television in the living room, stimulated our imaginations. President Kennedy’s speech inspired a nation and the decade-long pursuit that saw a surge in academic scholarship and technological advances. There are many technologies and spinoffs10 woven into the fabric of the world culture that owe their birth to that speech and subsequent technology development.

Can we expect the development of a humanity insurance policy before a crisis begins? It might require funding of NASA at levels similar to the 1960s, when we successfully landed men on the moon. It might require the development of a space-industrial complex that could help drive future economic growth. It might require that we spread out to other planets and achieve Earth independence to stave off global human extinction, even on our watch. It does require that we take the threat, and its inevitability, seriously and devote resources to preventing our extinction.

The ancient seafarers were motivated to take risks for the sake of curiosity and the desire for exploration and resources.11 The drive to leave the planet and set up colonies is similar: There is the allure, the curiosity, the adventure, and the insurance. It could, and should, be an international effort justified based on the purpose of planning for the preservation of humanity.

Certain plans are underway. Mars One is a nonprofit organization that promotes its plans for a Mars settlement within fifteen years.12 Elon Musk’s company SpaceX is reportedly developing plans to send large numbers of people to Mars.13 And NASA recently released a comprehensive strategy14 that leverages nearterm space activities with a comprehensive capability development culminating in an independent human presence on Mars. The NASA plan, at a minimum, would provide a future with a sustainable presence for humanity in deep space and provide an answer to many global extinction scenarios. Some of these plans are more logistically feasible than others, but all demonstrate the ambition of a select sect of humanity interested in pursuing off-Earth colonization. This strategy is well reasoned and has the potential to save humanity as well as provide a much needed economic boost by creating a space-industrial complex with the nascent private-public partnerships15 for mining asteroids, manufacturing propellant on the moon, creating fuel depots, and launching humans into space. The spinoff technologies would fuel real job growth as evidenced by the Apollo program of the 1960s. Rather than a short lived event to win a space race, this modern space age will be designed as a sustained effort in human space colonization. The current roadblocks preventing this strategy from moving forward are budgets, political priorities, and the changeable public interests; the exact same denouement of the moon landings over 40 years ago. An article posted on the Washington Post website by Joel Achenbach made the following observation:16

At the moment NASA can’t even get an astronaut to the International Space Station without buying a seat on a Russian rocket. A new NASA space capsule that was conceived in 2005 likely won’t be ready until 2023, according to NASA’s latest estimate, and it’s built for 21-day missions, not for trips to Mars.

The same article quotes Doug Cooke, a former NASA associate administrator as saying:

There needs to be more of a plan for actually getting there [Mars]. You can’t have a flatline budget indefinitely and think you’re going to put all of this together by 2030.

We must support the mission of human space exploration and colonization with both our interests as well as our national budget priorities if we want any hope of surviving the inevitable existential global extinction event.

#### Space settlement outweighs every impact. Even slight delays result in an unfathomable loss of life.

Bostrom 03 [Nick Bostrom, “Astronomical Waste: The Opportunity Cost of Delayed Technological Development,” Utilitas Vol. 15, No. 3 (2003): pp. 308-314. https://nickbostrom.com/astronomical/waste.html#\_edn8,] CT

II. THE OPPORTUNITY COST OF DELAYED COLONIZATION

From a utilitarian perspective, this huge loss of potential human lives constitutes a correspondingly huge loss of potential value. I am assuming here that the human lives that could have been created would have been worthwhile ones. Since it is commonly supposed that even current human lives are typically worthwhile, this is a weak assumption. Any civilization advanced enough to colonize the local supercluster would likely also have the ability to establish at least the minimally favorable conditions required for future lives to be worth living. The effect on total value, then, seems greater for actions that accelerate technological development than for practically any other possible action. Advancing technology (or its enabling factors, such as economic productivity) even by such a tiny amount that it leads to colonization of the local supercluster just one second earlier than would otherwise have happened amounts to bringing about more than 10^29 human lives (or 10^14 human lives if we use the most conservative lower bound) that would not otherwise have existed. Few other philanthropic causes could hope to match that level of utilitarian payoff. Utilitarians are not the only ones who should strongly oppose astronomical waste. There are many views about what has value that would concur with the assessment that the current rate of wastage constitutes an enormous loss of potential value. For example, we can take a thicker conception of human welfare than commonly supposed by utilitarians (whether of a hedonistic, experientialist, or desire-satisfactionist bent), such as a conception that locates value also in human flourishing, meaningful relationships, noble character, individual expression, aesthetic appreciation, and so forth. So long as the evaluation function is aggregative (does not count one person’s welfare for less just because there are many other persons in existence who also enjoy happy lives) and is not relativized to a particular point in time (no time-discounting), the conclusion will hold. These conditions can be relaxed further. Even if the welfare function is not perfectly aggregative (perhaps because one component of the good is diversity, the marginal rate of production of which might decline with increasing population size), it can still yield a similar bottom line provided only that at least some significant component of the good is sufficiently aggregative. Similarly, some degree of time-discounting future goods could be accommodated without changing the conclusion.[7]

III. THE CHIEF GOAL FOR UTILITARIANS SHOULD BE TO REDUCE EXISTENTIAL RISK

In light of the above discussion, it may seem as if a utilitarian ought to focus her efforts on accelerating technological development. The payoff from even a very slight success in this endeavor is so enormous that it dwarfs that of almost any other activity. We appear to have a utilitarian argument for the greatest possible urgency of technological development. However, the true lesson is a different one. If what we are concerned with is (something like) maximizing the expected number of worthwhile lives that we will create, then in addition to the opportunity cost of delayed colonization, we have to take into account the risk of failure to colonize at all. We might fall victim to an existential risk, one where an adverse outcome would either annihilate Earth-originating intelligent life or permanently and drastically curtail its potential.[8] Because the lifespan of galaxies is measured in billions of years, whereas the time-scale of any delays that we could realistically affect would rather be measured in years or decades, the consideration of risk trumps the consideration of opportunity cost. For example, a single percentage point of reduction of existential risks would be worth (from a utilitarian expected utility point-of-view) a delay of over 10 million years. Therefore, if our actions have even the slightest effect on the probability of eventual colonization, this will outweigh their effect on when colonization takes place. For standard utilitarians, priority number one, two, three and four should consequently be to reduce existential risk. The utilitarian imperative “Maximize expected aggregate utility!” can be simplified to the maxim “Minimize existential risk!”.

# CASE

### General

#### The moon treaty is ineffective and ambiguous. Filling Space 20

Filling Space [a social enterprise that democratizes engagement with space that speaks to individuals engaging in space] (No Author named), 20 - ("What is the Moon Treaty and is it still useful?," Filling Space, 1/17/2020, accessed 12-27-2021, https://filling-space.com/2020/01/17/what-is-the-moon-treaty-and-is-it-still-useful/)//ML

Should it be implemented or discarded?¶ Unfortunately, I believe that while we can take many lessons and concepts from the Moon Agreement, ultimately it must be discarded and used as a foundation upon which to build new understandings about the governance and regulation of activities in space.¶ Some would say the biggest challenge for the implementation of the Moon Agreement are four little words found in Article 11(1). While the Outer Space Treaty characterizes space as the “province of all mankind”, the Moon Agreement seems to go one step farther. It labels space the “common heritage of [hu]mankind”.¶ The meaning of the progression from “province” to “common heritage” has been the subject of countless debates, legal expositions, and commentaries. The fact of the matter, though, is that neither construct offers a legal rule. “Common heritage” in particular is an imprecise concept that the Moon Agreement fails to enumerate. Compounding this ambiguity is a confluence of history. The Moon Agreement was prepared in the shadow of the Convention of the Law of the Sea. The Convention politicized the notion of common heritage and assured its evolution into an unwieldly, ungainly, overbroad, and divisive term.¶ Consider that it is generally agreed that there are five elements to consider when declaring an area the common heritage of humankind:¶ 1. The area is not subject to appropriation.¶ 2. All countries share in the management of the area.¶ 3. The benefits derived from exploitation of resources in the area must be shared with all, regardless of participation.¶ 4. The area must be used for peaceful purposes.¶ 5. The area must be reserved for future generations.¶ The Outer Space Treaty already covers the first and fourth points – outer space is not subject to national appropriation and must be used for peaceful purposes. I hardly think any nation would disagree with the need to use an area sustainably so as to reserve it for future generations. Thus, it’s points two and three that generate the biggest concern.¶ At first glance, it appears that to implement the concept of common heritage of humankind, an international body must be created to redistribute wealth and technology among nations.¶ Indeed, in response to implementing provisions in the Convention on the Law of the Sea, President Ronald Reagan criticized the concept of international management, stating that “no national interest of ours could justify handing sovereign control over two thirds of the Earth’s surface over to the Third World”. As to the sharing of benefits? Reagan was definitely set against what he called a “free ride” at the expense of the US.¶ Reagan cast the Law of the Sea Treaty as being intentionally designed to promote a new world order – a form of global collectivism – that seeks ultimately the redistribution of the world’s wealth through a complex system of manipulative central economic planning and bureaucratic coercion. Reagan blamed this on what he called the distorted interpretation of the noble concept of the Earth’s vast oceans as the common heritage of humankind. ¶ Pretty scathing. Note, though, that Reagan did not suggest that the oceans are NOT the common heritage of humankind. He instead said the Law of the Sea Treaty had distorted the interpretation of that concept. ¶ The Moon Agreement was collateral damage in this distortion.¶ Indeed, the Moon Agreement allows for private ownership of natural resources that have been extracted. It requires the establishment of a governing regime to manage the extraction of space resources. That regime may or may not impose prohibitive fines after a company has already undertaken to mine. The Moon Agreement certainly appears to set the stage for implementing some sort of sharing, though how sharing would happen remains indeterminate.¶ In short, the treaty won’t implement necessary laws until mining is feasible – yet the very structure of the treaty and the uncertainty surrounding it discourages the research and investment necessary to make mining feasible.¶ It should be noted that it is in the best interests of all parties – whether a developing or a developed nation – to implement a fair and supportive system. Because indeed, the whole world WILL benefit from space resource utilization whether directly or indirectly. Making the cost of sharing prohibitive helps no one.¶ We also clearly need some sort of regime in place. Space exploration and utilization activities need assurances of safety and stability. Such activities need a certain level of legal security. And people carrying out those activities need to know the cost of that security – the complete level of their financial investment, including any licenses and fees.¶ The Moon Agreement was ahead of its time. What Ronald Reagan called the noble concept of common human heritage of humankind was in its infancy. Even then it was understood that this concept would not benefit from a “one-size-fits-all” approach. It was hoped that parties would evolve with the times and develop a bespoke regime for space – or at least parts of it.¶ But the Moon Agreement was doomed by its own uncertainties and the growing pains of a hortatory message that is not really new or groundbreaking – we are all in this together.¶ I am not convinced that the Moon Agreement can be saved from the weight of this baggage. I am convinced, though, that we can turn the Moon Agreement’s “failure” into success.¶

### A1

#### Asteroid mining can happen with private sector innovation and is key to solve a laundry list of impacts--climate change, economic decline and asteroid collisions. Taylor 19

Chris Taylor [journalist], 19 - ("How asteroid mining will save the Earth — and mint trillionaires," Mashable, 2019, accessed 12-13-2021, https://mashable.com/feature/asteroid-mining-space-economy)//ML

How much, exactly? We’re only just beginning to guess. [Asterank](http://www.asterank.com/" \t "_blank), a service that keeps track of some 6,000 asteroids in NASA’s database, prices out the estimated mineral content in each one in the current world market. More than 500 are listed as “>$100 trillion.” The estimated profit on just the top 10 asteroids judged “most cost effective” — that is, the easiest to reach and to mine, subtracting rocket fuel and other operating costs, is around $1.5 trillion.¶ Is it ours for the taking? Well, here’s the thing — we’re taking it already, and have been doing so since we started mining metals thousands of years ago. Asteroid strikes are the only reason rare metals exist in the Earth’s crust; the native ones were all sucked into our planet’s merciless iron core millions of years ago. Why not go to the source?¶ As a side project, space mining can grab water from the rocks and comets — water which, with a little processing makes rocket fuel. Which in turn makes even more currently unimaginable space operations possible, including ones that could give the planet all the energy it needs to avert climate catastrophe. Cislunar space — the bit around us and the moon, the local neighborhood, basically — is about to get very interesting.¶ It’s hard, even for the most asteroid-minded visionaries, to truly believe the full scope of this future space economy right now. Just as hard as it would have been in 1945, when an engineer named Vannevar Bush first proposed [a vast library of shared knowledge that people the world over would access via personal computers](https://en.wikipedia.org/wiki/Memex), to see that mushroom into a global network of streaming movies and grandmas posting photos and trolls and spies who move the needle on presidential elections. ¶ No technology’s pioneer can predict its second-order effects.¶ The space vision thing is particularly difficult in 2019. Not only do we have plenty of urgent problems with democracy and justice to keep us occupied, but the only two companies on the planet to have gone public with asteroid-mining business plans, startups that seemed to be going strong and had launched satellites already, were just bought by larger companies that are, shall we say, less comfortable executing on long-term visions.¶ Planetary Resources was founded in 2012 in a blaze of publicity. Its funding came from, among others, Larry Page, Eric Schmidt, Ross Perot, and the country of Luxembourg. It had inked an orbital launch deal with Virgin Galactic. And it was sold last October to a blockchain software company. (To 21st century readers, this paragraph would look like I’m playing tech world mad libs.)¶ In January, the other company, Deep Space Industries, also partly funded by Luxembourg (way to get in the space race, Luxembourg!), was sold to Bradford Space, owned by a U.S. investment group called the American Industrial Acquisition Corporation. Maybe these new overlords plan on continuing their acquisitions' asteroid mining endeavors rather than stripping the companies for parts. Both companies have been notably silent on the subject. “The asteroid mining bubble has burst,” [declared The Space Review](http://www.thespacereview.com/article/3633/1), one of the few online publications to even pay attention.¶ That’s also to be expected. After all, anyone trying to build Google in 1945 would go bankrupt. Just as the internet needed a half-dozen major leaps forward in computing before it could even exist, space industry needs its launch infrastructure.¶ Currently, the world’s richest person and its most well-known entrepreneur, Jeff Bezos and Elon Musk, respectively, are working on the relatively cheap reusable rockets asteroid pioneers will need. (As I was writing this, Bezos announced in an email blast that one of his New Shepherd rockets had flown to space and back five times like it was nothing, delivering 38 payloads for various customers while remaining entirely intact.) ¶ Meanwhile, quietly, Earth’s scientists are laying the groundwork of research the space economy needs. Japan’s Hayabusa 2 spacecraft has been in orbit around asteroid Ryugu for the last year and a half, learning everything it can. (Ryugu, worth $30 billion according to Asterank, is the website's #1 most cost-effective target.) The craft dropped [tiny hopping robot rovers](https://www.space.com/41941-hayabusa2-asteroid-rovers-hopping-tech.html) and a [small bomb](https://www.space.com/japan-hayabusa2-asteroid-bomb-video.html) on its target; pictures of the small crater that resulted were released afterwards.¶ Officially, the mission is to help us figure out how the solar system formed. Unofficially, it will help us understand whether all those useful metals clump together at the heart of an asteroid, as some theorize. If so, it’s game on for asteroid prospectors. If not, we can still get at the metals with other techniques, such as optical mining (which basically involves sticking an asteroid in a bag and drilling with sunlight; sounds nuts to us, but [NASA has proved it in the lab](https://www.nasa.gov/directorates/spacetech/niac/2017_Phase_I_Phase_II/Sustainable_Human_Exploration/)). It’ll just take more time.¶ Effectively, we’ve just made our first mark at the base of the first space mineshaft. And there’s more to come in 2020 when Hayabusa 2 returns to Earth bearing samples. If its buckets of sand contain a modicum of gold dust, tiny chunks of platinum or pebbles of compressed carbon — aka diamonds — then the Duchy of Luxembourg won’t be the only deep-pocketed investor to sit up and take notice.¶ The possibility of private missions to asteroids, with or without a human crew, is almost here. The next step in the process that takes us from here to where you are? Tell us an inspiring story about it, one that makes people believe, and start to imagine themselves mining in space. How would you explain the world-changing nature of the internet to 1945? How would you persuade them that there was gold to be mined in Vannevar Bush’s idea? You’d let the new economy and its benefits play out in the form of a novel.¶ As Hayabusa dropped a bomb on Ryugu, Daniel Suarez was making the exact same asteroid the target of his fiction. Suarez is a tech consultant and developer turned New York Times bestselling author. His novels thus far have been techno-thrillers: his debut, [Daemon](https://www.amazon.com/dp/B003QP4NPE/ref=dp-kindle-redirect?_encoding=UTF8&btkr=1), a novel of Silicon Valley’s worst nightmare, AI run rampant, made more than a million dollars.¶ So it was a telling shift in cultural mood that Suarez’s latest thriller is also a very in-depth description of — and thinly-disguised advocacy for — asteroid mining. In [Delta-v](https://www.amazon.com/Delta-v-Daniel-Suarez-ebook/dp/B07FLX8V84/ref=sr_1_1?crid=UMNUUSR3NCBX&keywords=delta-v&qid=1556930756&s=digital-text&sprefix=delta-v%2Cdigital-text%2C204&sr=1-1), published in April, a billionaire in the 2030s named Nathan Joyce recruits a team of adventurers who know nothing about space — a world-renowned cave-diver, a world-renowned mountaineer — for the first crewed asteroid mission.¶ Elon Musk fans might expect this to be Joyce’s tale, but he soon fades into the background. The asteroid-nauts are the true heroes of Delta-v. Not only are they offered a massive payday — $6 million each for four years’ work — they also have agency in key decisions in the distant enterprise. Suarez deliberately based them on present-day heroes. 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](https://www.washingtonpost.com/opinions/the-247-trillion-global-debt-bomb/2018/07/15/64c5bbaa-86c2-11e8-8f6c-46cb43e3f306_story.html?noredirect=on&utm_term=.5fb3ff1155d9). 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](https://en.wikipedia.org/wiki/Space-based_solar_power). 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](https://www.forbes.com/sites/scottsnowden/2019/03/12/solar-power-stations-in-space-could-supply-the-world-with-limitless-energy/#2d3f78a54386) 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. ¶ Robot craft can move 10-meter boulders like they’re nothing. You bring it all back to sell to companies that will refine and synthesize it in orbit for a myriad of purposes. Big pharma, to take one controversial industry, would [benefit by taking its manufacturing off-world](https://medium.com/fitch-blog/why-is-big-pharma-interested-in-the-space-economy-c078ac1bf67c). The molecular structure of many chemicals grows better in microgravity.¶ The expectation is that a lot of these space businesses — and all the orbital infrastructure designed to support them — will be automated, controlled remotely via telepresence, and monitored by AI. But Suarez is adamant that thousands if not millions of actual human workers will thrive in the space economy, even as robots take their jobs in old industries back on Earth.¶ “Our initial expansion into space will most likely be unsettled and experimental. Human beings excel in such environments,” he says. “Humans can improvise and figure things out as we go. Robots must be purpose-built, and it's going to take time and experience for us to design and build them.”¶ Which is another way startups back on Earth will get rich in the new economy: designing and building those robots, the nearest thing to selling picks and shovels to prospectors in the space gold rush. Thousands of humans in space at any one time will also require the design and construction of stations that spin to create artificial gravity. Again, this isn’t a great stretch: Using centrifugal force to simulate gravity in space was first proposed by scientists in the 19th century. NASA has had workable designs for spinning cislunar habitats called [O’Neill cylinders](https://en.wikipedia.org/wiki/O%27Neill_cylinder) since the 1970s. We just haven’t funded them. ¶ But the trillionaires clearly will.¶ In short, Suarez has carefully laid out a vision of the orbital economy that offers something for everyone in our divided society. For Green New Deal Millennials, there’s the prospect of removing our reliance on fossil fuels at a stroke and literally lifting dirty industries off the face of the planet. For libertarians and other rugged individualists, there’s a whole new frontier to be developed, largely beyond the reach of government. ¶ For those who worry about asteroids that could wipe out civilization — though luckily, [this isn't likely to happen any time soon](https://mashable.com/article/armageddon-asteroid-threat) — here is a way for humanity to get proficient in moving them out of the way, fast. Indeed, the National Space Society has offered [a proposal](https://space.nss.org/technologies-for-asteroid-capture-into-earth-orbit/) to capture the asteroid Aphosis (which is set to miss Earth in the year 2029, but [not by a very comfortable margin](https://www.space.com/asteroid-apophis-2029-flyby-planetary-defense.html)), keep it in orbit, and turn it into 150 small solar-power satellites, as a proof of concept. ¶ For the woke folks who care about the bloody history of diamond production, there’s the likelihood that space mining would wipe out Earth’s entire diamond industry. “They will be found in quantities unattainable on Earth,” claims Suarez, with good reason. We are starting to discover that there is more crystalized carbon in the cosmos than we ever suspected. Astronomers have identified one [distant planet made entirely of diamond](https://www.nationalgeographic.com/science/phenomena/2014/06/24/diamond-the-size-of-earth/); there may be more, but they are, ironically, hard to see. ¶ We don’t have diamond planets in our solar system (and we can’t do interstellar missions), but we do have diamond-studded asteroids. Mine them for long enough and you will wear diamonds on the soles of your shoes.¶ For investors and entrepreneurs, there is the thrill of racing to be the first member of the four-comma club. ([Neil deGrasse Tyson believes that the first trillionaire will be an asteroid mining mogul](https://www.nbcnews.com/science/space/neil-degrasse-tyson-says-space-ventures-will-spawn-first-trillionaire-n352271); Suarez isn’t sure whether they’ll be the first, but he suspects that asteroid mining “will mint more trillionaires than any industry in history.”) ¶ For the regular guy or gal with a 401K, there’ll be a fast-rising stock market — inflated not by financial shenanigans this time, but an actual increase in what the world counts as wealth.¶ For workers, there is the promise of sharing in the untold riches, both legally and otherwise. It would be hard to stop miners attaining mineral wealth beyond their paycheck, under the table, when your bosses are millions of miles away. Then there’s the likelihood of rapid advancement in this new economy, where the miners fast gain the knowledge necessary to become moguls.¶ “After several tours in space working for others, perhaps on six-month or year-long contracts, it's likely that some workers will partner to set up their own businesses there,” says Suarez. “Either serving the needs of increasing numbers of workers and businesses in space, marketing services to Earth, or launching asteroid mining startups themselves.” All in all, it’s starting to sound a damn sight more beneficial to the human race than the internet economy is. Not a moment too soon. I’ve written encouragingly about asteroid mining several times before, each time touting the massive potential wealth that seems likely to be made. And each time there’s been a sense of disquiet among my readers, a sense that we’re taking our rapacious capitalist ways and exploiting space.¶ Whereas the truth is, this is exactly the version of capitalism humanity has needed all along: the kind where there is no ecosystem to destroy, no marginalized group to make miserable. A safe, dead space where capitalism’s most enthusiastic pioneers can go nuts to their hearts’ content, so long as they clean up their space junk. ¶ ([Space junk](https://mashable.com/category/space-junk) is a real problem in orbital space because it has thousands of vulnerable satellites clustered closely together around our little blue rock. The vast emptiness of cislunar space, not so much.)¶ And because they’re up there making all the wealth on their commodities market, we down here on Earth can certainly afford to focus less on growing our stock market. Maybe even, whisper it low, we can afford a fully functioning social safety net, plus free healthcare and free education for everyone on the planet.¶ It’s also clearly the area where we should have focused space exploration all along. If we settle on Mars, we may disturb as-yet-undiscovered native bacteria — and as the character Nathan Joyce shouts at a group of “Mars-obsessed” entrepreneurs in Delta-V, Mars is basically filled with toxic sand and is thus looking increasingly impossible to colonize. (Sorry, Mark Watney from The Martian, those potatoes would probably kill you.)

#### An asteroid collision would ensure extinction – would fundamentally alter the biosphere, don’t underestimate its risk. Hudson 19

Wesley Hudson ’19, news reporter for Express, “Asteroid alert: NASA warning as kilometre long space rock set to skim Earth at 25,000mph”, 8/28/19, Express, https://www.express.co.uk/news/science/1170826/asteroid-news-NASA-latest-space-rock-asteroid-1998-HL1-earth-danger-apocalypse

AN ASTEROID almost a kilometre wide is currently barreling through space at more than 25,000mph and is due to skim the earth towards the end of October. NASA’s Jet Propulsion Laboratory (JPL) claim the space rock will shoot past the earth within a “close” proximity of the planet in the early hours of October 26. The asteroid, dubbed 1998 HL1, is a so-called Near-Earth Object (NEO) flying on a Close Approach Trajectory. NASA expects the 1998 HL1 to come flying by dangerously close around 1.21am BST (17.21pm PDT). The daunting moment will mark anther journey around the sun for the asteroid since it was discovered in 1998. The asteroid will be travelling at a staggering speed of over 25,000mph as it barrels past the Earth. The JPL predict the asteroid could be between 440m and 990m wide. At its largest an asteroid of this size is bigger than the tallest building in the world, the Burj Khalifa in Dubai. Even at it’s smallest, 1998 HL1 is still bigger than The Shard. Since it was discovered, 1998 HL1 has been seen up to 408 times. An NEO is an asteroid or comet which is on an orbital path intersecting that of the Earth's. This asteroid will miss the Earth by almost four million miles. If it were to strike the Earth, an asteroid of this size would cause catastrophic damage. The extinction of the dinosaurs in the Cretaceous-Tertiary event 65million years ago is famously believed to have been caused by a massive asteroid impact. The Chicxulub Crater in Mexico is the most commonly accepted point of impact, with the responsible body thought to be around 10km in diameter. A car-sized asteroid is estimated to hit the Earth roughly once a year. The majority of asteroids on track for the planet are usually burnt up as they enter the Earth's atmosphere. NASA administrator Jim Bridenstine has previously warned a potential asteroid collision is more likely then people realise. He said: "We have to make sure that people understand that this is not about Hollywood, it's not about the movies. "This is about ultimately protecting the only planet we know, right now, to host life - and that is the planet Earth.” NASA is currently in the process of developing the Double Asteroid Redirection Test (DART). DART will test if it is possible to redirect asteroids that are threatening to impact with Earth. SpaceX chief Elon Musk had previously tweeted fears of a deadly collision that Earth was not prepared for. Mr Musk tweeted: “A big rock will hit Earth eventually & we currently have no defence.”

### A2

#### Terrestrial mining is disastrous for Africa, destroying the environment and locking millions into horrible working conditions. Asteroid mining presents an opportunity to improve conditions while supercharging development. Their author.

Oni 19 [David Oni (space industry and technology analyst at Space in Africa. He’s a graduate of Mining Engineering from the Federal University of Technology Akure), “Why Africa Should Consider Asteroid Mining,” AfricaNews, August 26, 2019. <https://africanews.space/why-africa-should-consider-asteroid-mining/>] CT

Africa is home to large mining activities. The mining industry is an integral part of the African economy, contributing via intra-state trade and exports. Ongoing mining projects worth more than US$1 billion are taking place in South Africa (PGM 69%; gold: 31%), Guinea (bauxite and aluminum), Madagascar (nickel), Mozambique (coal), Democratic Republic of Congo and Zambia (cobalt and copper), Nigeria and Sudan (crude petroleum), Senegal (iron), among others. It is no news that mining activities have caused severe environmental consequences, and Africa has had its fair share too. While policies and regulations are being put in place by governments and various international bodies to prevent further environmental degradation and protect what is left of the earth’s habitat, the majority of the African continent has struggled to enforce these regulations, largely due to weak governmental structures. Sadly, the African political clime has been plagued with a complicated history of inconsistent legislation and weak law enforcement mechanisms. For most African countries, it is a conundrum. Many mining firms thrive, not only because of the promising prospects but also because of the loopholes in the regulations and policies of most African countries. To them, working under unpleasant conditions is a small price to pay, compared to upholding safety and environmental standards. Mining, by nature, is an exploitative, dangerous and environmentally damaging activity. Even with strict policies and regulations in place, mining activities will still release dangerous substances into the atmosphere and surroundings. It really is a catch-22 with combating environmental degradation, because eventually, it is only a matter of time before the consequent environmental hazards catch up with us. The good news is that significant progress is being made in the space industry. Our world has gone from baby steps on the moon to giant leaps in space technology. These milestones are now beyond bragging rights, but rather an exigent obligation to keep up with the global paradigm shift. What’s more, these advancements are extending to the African continent. A number of African states have several satellites already launched into space, and more African states already have space programmes running. Space science and technology is the new black! The industrialisation of space would be brought about primarily by increasing commercial activities in space, worth several billion dollars per year, largely involving the following activities: telecommunications, direct broadcast television, navigation (e.g. the Global Positioning System), remote sensing, and meteorological services. With SpaceX, Blue Origin and Virgin Galactic —the top three frontline space tourism companies— are engaged in a fierce rivalry as to who would be the supreme space tourism company, and a host of government as well as private companies showing sufficient interest and involvement in space tourism, it is safe to say that asteroid mining is imminent. There are millions of asteroids in the solar system – remnants of bodies colliding in space. Most of the asteroids are distributed between the orbits of Mars and Jupiter —the main asteroid belt— but not all of them. According to Advantage Environment, approximately 13,000 asteroids are categorized as near-Earth objects, well within reasonable reach, and at least 900 more are discovered every year. Asteroid mining is a concept that involves the extraction of useful materials from asteroids and near-earth objects, which are useful for propulsion, construction, life support, agriculture, metallurgy, and precious and strategic metals. Volatiles such as hydrogen and methane could be used to produce rocket fuel for transporting spacecraft between the Earth and near-earth objects. Rare-earth metals, such as thulium, scandium, and holmium could be used to manufacture materials as well as solar panels which could be used to power habitats in space. These solar-powered cells could also be used to provide electricity for its inhabitants with satellites specifically designed for this purpose. Iron, nickel and cobalt would serve as fundamental raw materials for building space factories. Precious metals such as platinum, platinum-group metals (PGMs), and gold are also useful. A handful of companies, emerging and existing, will require materials with a high level of purity in large quantities, all of which are readily available in asteroids. There are conjectures that the asteroid mining industry is a whooping trillion-dollar industry. With all of the vast possibilities that space technology brings our way, we might want to ask ourselves, is asteroid mining still rocket science? To establish a mine, a portion of vegetation is cleared. This causes deforestation (and eventually, erosion and flooding) as well as the loss of biodiversity, which adversely affect native inhabitants. Leakages and tailing dumpings have raised serious environmental concerns. Yet most African governments struggle to keep these occurrences in check. There have been several reported cases of cyanide leaks and lead poisoning. Rivers and dams are re-routed to create exposed riverbeds for mining, which has a detrimental effect on fish and wildlife that depend on rivers for survival. OK Tedi copper and gold mine in Papua, New Guinea has caused environmental harm that is far-reaching to the 50,000 residents spread across the 120 villages close to the mine, due to the discharges produced daily. Mining also has a remarkable adverse effect on the atmosphere. During mining, particles that are not visible to the ordinary eye are released into the air and transported by wind. Lead, arsenic, cadmium, and other toxic elements are often present in such particles. Respiratory diseases and allergies can be triggered by the inhalation of such airborne particles. Underground mining causes huge amounts of waste earth to be brought to the surface, waste that often becomes toxic when it comes into contact with air and water. It causes cave-ins and sinkholes which can cause severe damage to buildings and equipment, as well as the loss of life. Coal mining also leads to greenhouse gas emissions. Acid mine drainage occurs when water comes in contact with coal and other rocks during the mining process. This water, made toxic because of the influence of toxic minerals and other heavy metals, eventually leaks out of abandoned mines and contaminates groundwater, streams, rivers, soil, plants, animals and humans. As a result, an orange colour blankets the river, estuary or sea bed, killing plants and making surface water unfit for drinking. Common health threats posed by coal mining include pneumoconiosis (aka black lung disease), cardiopulmonary disease, chronic obstructive pulmonary disease, hypertension, lung disease, and kidney disease. In a report given by Infogalactic, a series of lead poisonings in Zamfara State, Nigeria, led to the deaths of at least 163 people between March and June 2010, including 111 children. Health ministry figures state the discovery of 355 cases, with 46 per cent proving fatal. According to NASA-compiled data, Kriel, a town in South Africa’s coal mining province in east Johannesburg, has the second-highest volume of sulphur dioxide (SO2) emissions in the world. Mining activities have taken a toll on our environment, which is why beyond maximizing of mineral resources for space infrastructure and fuelling of propellants, asteroid mining also provides a ready recourse to terrestrial mining activities, with a view to saving the planet. Thousands of people are forced to work in mines and are also forced to live under sub-human conditions. If attention is shifted from terrestrial mining, of course with robots working the mines in space, these people could not only live elongated lives but also find healthier employment alternatives. The advantages of asteroid mining are numerous: trip exchanges for cargo to reduce wasteful journeys of transport trucks, development of cheaper batteries to reduce energy and storage costs, beneficiation of plastic waste to sustainable and clean bio-fuel as well as the development and use of solar-powered airships Some studies indicate that an asteroid that runs 1,000 m (3,280 ft) across could yield about 100,000 tons of platinum, which already has miners in South Africa worried because they only mine a measly 130 tons of the metal on Earth each year. “Space miners will first target water-rich asteroids for their hydrogen potential, then mineral-rich asteroids for their nickel and iron-ore. Platinum is a small by-product of their yield and has no use in space. But that means it poses a risk to the platinum resources below the earth’s surface”, says Kieck. This is not the time for African countries to take the back seat, instead, they should take advantage of the momentum that is driving the space industry. Nations like South Africa, Zimbabwe and Nigeria have shown interests in asteroid mining, having recognised its vast potential. It will be noteworthy to see African countries on the frontiers with technology giants like Russia, China and the USA. In May 2017, Mechanical engineer and PhD graduate, Jonathan Lun’s idea for the innovation challenge was chosen as the winner at the GIC awards ceremony, in Johannesburg. His idea is to use an innovative rocket technology, known as a vacuum arc thruster, which consumes asteroid metal as fuel to achieve industrial-scale transport of mined asteroid material. Asteroid mining will serve as a stepping stone, bridging the gap between developed countries and developing countries in space technology to a significant level, Africa will be setting the foundation to be key players in the space industry, while at the same time contributing significantly to the battle against environmental degradation.

#### No internal link to their Africa War scenario – Oni says the mining sectors are underdeveloped and therefore rely on oil, even if they are rich in minerals

#### Since these cards were written, there have been multiple conflicts in Africa -- Sudan, Ethiopia, and most recently Burkina Faso – that have not led to great power war – there’s no warrant for why this war would be different

#### No large impact to Africa war – the wars are small and stay that way.

Straus 12—professor of politics at the University of Wisconsin (Scott, WARS DO END! CHANGING PATTERNS OF POLITICAL VIOLENCE IN SUB-SAHARAN AFRICA, afraf.oxfordjournals.org/content/early/2012/03/01/afraf.ads015.full)

The principal finding is that in the twenty-first century both the volume and the character of civil wars have changed in significant ways.5 Civil wars are and have been the dominant form of warfare in Africa, but they have declined steeply in recent years, so that today there are half as many as in the 1990s. This change tracks global patterns of decline in warfare.6 While some students of African armed conflicts, such as Paul Williams, note the recent trend,7 it is fair to say that the change in the prevalence of civil wars is not recognized by most Africanists and generalists. Equally important but even less noted is that the character of warfare in Africa has changed. Today's wars are typically fought on the peripheries of states, and insurgents tend to be militarily weak and factionalized. The large wars that pitted major fighting forces against each other, in which insurgents threatened to capture a capital or to have enough power to secede, and in which insurgents held significant territory – from the Biafra secessionists in Nigeria, to UNITA in Angola, RENAMO in Mozambique, the TPLF in Ethiopia, the EPLF in Eritrea, the SPLM in Sudan, the NRM in Uganda and the RPF in Rwanda – are few and far between in contemporary sub-Saharan Africa. Somalia's Al-Shabab holds territory and represents a significant threat to the Somali federal transitional government, but given the 20-year void at the centre of Somalia the case is not representative. In April 2011, rebel forces in Côte d'Ivoire captured Abidjan, but they did so with external help and after incumbent Laurent Gbagbo, facing a phalanx of domestic, regional, and international opposition, tried to steal an election.8 More characteristic of the late 2000s and the early 2010s are the low-level insurgencies in Casamance (Senegal), the Ogaden (Ethiopia), the Caprivi strip (Namibia), northern Uganda (the Lord's Resistance Army), Cabinda (Angola), Nigeria (Boko Haram), Chad and the Central African Republic (various armed groups in the east), Sudan (Darfur), and South Sudan, as well as the insurgent-bandits in eastern Congo (a variety of armed actors, including Rwandan insurgents) and northern Mali (al-Qaeda in the Maghreb). Although these armed groups are in some cases capable of sowing terror and disruption, they tend to be small in size, internally divided, poorly structured and trained, and without access to heavy weapons.9 Several of today's rebel groups have strong transnational characteristics, that is, insurgents move fluidly between states. Few are at present a significant military threat to the governments they face or in a position to seize and hold large swaths of territory.

#### Multiple dispute mechanisms resolve conflict.

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Lastly, the end of the Cold War has seen a strengthening of international and regional mechanisms of dispute resolution and conflict containment.46 In the African context, three mechanisms are salient. The first is United Nations peacekeeping. As Figure 7 shows, UN peacekeeping has grown remarkably in the size of missions in sub-Saharan Africa during the last twenty years and in the sophistication of mandates.47 In the past decade, almost every UN peacekeeping mission is deployed with a robust Chapter VII mandate, as opposed to more limited Chapter VI mandates, which were dominant in the 1990s and before. To be sure, one should not be naïve about the problems of peacekeeping.48 On the other hand, there has been learning in the organization, and empirically the missions are more frequent, more sophisticated, and larger than at any previous time. There are sound theoretical reasons to think UN peacekeeping may have an effect on conflict reduction.49 Second, African regional mechanisms are stronger. The African Union and regional organizations like ECOWAS have taken a greater interest in the prevention of armed conflict.50 In addition, in many cases African luminaries serve as ad hoc ambassadors of peace. In Kenya's 2007–8 crisis, for example, Kofi Annan was a key player; in Côte d'Ivoire's 2010–11 crisis, Raila Odinga and five African heads of state were quite active. South Africa plays an increasingly active role in settling African wars. Jerry Rawlings has emerged as an elder statesman. Critics question the decisions and effectiveness of these actors, but on balance their presence is greater than in previous periods of African international relations. Finally, international criminal justice mechanisms – from the ad hoc tribunals for Rwanda and Sierra Leone to the International Criminal Court – are stronger than ever before.51 Again, one may be circumspect about the strong deterrence claims of advocates, but on the other hand in some cases the implantation of these mechanisms correspond with a decline of warfare. On balance, it is reasonable to conclude that each of these mechanisms shapes the incentives – even marginally – of African decision makers in ways that limit the extent of warfare. They may not always work in every case, but they point to a stronger and strengthening international conflict reduction regime that has emerged since the end of the Cold War. The proposition clearly deserves greater empirical testing. But taken together with the diminished opportunities and incentives for civil war that followed the end of the Cold War, we have evidence to explain the recent change in frequency and character of warfare observed during the past decade.