## Plan

#### We affirm: The appropriation of outer space by private entities is unjust.

#### We’ll defend a leasing regime operationalized by the UN Committee on Peaceful Uses of Outer Space (COPUOS) establishing an International Outer Space Authority (IOSA). Forbid appropriation allows the streamlining and regulation of exploitation that provides the secure foundation for private space activities – the alternative is an ad-hoc CIL regime that decks legal certainty.

Pershing 19 [Abigail D. Pershing, J.D., Yale, “Interpreting the Outer Space Treaty’s Non-Appropriation Principle: Customary International Law from 1967 to Today,” 2019, *The Yale Journal of International Law*, Vol. 44, https://openyls.law.yale.edu/bitstream/handle/20.500.13051/6733/Pershing.pdf?sequence=2&isAllowed=y, EA]

B. A New Property Rights Proposal: Leasing Space

One promising proposal that does not appear to have received much attention in the literature is the concept of leasing space to nations, private individuals, or companies rather than allocating it as permanently-owned property. It appears that the only authors who have even tangentially considered the possibility of leasing property rights in space beyond rights to mineral extraction are Marcel Williams and G.S. Sachdeva. Williams’ writing is limited to a thought experiment in which he imagines renting out up to one percent of the moon’s surface. This property would be directly leased to national governments, which in turn would be vested with the power to sublease sections of this territory to private companies or individuals.134 This proposal is not elaborated any further and is left as a broad-strokes outline. The second mention of leasing or renting space comes from G.S. Sachdeva, who argues that a U.N. Space Superintendence Authority could grant leases to those able to pay.135 Yet this theory is limited to a discussion of renting property rights in particular orbits to allow for hovering geostationary space hotels and does not delve into questions of renting land on celestial bodies.

The concept of leasing outer space deserves greater consideration by space law scholars. This Section sketches a brief outline of how such a system might operate via an internationally-run space property rental system modeled on UNCLOS. Although UNCLOS itself is deeply problematic in its potentially devastating environmental consequences and negative impacts on indigenous peoples as it regulates deep-sea mining,136 the UNCLOS model may nonetheless be the best option for preserving non-space-faring nations’ rights with regard to outer space, given its success in providing developing nations with a voice in the regulation of the high seas and the seabed beyond national jurisdiction.137 It is worth noting that although very few scholars appear to have considered the possibility of renting space, several have examined the similarities between UNCLOS and space law.138 The approach advanced here differs from the conventional approach to this comparison in that it suggests that the international community move beyond merely authorizing nations or individuals to extract a certain quantity of minerals and instead consider the possibility of leasing out actual tracts of space land.

Opened for signature on December 10, 1982, UNCLOS establishes the international rules that govern the use of the world’s oceans and their resources. An examination of UNCLOS is especially apt because it deals with resources— the high seas—that, like space, are not subject to national appropriation. In language strikingly similar to Article II of the Outer Space Treaty, Article 137 of UNCLOS reads:

No State shall claim or exercise sovereignty or sovereign rights over any part of the Area [resources of the seabed and ocean floor beyond the limits of national jurisdiction] or its resources, nor shall any State or natural or juridical person appropriate any part thereof.139

Although there are clear similarities between the two treaties, there are substantial differences as well, many of which would be useful in informing an update to the Outer Space Treaty. In addition to extending the prohibition on sovereignty to individuals as well as to nations, UNCLOS goes far beyond the Outer Space Treaty in detailing the limits of the non-appropriation principle. All of Part XI of UNCLOS, totaling fifty-eight Articles, gives a detailed description of how States can negotiate within the bounds of the non-appropriation principle to exploit ocean resources. Of particular relevance for purposes of crafting a parallel space law proposal is UNCLOS Part XI, Section 4, which lays out the rules governing the International Seabed Authority—the main mechanism through which States and private companies can legally exploit ocean resources, including mining of the deep seabed.140

Using UNCLOS as a model, a similar system may prove promising for the evolution of space law. However, the new space system should allow for rental of space land instead of merely allowing for the extraction of space resources. As with UNCLOS, any such space leasing system should be run through the United Nations. Situating such a system in this forum would help the international community stay true to the intentions of the Outer Space Treaty, which provides, in the words of one author, a “philosophical roadmap for the future development of the outer space legal regime.”141 Although a new committee within the United Nations could be formed for this purpose, the existing Committee on the Peaceful Uses of Outer Space (UNCOPUOS) would be an ideal environment for the creation and operation of such a system. UNCOPUOS is composed of eighty-seven geographically and economically diverse member States (including all the major space-faring States). Additionally, intergovernmental organizations and non-governmental organizations have observer status.142 Given its central mission to maintain space as a peaceful arena of international cooperation, as well as its representative composition,143 it would be an ideal body to bring a space leasing system to fruition.

UNCOPUOS, in turn, should operationalize the leasing system by establishing a new International Outer Space Authority. This Outer Space Authority should parallel the International Seabed Authority described above.144 There should be similar provisions for the International Outer Space Authority relating to the makeup and functioning of the Authority (with each country getting one vote and decisions made by a two-thirds majority);145 the power of the Outer Space Authority to exercise control over space generally;146 the ability to decide how much rent to charge nations or individual corporations;147 and how to use these funds,148 among other provisions.

For this proposed Outer Space Authority to be useful as well as operational, it is critical that it have jurisdiction over property rights in space beyond mining rights. Having rights to property in addition to rights to extracted minerals would add an extra layer of legal security for companies considering venturing into space for mining purposes. And, although businesses currently seem most interested in the possibilities of mining space resources, in the long term, questions of space tourism and the potential development of space colonies may arise. Having a flexible system in place that can adequately handle these concerns is therefore desirable. Instead of just focusing on mining, an Outer Space Authority with broader jurisdiction will have longer staying power and will require less reworking in the near future.

Part of the appeal of this rental model is that it works so seamlessly with the current Outer Space Treaty. Turning again to the language of the Treaty and beginning with the non-appropriation principle, Article II lays out that “[o]uter 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.”149 Because no State or individual would ever own land in space under a leasing system, this proposed leasing regime would not be in contravention to Article II. And yet, despite this, a leasing regime would establish enough legal security that exploitation of space resources would not be impeded—the main rationale for those who argue that the Treaty (or at least Article II) should be rescinded.

Moreover, the principle established in Article I of the Outer Space Treaty, that “[t]he exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind,” is also upheld under this leasing regime.150 Leasing not only allows nations and private companies to exploit space resources and reap the benefits of their labor, but also directly benefits developing countries not yet able to tap into the resources of space by redistributing some of the space-going nations’ profits via a leasing fee and a tax on extracted resources.

A potential argument against this rental system, as well as any other international legal system that would seek to regulate property rights in space, is that the United States never signed on to UNCLOS and there is nothing different about this situation that would cause the United States to join an international treaty regulating property in space either. However, space law has a fairly different history than the law of the sea. These differences make it more likely (though unfortunately not certain) that a proposal for an International Outer Space Authority would be adopted by the United States despite the fact that the facially similar UNCLOS proposal failed to garner a two-thirds majority vote in the Senate.

The major difference between UNCLOS and this proposed International Outer Space Authority is that the United States has self-interested reasons for supporting an International Outer Space Authority, whereas it did not have similar reasons to join UNCLOS. The United States has maintained that under customary international law, deep seabed mining is already permissible.151 Since the United States does not recognize limitations of deep seabed mining established in UNCLOS, it may legally undertake deep sea mining under customary international law—a right that is codified in domestic U.S. law in the Deep Seabed Hard Mineral Resources Act:

[I]t is the legal opinion of the United States that exploration for and commercial recovery of hard mineral resources of the deep seabed are freedoms of the high seas subject to a duty of reasonable regard to the interests of other states in their exercise of those and other freedoms recognized by general principles of international law . . . .152

The United States therefore already has access to what it wants without having to join UNCLOS. As an additional point, there is also not much pressure from American companies to ratify UNCLOS, in part because the American Exclusive Economic Zone (recognized by the United States under customary international law)153 and the continental shelf is hugely rich in the resources companies might otherwise have hoped to gain by joining the Treaty and gaining access to minerals from deep sea mining in other areas. Finally, not only does the United States stand to gain very little by ratifying the Treaty, there is an argument that ratification would disadvantage the United States. Under UNCLOS, “coastal States are required to make payments to the International Seabed Authority based on a percentage of revenues derived from the exploitation of the resources found within the continental margin beyond two hundred miles from the coast.”154 Notably, customary international law creates no such obligation.155

In stark contrast to UNCLOS, the new rental system proposed would directly benefit the United States. Unlike with deep sea mining, the United States and its citizens currently are bound by a treaty that prohibits appropriation of space: the Outer Space Treaty. Unlike the UNCLOS analogy, the United States has already relinquished rights in this arena. Agreeing to a leasing amendment would expand the scope of its rights, not infringe upon them. Additionally, the United States does not have access to an outer space “exclusive economic zone” in the same way that it does for the sea. Without some sort of agreement, the United States simply may not legally appropriate any in situ property in outer space.

One final consideration increases the likelihood that the United States would in fact become a signatory to an amendment to the Outer Space Treaty. Such an amendment would likely have the support of businesses, environmental groups, and the military, an unlikely combination of key constituencies that would help push an amended treaty forward. Businesses would advocate for the change because it would provide a clearer mechanism for establishing property rights.156 Environmental groups might push for the amendment’s ratification because of the environmental protections that could be included in such an agreement.157 Finally, the military would also likely be a proponent of the system because having access to property in space gives strategic advantages158 and because it is likely that certain Cold War-era concerns that prompted spacefaring nations to sign the original Outer Space Treaty remain relevant—most notably, concerns over the weaponization of space.159

CONCLUSION

The brief history of outer space law since the adoption of the Outer Space Treaty in 1967 highlights the ease with which customary international law shifts in this arena. Despite an original broad interpretation of the non-appropriation principle during the Treaty’s drafting, customary international law has since carved out an exception to this principle for extracted space resources. A second shift could be similarly underway. Driven by economic incentives, States may reinterpret the non-appropriation principle to allow for private appropriation of space property.

Currently, States have an incentive to cooperate to establish a new international agreement concerning the use of outer space because international law, as it is presently understood, prohibits private property rights in space. A new amendment could broaden these rights, providing an enticing carrot to encourage State cooperation. But this enticement may soon disappear. Given the flexibility of the current outer space legal regime, customary international law could easily shift to interpret the non-appropriation principle as allowing private appropriation of property in space. Whatever the international community decides is the optimal solution regarding outer space property rights, it is vital that action be taken now to preserve the principles advanced by the Outer Space Treaty, such as equitable access and peaceful use of outer space. As the original drafters of the Outer Space Treaty recognized, these principles are best protected through a formal agreement and not merely through customary international law, which is often driven by the most powerful States. Regardless of whether a rental system similar to the one described above is established or some other method is used, the international community will have to act quickly if it wants to maintain shared international control over space. Pursuing an amendment to the Treaty as described also provides certainty and timeliness, two elements that would likely appeal to constituencies that might otherwise be supposed to be content with waiting for customary international law to shift.

#### That’s comparatively better for private entities than unlimited appropriation.

Pastorius 13 [Claudia Pastorius, J.D., Barry University School of Law, “Law and Policy in the Global Space Industry's Lift-Off,” 2013, *Barry Law Review*, Vol. 19, Issue 1, https://lawpublications.barry.edu/cgi/viewcontent.cgi?article=1007&context=barrylrev, EA]

Two successful applications of the public trust principles that could influence the management of outer space resources are the International Telecommunications Union (ITU) and the United States Bureau of Land Management (BLM).298 The ITU issues licenses for orbital allocations of satellites and the use of radio frequencies.299 By necessity, the nation-states of the world have peaceably participated in the licensing regime.300 A true tragedy of the commons would result if our telecommunications channel appropriations were chaotic, and, if entities placed satellites into orbit unilaterally with no precautionary coordination.301 Without coordination and commitment to the rules, the overlapping noises would prevent people from hearing each other on the radio, and millions of dollars of satellite equipment, as well as our communication systems, would be at risk.302

The BLM raises an incredible amount of revenue for the government by selling leases of publicly managed lands for oil and natural gas exploration and exploitation to the United States.303 The BLM raised $233 million through leases of public lands in 2012 alone.304 Methods the BLM employs that could be adopted for use with outer space leaseholds are: (1) the auctioning of leases; (2) relative pricing per acre of lease payments depending on whether or not the land is producing; (3) imposing environmental resource management limits on resource exploitation, and (4) issuing fixed term leases with conditions for renewal.305 Some space law academics have noted that United Nations’ treaties and other space law accords will need to distinguish surface property rights on celestial bodies and extraction rights.306 Some even argue that asteroids should be treated as chattel and not land.307 The BLM legal property rights management is an excellent model to look to for establishing the legal property rights that will be needed in outer space for mining minerals, extracting water, and harvesting Helium-3.

If leasehold estates held in trust were conferred in outer space, then measures could be taken to ensure optimal and equitable allocation of outer space leaseholds, and rules could be imposed to manage the sustainable exploitation of space resources.308 Problems such as space debris pollution could be avoided by reviewing development plans to ensure measures to prevent pollution, exit strategies of endeavors, or plans of relative permanence are in place before the projects take-off.309 Controversies regarding planned celestial land use and competing claims to more lucrative territories could be arbitrated and resolved on Earth. From an economic perspective, even though the possibility of “free” appropriation of outer space resources might encourage more space exploration initiatives, development with consistent and reliable rules would provide the stronger incentive of protecting the commercial investments in space exploration.310

#### No PICs – decks the whole regime.

Hickman 2 [John Hickman and Everett Dolman, \* associate professor in the Department of Government and International Studies at Berry College, “Resurrecting the Space Age: A State-Centered Commentary on the Outer Space Regime,” 2002, *Comparative Strategy*, Vol. 21, Issue 2, https://www.tandfonline.com/doi/abs/10.1080/014959302317350855]

Is the collectivization of all of outer space under international law a permanent disability? Fortunately, the answer is no. Under international law, state parties to a treaty may withdraw from its obligations through negotiation, novation, substitution, cancellation, or, rebus sic stantibus, when events overcome the intent of the original treaty, such as when one or more of the other state parties has ceased to exist. Moreover, Article 17 of the OST articulates a straightforward mechanism for withdrawal:

“Any state party to this treaty may give notice of its withdrawal from the treaty one year after its entry into force by written notification to the Depositary Governments. Such withdrawal shall take effect one year from the date of receipt of this notification.”

Thus a state party need merely announce its intention to withdraw and then wait one year. Withdrawal of a single state party to the treaty, however, would not necessarily terminate the treaty between the other state parties. Yet, the decision of an important state not to be bound by a regime–creating treaty obviously endangers the entire treaty. The decision of the United States or China to withdraw from the OST would have far greater implications for the survival of the international space regime than the same decision by Bangladesh, Burkina Faso, or Papua New Guinea—the equality of states under international law remains nothing more than a useful fiction. For the OST to remain good international law, it must be accepted as such by the major space faring states of the 21st Century: the United States, Russia, the European Union, Japan, and China. One defection from the regime by a member of this group would no doubt lead to its effective collapse, as the remaining space faring states are unlikely to use the kind of coercion necessary to enforce the regime. A more likely response to such a defection is a scramble to make similar claims to sovereignty, based on historical precedent and effective occupation. Similar rushes to stake claims for territory sovereignty in other celestial bodies might follow.

## Mining Advantage

#### Advantage one is mining.

#### Space mining coming now – lack of regulations makes conflicts likely.

Zeisl 19 [Yasemin Zeisl, MSc in International Relations and Affairs from the London School of Economics and Political Science (LSE), “Three Salient Risks of Mining in Space,” 05/03/19, *GlobalRiskIntel*, https://www.globalriskintel.com/insights/three-salient-risks-mining-space, EA]

The harvesting of natural resources from space objects is the goal of numerous companies such as Planetary Resources or Deep Space Industries in the United States, Asteroid Mining Corporation in Scotland, or iSpace in Japan. While some companies such as iSpace are focusing on resources inside the Moon, others are developing strategies to identify and extract resources from asteroids and extinct comets. Given that calculations evaluate space mining as a highly lucrative business with potential profits amounting to trillions in U.S.-dollars, it is unsurprising that investment into space mining rose from 534 million USD in 2014 to 3.1 billion USD in 2018.

Research institutions such as the Center for Near-Earth Object Studies (CNEOS) — which cooperates with the National Aeronautics and Space Administration (NASA) — detects, traces, and assesses risks of objects moving close to the Earth. Such calculations are relevant for future ventures into space mining, which will focus on metals such as platinum, gold, iron, rhodium, zinc, cobalt, and nickel, as well as water and carbon found in asteroids and extinct comets. Celestial ice would be particularly useful for generating rocket fuel by splitting it into hydrogen and oxygen. This may facilitate long space travel to destinations such as Mars. The usage of extinct comets as gas stations may bring engineers and scientists one step closer to the goal of colonizing Mars. While rocket fuel extraction may be a relatively feasible project for the near future, it is expected that harvesting metals from space may require several more decades to realize.

Spotting the potential profitability of space mining, the United States passed the Commercial Space Launch Competitiveness Act in 2015 to grant U.S. citizens the right to harvest natural resources from celestial bodies. Similarly, Luxembourg established a space mining law and provided investment opportunities in August 2017. In January 2019, Russia started negotiating a bilateral cooperation arrangement with Luxembourg.

The fact that there is no clearly defined international treaty on space mining poses a major risk. Although the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies of 1984 may provide some detail on the issue by asserting that no state, organization, or natural person can lay claim to any object in space, the fact that only 18 countries have committed to this multilateral treaty leaves the majority of states unbound by this regulation. An inconsistent legal landscape in regard to resource extraction of celestial bodies could lead to legal clashes between different countries and potential disadvantages for companies or organizations from certain countries. Mining in space could turn into a fierce competition among various private businesses and states. Therefore, licensing regulations will also have to be clearly defined. Licenses will help to clarify both ownership of yields and the relationships among miners, investors, and governments in order to avoid conflict in the future.

#### Successful mining unlocks crucial rare earth metal supplies for renewables and space colonization BUT legal uncertainty makes investment unviable.

Doshi 16 [Priyank D. Doshi, J.D., Notre Dame Law School; B.A., University of Illinois Urbana-Champagne, “Regulating The Final Frontier: Asteroid Mining and The Need For A New Regulatory Regime,” 2016, *Notre Dame Journal of International & Comparative Law*, Vol. 6, Issue 1, https://scholarship.law.nd.edu/cgi/viewcontent.cgi?article=1055&context=ndjicl, EA – OCR used]

C Benefits of Asteroid Mining

While Part I sought to show that asteroid mining is possible and will soon be a reality, it also raised the question of why asteroid mining might be something the international stage needs to pursue collectively and aggressively. The simple answer is two-fold: the need for the resources and future space exploration.

C.i The Need For Resources

Scientists posit that the key natural resources we will need to fuel and develop the modern economy will run out within the next fifty to sixty years.51 Key resources like platinum, zinc, copper, phosphorus, lead, gold, and indium, could become depleted on Earth very soon.52 As the push for more environmentally friendly solutions to things like energy surges, the actual replacement materials to support that dream grow more and more scarce. Wind turbines and solar panels use rare earth metals in their very construction, and the future of renewable energy will demand more of these resources.53 Even everyday items like batteries, jewelry, and computer chips use platinum, gold, and nickel, which are starting to become more and more expensive as their supplies decrease. The scarcity problem is exacerbated by the fact that a lot of these elements have no readily available alternative on Earth. Asteroid mining is the solution to the coming scarcity issues. Mining the asteroids isn’t just a capitalist dream; it is the average man’s necessity.

Most of the minerals being mined on Earth, including gold, iron, platinum, and palladium, originally came from the many asteroids that hit the Earth after the crust cooled during the planet’s formation.54 Asteroids are suspected to be filled with an abundance of natural resources like gold, cobalt, iron, manganese, molybdenum, nickel, osmium, palladium, platinum, rhenium, rhodium, ruthenium, and tungsten that are worth billions to trillions of dollars.55 Speaking to just one of the many examples,

Some of these Near-Earth Asteroids (NEAs) are metallic, composed of metals like iron and nickel, similar to the center of the Earth. One of these asteroids is 1986 DA, a metallic NEA 1.2 miles wide that is likely composed primarily of iron and nickel with significant amounts of gold and platinum. Estimates show 1986 DA contains approximately 10,000 tons of gold and 100,000 tons of platinum, which if completely recovered would be valued on today’s market at $460 billion and $5.6 trillion, respectively. Including the value of the iron and nickel, 1986 DA could be worth between $6 and $7 trillion.56

These NEAs are close enough to be mined and harvested for the development of human technology. John S. Lewis, professor of planetary science at the University of Arizona and author of Mining the Sky: Untold Riches from the Asteroids, Comets, and Planets, estimates that asteroid 3554 Amun is worth $20 trillion. Composed of platinum, iron, nickel, and cobalt, it has enough resources to pay off the U.S. national debt.57 It is estimated that there are about one to two million asteroids in the solar system that are large enough to consider for mining projects:58

Each of these asteroids is projected to weigh roughly two billion tons and “contain 30 million tons of nickel, 1.5 million tons of metal cobalt, and 7,500 tons of platinum.” The value of these items, for both private companies and governments around the world could be significant with the dollar value being somewhere in the trillions or higher. With nickel selling for $14,575 per ton, cobalt selling for $26,600 per ton, and platinum at $1,454 per ounce, mining one single asteroid could be more than profitable.59

Though these numbers presuppose that prices of the various resources would stay the same, they provide a telling picture of the potential wealth in wait and its ability to drastically alter the shape of the future.60

Providing more than a fix for natural resource shortages, asteroids also contain other elements that are scarce or practically nonexistent on Earth. One of these, helium-3, could be used as a low-cost, efficient energy source that gives only a fraction of the polluting effect of current practices.61 Helium-3 could potentially light the future, and that is just the beginning of the possibilities reaped from asteroid mining.

C.2 Future Space Exploration

The societal good that could be achieved from mining asteroids, which contain both rare-Earth minerals and scarce and/or non-existent resources, is self-explanatory. Similar is the resultant financial gain from these mining activities. There is extensive scholarship surrounding the potential value of asteroids, and this Note only scratches their proverbial surface. A large share of asteroids’ benefits is derived from their position in outer space. They will allow us to push further in space exploration and space colonization by drastically bringing down the cost of travel.

To those still reading this with an eye of incredulity about space, this section may seem the most unnerving, but it is by far the important use for asteroid mining. The largest barriers to space exploration and space colonization are the cost of shipping materials from Earth, and the fuel limitations inherent in travel. Asteroid mining has the potential to help with both of these problems and act as the catalyst for the modern space age. The mining of NEOs will yield great quantities of hydrogen, helium, and water.62 These materials could be used to fuel human spacefarers, untying them from the need to be refueled or resupplied from Earth.

More specifically, mined water could be extremely useful as rocket fuel or as a fuel for other power and propulsion systems.6’ If water can be found on asteroids (as many believe it can be) the water could also be broken down into its hydrogen and oxygen components, which can then be used to form the basic building blocks of rocket fuel.64 Mining water alone makes both space colonization and space exploration cheaper and consequently more feasible. Furthermore, sources of water have been identified: a 2006 announcement by the Kech Observatory claimed that 617 Patroclus, a Jupiter Trojan, was essentially an extinct comet that consists largely of ice. Similarly, Jupiter-family comets, and possibly NEAs that are extinct comets, might also economically provide water which through the process of in-situ resource utilization— using materials native to space for propellant, tankage, radiation shielding, and other high-mass components of space infrastructure—could lead to radical reductions in its cost for space exploration.65 Fuel tends to make up the greatest weight of rockets; the ability to produce fuel in space would provide much needed flexibility to survive in outer space and explore the depths of the solar system.66

Part I addressed the technology that is being developed by Planetary Resources and DSI for asteroid mining; that technology will help realize the benefits of asteroid mining for space travel.

Launches from Earth could be cheaper if the shuttles were able to refuel at a DSI Propellant Refinery. Planetary Resources’ ARKYD- 300 could scout ahead for possible colonization sites on both asteroids and planets. Imagine a scenario where a DSI Harvestor mines the minerals needed to create a colony, and then the shuttle takes those materials, along with a DSI Microgravity Foundry, to build the colony itself.67

Fuel for spaceships to go further and resources to build and re-equip space colonies unburdened by the high costs of Earth-to-colony transport could be the stepping stone we need to begin the new age space race.

Lastly, in addition to mining for supplies, we could also use asteroids as space stations. An asteroid-based space station could be highly beneficial to research and development. It has the potential to provide conditions that cannot easily be replicated on Earth, such as zero-gravity environments, freedom from atmospheric interference, and nearly continuous sunlight for solar power.68 While on the surface this may not seem like a large benefit, it will be invaluable as a place to test some of the radiation shielding problems that have historically stalled many long-term space exploration plans.69

Many people dismiss asteroid mining positing that the benefits are primarily financial ones that will do nothing more than further line already rich pockets. But the reality is far more layered than that simple assertion. Asteroid mining is a societal necessity for global advancement. Modern technology relies increasingly on rare and scarce resources; we will need to find a new source to continue the advancement. Any future with space exploration has to be grounded in the understanding that we will need a cheaper way to deliver materials in space. Asteroid mining is the answer.

D Problems Surrounding Asteroid Mining

While the significant benefits described above show the impending need and the rewards of asteroids mining, many problems must be addressed before asteroid mining becomes a certain fixture of the future. The main issues confronting asteroid mining are the needs for a massive upfront investment and the economic and political implications of mining asteroids in the future.

The most obvious roadblock to asteroid mining is the high required upfront investment needed to participate. While Part I spoke to some of the plans that the NASA is supporting and the goals the agency has set, it omits an important point: the funding for NASA has decreased drastically over the last twenty years. Currently, it operates using the lowest percentage of the federal budget since I960.70 Just when we are on the cusp of cracking open the final frontier, the government is bowing out. According to a Collaborative Modeling for Parametric Assessment of Space Systems (COMPASS) team at NASA’s Glenn Research Center in Cleveland, the estimate for a successful asteroid capture endeavor is in the ballpark of $2.6 billion/1 while the government’s grant to NASA for its capture project is only around $100 million. 2 Private companies will have to take the lead and absorb the large costs associated with asteroid mining and space exploration. The costs only continue to increase beyond the creation of asteroid capture technology—from the harnessing technology, or the costs required for the transport and process of raw asteroidal material to Earth for use (on Earth or elsewhere). In this assessment, the administrative costs of running a company are not even taken into account. While the discussion of technology in Part I of this Note highlights a few successfully funded companies, the high costs operate as a roadblock for others. Even though the potential profits are massive, the initial risks of asteroid mining come close to swallowing the benefits. While both Planetary Resources and Deep Space Industries have been very tight-lipped about their costs, the list of big name investors and the ambitious plans insinuate investments in the hundreds of millions of dollars, at a minimum.

As it stands today, mining asteroids is too theoretical and not yet profitable enough to ask the private industry to continue to dump billions into the endeavor. It will require more relative financial certainties, rather than mere mirages of wealth, to propel the industry.

The current legal framework that is in place, as is described in the next section, is not adequate to incentivize investors for such a risky endeavor. These businesses want to be sure that the technology, funding, and efforts they put toward the development of space will be rewarded, and so a properly crafted property law regime, unique to outer space, must be developed to ensure that private space industry continues to invest in cosmic ventures and technologies.7’ The law needs to create a level of predictability and incentive structure that will actually make investors overlook the long path still ahead of them and see the end goal.

Assuming the substantial financial roadblocks that exist are overcome and private money pours into the industry, there are still other economic and political considerations that are sources of serious concern before asteroid mining can become a reality. The central problem is the issue of control. Once private companies get into space, after investing their own money and bearing all the risk, they will want to control how things operate. To have them take all the risk and then expect corporations to willingly subordinate themselves from their spoils is a fool’s dream. So far, the government has had a limited response. On July 10, 2014, two Congressmen proposed the Asteroids Act, intended to facilitate the commercial exploration and utilization of asteroid resources to meet national needs and to promote the right of US commercial entities to explore and utilize resources from asteroids.74 The Act seeks to create property rights in resources extracted from asteroids, stating: “Any resources obtained in outer space from an asteroid are the property of the entity that obtained such resources, which shall be entitled to all property rights thereto, consistent with applicable provisions of Federal law.”75 The legislation, while noting that no state can lay claim to the asteroids, and giving corporations some protections on their investments, is still the beginning of a scary trend; a trend where national governments are granting and recognizing property rights subject to their own rule. This bill essentially sets the stage for a showdown for when an American company and a foreign company (with their country’s support) lay claim to the same asteroid. What happens when a Chinese company subject to Chinese laws starts to mine an asteroid that an American company has rights to under American law? What happens to any company not based in a major superpower, do they just cede their rights when a company backed by a more powerful nation intervenes? Individual governments’ respective abilities to regulate, as seen by the Asteroids Act, will lead to conflicting laws and conflicting claims that have the potential to create serious political and military ramifications.

Putting aside the political chaos this could cause in the global system, the question of why corporations would even cede any control comes into question. With practically no governmental involvement in the initial stages of asteroid mining, why would corporations allow the government to share the benefits of something that they, in reality, have no jurisdiction over? Building on the conflict over control, who would control how much of the resource could be brought back? Markets already exist for a lot of the natural resources that would be mined on asteroids; bringing back a large load of the resource could wreak economic havoc on those existing markets and the political systems that rely on them. The social costs to resource-based countries alone would be catastrophic. Will the corporations care? Can any government really curb the corporation’s ability to flood the market? What stops them from creating a false market due to their ability to monopolize an asteroid? Is there a state interest in miner safety and other environmental considerations involved in extra-terrestrial mining? Who can really enforce any safety and protection regulations with only claimed jurisdiction?

This non-exhaustive catalog of questions is asked in an attempt to understand the wide breadth of problems that will arise under the current regulatory regimes that are in place. The problems surrounding asteroid mining are more than just the high costs of investment; there are also questions about control and global cooperation over corporate activities in space.

E Current Law

The problems posed in the last section rise in part due to lack of legal clarity in this area. The international community has no policy that directly speaks to asteroid mining. It has instead relied on the interpretation of a series of tangentially connected treaties and agreements to address the burgeoning industry. This section is focused on briefly introducing some of the international agreements and treaties that try to govern space.

The phrase “space law” draws a blank on most faces, as very little is actually known about the practice area. Still, despite the lack of public knowledge around international space law, there are quite a few guiding documents for asteroid mining, namely: the Outer Space Treaty of 1967, the Registration Convention of 1975, and the Moon Treaty of 1979.

E.i The Outer Space Treaty of 1967

The Outer Space Treaty of 1967 was the first real international agreement dealing with space. Created in the midst of the Space Race and the Cold War, it was drafted to ensure that space did not become the next battleground. Its legacy has long outlived that original purpose, and almost 50 years later, it still stands as the primary agreement on international space law, serving as the foundation for all agreements and treaties that followed. The most marked and deliberate feature of the agreement was its rejection of the traditional concept of res nullius, or treating outer space as unclaimed territory that, since unclaimed, was open for conquest by anyone.76 The policy laid out in the Treaty opted for the res communis theory, there by all entities, individual or corporate, and nations have common or open access to the resources that are contained within its realm and are precluded from making any claims of ownership.77 The strong tone of the document and the widespread agreement of the treaty has led some to assert that celestial bodies are res extra commercium as whole, and cannot be owned.78 This treaty stands at the center of international space law today, making a breakdown of its relevant articles essential.

Article I of the Treaty covers its general purpose. It states that, “the exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and interests of all countries...and shall be the province of all mankind.”79 It is important to recognize the lofty language in this international consensus, as it is the result of concessions given to developing nations. The developed, space-faring nations would have much preferred the open space principle to allow for them to stake their claim. However, they recognized that any international consensus had to take the opinions of developing countries into account, and developing nations refused any agreement that would impede their future rights to space exploration. That understanding still holds today, and any international cooperative agreement on space has to make some concession to the developing and non-space faring states to be workable long-term.

Article II reiterates the underlying purpose of the agreement by stating that outer space “is not subject to national appropriation by claim of sovereignty.” But its broad language in this article has created a large and very controversial loophole: nowhere in prohibiting claims of ownership does the treaty mention corporations, private entities, or individuals.80 In fact, the treaty lacks

[A]ny explicit mention of property rights. It does not, however, specifically reject individual or corporate property in space. The treaty only prohibits “national appropriation” of space by claim of sovereignty, use, occupation, or other means. The drafters of the Outer Space Treaty chose to limit this prohibition to nations, even though scholars at the International Institute of Space Law had suggested that the Treaty should prohibit “national and private appropriation.”81

This large loophole becomes extremely relevant given that the Outer Space Treaty is the only space-related treaty onto which the majority of the world has signed.

#### Renewables remove leverage – staves off global conflict.

Roman Vakulchuk 20, PhD in economics, senior research fellow at the Norwegian Institute of International Affairs, and adjust professor at Nord University, “Renewable energy and geopolitics: A review,” 1/07/2020, Renewable And Sustainable Energy Reviews, [https://www.sciencedirect.com/science/article/pii/S1364032119307555#](https://www.sciencedirect.com/science/article/pii/S1364032119307555)!, cc

By contrast, the reduced conflict camp sees geopolitical tensions as less likely in a world that has renewables as its main source of energy (Peters [91], Verrastro et al. [92], Lacher and Kumetat [93], Kostyuk et al. [94], Escribano et al. [95], Johansson [96], Hoggett [97], Sweijs et al. [70], Månsson [72], Paltsev [98], Scholten and Bosman [54], Smith Stegen [99], Escribano [84], Freeman [85]). This camp emphasises that it is more difficult to control, cut the supply or manipulate the price of renewable energy than of fossil fuels and the expansion of renewables will therefore lead to greater energy self-sufficiency and less conflict. It shifts the focus from the external to the internal supply of energy, reducing the scope for conflict among states.

An argument frequently used by this camp is that renewables are more difficult than fossil fuels to manipulate as they are less dense and more evenly distributed geographically. Månsson [72] holds the view that due to its geographic and technical characteristics, renewable energy creates few geopolitical motivations for states to start conflicts in order to control it. Peters [91], Tsao et al. [100] and Kostyuk et al. [94] similarly note that developing renewable energy would lead to a more equitable energy distribution and energy-based economic power, in turn leading to reduced geopolitical tensions. Also Overland et al. [101] found that geopolitical power will be more evenly distributed after a complete transition to renewable energy. In a related vein, Krewitt et al. [61] argue that the creation of international solar energy partnerships would have geopolitical advantages because they could “reduce economic imbalances between the North and the South and create global markets for future-oriented energy technologies without having to fear conflicts over scarce resources” (p. 23).

The application of a resource scarcity perspective to the geopolitics of oil triggers energy-insecurity anxiety among states and implicitly or explicitly justifies aggressive behaviour in resource conflicts (Jaffe and Soligo [102], Stern [103]). This perspective is not simple to transpose onto renewables, as they are both non-exhaustible and abundant, except for the critical materials used in the production of renewable energy technologies (see Section 3.4 for more on this). Fischhendler et al. [104,105] exemplify how geopolitical arguments have been used to convince Israeli decision-makers to adopt renewable energy to reduce the country's energy dependence and improve its security. These arguments have led others to draw further conclusions. Compared to an energy system based on fossil fuels, in a system dominated by renewables, access to resources is less important than distribution and infrastructure management (Scholten and Bosman [54]). Escribano [84] implies the same when he writes that “[e]nergy dependence and security of supply lose geopolitical relevance, whereas technical and regulatory aspects gain weight” (p. 7).

Many publications share an understanding that the location of renewable energy resources is as important as that of fossil fuels (Skeet [106], Criekemans [67], Criekemans [107]). However, location as a geopolitical concern is mainly relevant for the large-scale and not for the small-scale domestically-oriented production and transmission of electricity from renewable energy. O'Sullivan et al. [75] argue that if renewable energy is deployed on a large scale and cross-border trade in electricity grows, then the principle of territorial control will be similar to that for oil and gas pipelines: “[c]ountries like Algeria, Mexico or Morocco, or transit countries, or actors such as the Islamic State, could still try to leverage their geographical position and in case of conflict they could threaten to interrupt electricity supplies” (p. 41). Several authors also ask whether an external supply of electricity can be used as an “energy weapon” (e.g. Escribano et al. [95]). Renewable energy infrastructure, such as the ambitious but failed Desertec project, can also be an easy target for terrorists (Smith Stegen et al. [108]). The same logic can be applied to the location of biofuels.

On the other hand, if countries produce electricity from domestic renewable energy sources, geopolitical tensions and risks might recede due to falling energy imports and reduced interdependence between countries (Strunz and Gawel [66]). Escribano et al. [95] and Scholten and Bosman [54] argue that the geopolitical risks associated with domestically produced renewable energy are close to zero if we apply the energy-security standards of IEA. Hoggett [97] similarly notes that small-scale photovoltaics (and nuclear power) technologies are likely to promote a secure low-carbon transition with reduced geopolitical risks. Some believe that it is likely that the consumption of renewable energy at the location of production will prevail over large-scale regional production and distribution as it is seen as much more efficient and cost-effective when compared to the long-distance distribution of electricity (Proedrou [109], Sovacool [110]). These authors therefore see geographical location as less important for renewable energy resources than for fossil fuels from a geopolitical perspective. Nevertheless, there is a risk of local conflicts involving non-state actors that could potentially be caused by increased global competition for the land required for renewable energy installations (Capellan-Perez et al. [82], Månsson [72], Johansson [96], Walker [111]).

One issue seems to be stuck between the two camps: new interdependencies among states as a result of electricity interconnectors. Hache [81] discusses the possible emergence of new and unfamiliar inter-state interdependencies. Similarly, Westphal and Droege [64] argue that more electricity interconnectors between countries will lead to greater interdependence, which may translate into reduced international security. Pierri et al. [112] examine this question in the context of the European Union. Konstantelos et al. [113] discuss the division of costs and benefits among members of an integrated North Sea grid, making it similar to the difficulties caused by major pipeline projects. By contrast, Smith Stegen [99] argues that international affairs should benefit from renewables in many ways because their distribution will not be exposed “to the political and strategic dilemmas wrought by dependence on hydrocarbons” (p. 92). In a similar vein, IRENA [76] notes that electricity cut-offs and the use of hegemonic power to cut off transport bottlenecks will be greatly reduced due to increased rerouting possibilities, decentralised power generation and the absence of global electricity connections. But Smith Stegen [99] acknowledges that some tensions are possible due to increased interdependencies in such areas as high-voltage direct current (HVDC) transmission lines, biofuels and rare earth elements. Similarly, Verrastro et al. [92] and Lacher and Kumetat [93] see that renewable energy may strengthen energy security while facilitating the emergence of new interdependencies among states.

#### SpaceCol prevents other-wise inevitable extinction.

Green 21 [Brian Patrick Green, director of technology ethics at the Markkula Center for Applied Ethics, Santa Clara University, “Space Ethics,” 2021, Rowman, pp. 5, EA]

Another reason that humans may want to explore space would be to create a “backup Earth” to hedge against global catastrophic and existential risks (risks that may cause widespread disaster or human extinction, respectively) on our home planet. 8 Earth has always been a dangerous place for humans, with asteroid impacts, supervolcanic eruptions, pandemic disease, and other natural hazards threatening civilization. Now, in addition to these natural threats, human-made hazards such as nuclear weapons, climate change, biotechnology, nanotechnology, and artificial intelligence may threaten not only the viability of technological civilization but perhaps the survival of human life itself. A serious global-scale catastrophe could set back civilization many decades or centuries, and the worst disasters could cause human extinction. In one scenario, in which 100 percent of humanity dies, all of human effort for all of history would be for nothing. However, were the same global catastrophe to happen to Earth, yet humans were a multiplanetary species with just one self-sustaining settlement off-Earth, it would not result in the end of human civilization or human extinction. Instead while the same unimaginable fate would befall the Earth (certainly no mere triviality, with perhaps the deaths of 99.999 percent of all humans and possibly the destruction of the ecosphere and everything in it), at least all of human and planetory history would not be for nothing. Human life and culture would go on elsewhere, as well as other Earth species. This is a dire fate, but less terrible than the first.

#### Immeasurable expected value also outweighs.

Baum 16 [Seth D. Baum, Executive Director of the Global Catastrophic Risk Institute, “The Ethics of Outer Space: A Consequentialist Perspective,” 2016, Springer, pp. 115-116, EA]

Space colonization is notable because it may be able to bring utterly immense increases in intrinsic value. Early colonies might start small, given that other planets and moons have inhospitable environments. However, it may be possible to build large indoor colonies or create more hospitable outdoor environments (i.e., terraforming). Even just on other planets and moons in the Solar System, space colonies could multiply the total area available for human habitation. And there are many more planets around other stars, as ongoing research on exoplanets is now learning. One recent study estimates 22 % of Sun-like stars have Earth-like exoplanets (Petigura et al. 2013), implying billions to tens of billions of potentially habitable planets across the galaxy.

Opportunities at any given star may also be quite a bit greater than those available only on planets. Earth only receives about one two-billionth of the Sun’s radiation. To collect all the Sun’s radiation, humanity would need a Dyson swarm (named after Dyson 1960), which is a series of structures that surrounds a star, collecting its radiation to power a civilization. A Dyson swarm around the Sun could potentially enable a civilization a billion times larger than is possible on Earth. Likewise, Dyson swarms around one billion stars would bring humanity approximately 1018 (one billion–billion) times more energy per unit time.

Space colonies could also increase the amount of time available for human civilization. Earth will remain habitable for a few billion more years (O’Malley-James et al. 2014). Stars will continue shining for about 1014 more years (Adams 2008). That gives us an additional 105 times more energy, for a total of 1023 times more energy than is available on Earth. After the stars fade, other energy sources may be available. And even if our current universe eventually becomes uninhabitable, it may be possible to move to other universes (Kaku 2005). The physics here is speculative, but it cannot be ruled out, and hence there is a nonzero chance of a literally infinite opportunity for space colonization (Baum 2010a).

Whether the opportunity is infinite or merely, say, 1023 times larger than what can be done on Earth, the opportunity is clearly immense. As long as space colonization is an improvement (Sect. 8.3.1), then it would seem that the consequentialist should prioritize space colonization. The sooner space colonization begins, the more of its immense opportunity can be gained. Indeed, Ćirković (2002) estimates 5 × 1046 human lifetimes are lost for every century in which space colonization is delayed.

There can also be large value for space colonization under ecocentric intrinsic value. It is sometimes argued that Earth would be better off without humans. For example, the Voluntary Human Extinction Movement states that “Phasing out the human race by voluntarily ceasing to breed will allow Earth’s biosphere to return to good health” (http://vhemt.org, accessed 25 October 2015). However, this makes sense only if extraterrestrial locations are not intrinsically valued. Otherwise, exterminating humanity ruins the opportunity for humans to bring flourishing ecosystems into outer space. Terraforming other planets or bringing ecosystems into Dyson swarms could bring immense amounts of ecosystem flourishing.

## COPUOS Advantage

#### Advantage two is COPUOS.

#### Space arms control talks are in-progress now – their success solves a space arms race.

Kimball 21 [Daryl G. Kimball, Executive Director of the Arms Control Association; B.A. in Political Science and Diplomacy/Foreign Affairs, “A Small Step Toward an ASAT Ban,” December 2021, *Arms Control Today*, https://www.armscontrol.org/act/2021-12/focus/small-step-toward-asat-ban, EA]

Last month, the UN General Assembly First Committee, responsible for international security, approved a compromise resolution that sets into motion a new open-ended working group to develop rules of the road for military activities in space. If key countries, including the United States, provide leadership, the initiative could help advance progress toward legally binding measures designed to prohibit counterspace activities that threaten international security, beginning with a ban on land-based anti-satellite (ASAT) weapons.

A core rationale for the resolution, which was sponsored by the United Kingdom, is “that the creation of long-lived orbital debris arising from the deliberate destruction of space systems increases the risk of in-orbit collisions and the potential for misunderstanding and miscalculations that could lead to conflict.”

As if to underscore the threat posed by ASAT weapons, on Nov. 15, Russia launched an interceptor from its Nudol ground-based ASAT system to destroy one of its own aging satellites in low Earth orbit. The collision created at least 1,500 pieces of trackable debris that will pose a threat to orbiting objects for years to come.

Russia is not the only nation to act in such an irresponsible manner. China, the United States, and India have also demonstrated the ability to destroy satellites with ground- or air-launched missiles. In 1985, the United States successfully tested an air-launched missile to destroy a weather satellite. In 2007, China used a ground-based SC-19 ballistic missile to destroy a weather satellite. In 2008, the United States used a modified ship-based SM-3 missile defense interceptor to destroy a failed U.S. intelligence satellite. In 2019, India used a ground-based Prithvi ballistic missile to destroy one of its own target satellites.

Each of these demonstrations of ASAT weapons capabilities is destabilizing. If these and other potentially hostile activities in space are not stopped, an acceleration of a space arms race is all but certain.

The 1967 Outer Space Treaty prohibits the placement of nuclear weapons in space, but there are no restrictions on other types of weapons in that domain. Efforts to launch talks that might produce new understandings on maintaining the peaceful use of space have been stymied for years.

China and Russia have long advocated for a treaty that only bars the placement of any weapons in space. Their proposal, called the Prevention of the Placement of Weapons in Outer Space (PPWT), defines a “space weapon” as an object placed into orbit with the intent of harming other space objects. This means that the Russian Nudol system, which flies a suborbital trajectory, would not be a violation. But their proposed ban would restrict potential U.S. efforts to develop space-based missile defense interceptors while allowing suborbital ASAT capabilities.

For years, the United States has been wary of any legally binding restrictions on ASAT systems in part because they might restrict U.S. ground-based missile defense capabilities or a possible space-based kinetic anti-missile system that could involve a number of orbiting interceptors that provide a thin defense against intercontinental missiles.

But earlier this year, President Joe Biden’s Interim National Security Strategic Guidance stated that the United States “will lead in promoting shared norms on space.” The U.S. National Space Policy, issued in December 2020 by the Trump administration, said Washington shall consider “proposals and concepts for arms control measures if they are equitable, effectively verifiable, and enhance the national security of the United States and its allies.”

Curiously, although Beijing and Moscow voted “no” on the UK resolution for the working group on preventing an arms race in outer space, they refrained from pushing for discussions in a UN-sponsored forum for their PPWT proposal. This may be because the UK resolution allows for consideration by the new working group of legally binding measures of the kind that Russia and China have pursued, as well as voluntary rules designed to constrain threatening military activities.

The UK resolution, which was approved 163–8 with nine abstentions, is expected to win final approval by the UN General Assembly in December. It would authorize the working group to begin operating in 2022 with a final report due to the General Assembly in the fall of 2023. To its credit, the resolution also emphasized the need for verification of legally binding arms control regarding space systems.

The UK-led initiative is a small but much-needed breakthrough that creates the potential for positive results. As the process unfolds, the United States, Russia, China, and India could help build momentum and reduce tensions by declaring unilateral moratoriums on any further testing of their ASAT weapons that could create dangerous orbital debris and agree to participate in the working group next year.

Without commonsense rules of the road, a dangerous, destabilizing offensive-defensive space arms competition is on the way. It is past time for key states to engage in productive dialogue on space security, with a focus on halting ASAT weapons.

#### Space Arms Races go nuclear – UNCOPUOS has the best shot of averting them.

Grego 18 [Laura Grego, Stanton Nuclear Security Fellow at MIT’s Laboratory for Nuclear Security and Policy, on leave from the Union of Concerned Scientists’ Global Security Program, where she is senior scientist and research director, “Space and Crisis Stability,” 03/19/18, https://www.law.upenn.edu/live/files/7804-grego-space-and-crisis-stabilitypdf, EA]

For the foreseeable future, military tensions between the United States, China, and Russia are likely to remain high, as are those between China and India. Even absent intentional confrontation, regional problems, such as those in the Baltics and East and South Asia, have the potential to draw these actors into conflict. Thus, it is imperative to pay attention to any pathways that could lead an actor considering crossing the nuclear threshold, or approaching it very closely.

The United States and Russia continue to retain large nuclear arsenals on high alert1 . Each are developing new strategic weapons, including hypersonic conventional prompt global strike systems with a suggestion mission of holding ground-based anti-satellite weapons at risk.2 Russia has declared the existence of novel nuclear delivery systems as a response to US missile defense systems,3 weapons which complicate the management of crises. China is reportedly considering increasing the size, capacity and alert status of its nuclear weapons delivery systems4 and is also developing new kinds of strategic weapons. China is also developing hypersonic weapons,5 and the ingredients for an arms race around these technologies is in place. India continues to increase the sophistication of its strategic posture. And India, China, Russia and the United States have or are pursuing missile defense technologies that are important both in the nuclear realm but in space issues, since missile defenses present demonstrated or inherent antisatellite capabilities.

Thus it is critical to ensure that in times of tension, no actor escalates the crisis inadvertently or against their better judgment, and that misperception does not play an important role in the initiation or progress of the crisis. And that hostilities, if initiated, resolve as quickly as possible. Thomas Schelling‘s encapsulated an aspect of this idea in his landmark work this way:

This is the problem of surprise attack. If surprise carries an advantage, it is worth while [sic] to avert it by striking first. Fear that the other may be about to strike in the mistaken belief that we are about to strike gives us a motive for striking, and so justifies the other‘s motive. But if the gains from even successful surprise are less desired than no war at all, there is no “fundamental” basis for an attack by each side. Nevertheless, it look as though a modest temptation on each side to sneak in the first place — a temptation too small by itself to motivate an attack — might become compounded through a process of interacting expectations, with additional motive for attack being produced by successive cycles of ―He thinks we think he thinks we think … ~~he~~ think we think ~~he~~‘ll attack; so he thinks we will; so he will; so we must.6

This suggests that it is important to make the advantage of surprise attack negligible and the disadvantages as great as possible, to make sure that all actors understand this, and to make sure that actors have as clear an understanding of each other‘s motivations as possible to avoid miscalculation.

In the last twenty years, space assets have become important not only for strategic missions but also increasingly underpin conventional military force for modern militaries, and especially those with expeditionary forces, such as the United States. They are essential not only for militaries, but are a critical provider of essential civilian, commercial, and scientific services. Not only do satellites perform many more missions than they have in the past, there are many more spacefaring nations. While most satellites belong to the United States, Russia, and China, more than sixty countries own satellites or a large stake in one.7

At the same time, the technologies that are useful for holding satellites at risk have grown significantly in sophistication and capacity even in the last decade, and have become more widely available. This is particularly problematic because attacks on satellites can create or escalate terrestrial crises in potentially difficult to predict ways. The world is drifting towards a space regime that faces an ever more prevalent and more sophisticated anti-satellite technology and greater numbers and types of targets in space, with very little mutual understanding about how actions in space are perceived.

While space‘s foundational legal document, the 1967 Outer Space Treaty, sets out the principles by which space is used and provides a number of useful, most recognize that more is needed to secure lasting peace on earth and the long-term health of the space environment. Different stakeholders are tackling space security issues from different angles. Under the aegis of the United Nations Conference on Disarmament‘s (UNCD) Prevention of an Arms Race in Space (PAROS) agenda item, Russia and China have invested in the Treaty for the Prevention of the Placement of Weapons in Outer Space, a comprehensive ban on the deployment of space-based weapons and on threats of any kind against satellites. 8

The United States has stated that it sees little value in this treaty, but has not proposed revisions that would make it more acceptable nor suggested its own preferred legally-binding treaty. And the UNCD has struggled to extricate itself from a deadlock that has kept it from moving forward on discussions on this (and all other) topics. Others have suggested a ban on destructive anti-satellite weapons development and testing,9 and limits on exoatmospheric missile defense tests.10 These efforts have not yet produced any appreciable progress.

Others prefer the approach of starting with confidence building and transparency measures that are politically binding rather than legally binding. The European Union moved forward a Code of Conduct for Outer Space Activities, 11 which would set out rules of the road for space, creating transparency and building confidence. It did not address directly core security issues, and the gestures it made in this direction (the requirement by the United States that it include a specific reference to the right of self-defense) created disagreements serious enough to not be easily addressed in this format. The process hit a wall in 2015. A United Nations Group of Governmental Experts, convened to consider TCBMs for space, produced a consensus document,12 though for a number of reasons, little progress has been made on implementing them.13

Perhaps the greatest progress in creating new guidelines has come under the aegis of protecting the long-term sustainability of space. (While the long-term sustainability of space does imply that core security questions are solved enough to not threaten the space environment, work on this topic does not take the issue head-on.) The United Nations Committee on the Peaceful Uses of Outer Space has drafted a set of such guidelines which will be referred to the General Assembly in 2018.14

For its part, the United States, currently the most heavily invested in space in sheer capacity and in posture, is investing significant intellectual energy in creating a deterrence strategy to protect its military interests in space. While this is closely related to crisis stability, this work is distinctly from a US point of view.

Each of these approaches have something distinct to offer. The aim of this paper, however, is to look at the issue differently and to use crisis stability (rather than, e.g., preventing an arms race, preserving the space environment) as an organizing principle or lens to help identify which facets of space activities are particularly dangerous, and to prioritize the existing initiatives, as well as to offer other unilateral and collaborative actions that can help reduce the pathways to confrontation between nuclear powers.

Why space is a particular problem for crisis stability

For a number of reasons, space poses particular challenges in preventing a crisis from starting or from being managed well. Some of these are to do with the physical nature of space, such as the short timelines and difficulty of attribution inherent in space operations. Some are due to the way space is used, such as the entanglement of strategic and tactical missions and the prevalence of dual-use technologies. Some are due to the history of space, such the absence of a shared understanding of appropriate behaviors and consequences, and a dearth of stabilizing personal and institutional relationships. While some of these have terrestrial equivalents, taken together, they present a special challenge.

The vulnerability of satellites and first strike incentives

Satellites are inherently fragile and difficult to protect; in the language of strategic planners, space is an “offense-dominant” regime. This can lead to a number of pressures to strike first that don‘t exist for other, better-protected domains. Satellites travel on predictable orbits, and many pass repeatedly over all of the earth‘s nations. Low-earth orbiting satellites are reachable by missiles much less capable than those needed to launch satellites into orbit, as well as by directed energy which can interfere with sensors or with communications channels. Because launch mass is at a premium, satellite armor is impractical. Maneuvers on orbit need costly amounts of fuel, which has to be brought along on launch, limiting satellites‘ ability to move away from threats. And so, these very valuable satellites are also inherently vulnerable and may present as attractive targets.

Thus, an actor with substantial dependence on space has an incentive to strike first if hostilities look probable, to ensure these valuable assets are not lost. Even if both (or all) sides in a conflict prefer not to engage in war, this weakness may provide an incentive to approach it closely anyway.

A RAND Corporation monograph commissioned by the Air Force15 described the issue this way:

First-strike stability is a concept that Glenn Kent and David Thaler developed in 1989 to examine the structural dynamics of mutual deterrence between two or more nuclear states.16 It is similar to crisis stability, which Charles Glaser described as “a measure of the countries‘ incentives not to preempt in a crisis, that is, not to attack first in order to beat the attack of the enemy,”17 except that it does not delve into the psychological factors present in specific crises. Rather, first strike stability focuses on each side‘s force posture and the balance of capabilities and vulnerabilities that could make a crisis unstable should a confrontation occur.

For example, in the case of the United States, the fact that conventional weapons are so heavily dependent on vulnerable satellites may create incentives for the US to strike first terrestrially in the lead up to a confrontation, before its space-derived advantages are eroded by anti-satellite attacks.18 Indeed, any actor for which satellites or space-based weapons are an important part of its military posture, whether for support missions or on-orbit weapons, will feel “use it or lose it” pressure because of the inherent vulnerability of satellites.

Short timelines and difficulty of attribution

The compressed timelines characteristic of crises combine with these “use it or lose it” pressures to shrink timelines. This dynamic couples dangerously with the inherent difficulty of determining the causes of satellite degradation, whether malicious or from natural causes, in a timely way.

Space is a difficult environment in which to operate. Satellites orbit amidst increasing amounts of debris. A collision with a debris object the size of a marble could be catastrophic for a satellite, but objects of that size cannot be reliably tracked. So a failure due to a collision with a small piece of untracked debris may be left open to other interpretations. Satellite electronics are also subject to high levels of damaging radiation. Because of their remoteness, satellites as a rule cannot be repaired or maintained. While on-board diagnostics and space surveillance can help the user understand what went wrong, it is difficult to have a complete picture on short timescales. Satellite failure on-orbit is a regular occurrence19 (indeed, many satellites are kept in service long past their intended lifetimes).

In the past, when fewer actors had access to satellite-disrupting technologies, satellite failures were usually ascribed to “natural” causes. But increasingly, even during times of peace operators may assume malicious intent. More to the point, in a crisis when the costs of inaction may be perceived to be costly, there is an incentive to choose the worst-case interpretation of events even if the information is incomplete or inconclusive.

Entanglement of strategic and tactical missions

During the Cold War, nuclear and conventional arms were well separated, and escalation pathways were relatively clear. While space-based assets performed critical strategic missions, including early warning of ballistic missile launch and secure communications in a crisis, there was a relatively clear sense that these targets were off limits, as attacks could undermine nuclear deterrence. In the Strategic Arms Limitation Treaty, the US and Soviet Union pledged not to interfere with each other‘s “national technical means” of verifying compliance with the agreement, yet another recognition that attacking strategically important satellites could be destabilizing.20 There was also restraint in building the hardware that could hold these assets at risk.

However, where the lines between strategic satellite missions and other missions are blurred, these norms can be weakened. For example, the satellites that provide early warning of ballistic missile launch are associated with nuclear deterrent posture, but also are critical sensors for missile defenses. Strategic surveillance and missile warning satellites also support efforts to locate and destroy mobile conventional missile launchers. Interfering with an early warning sensor satellite might be intended to dissuade an adversary from using nuclear weapons first by degrading their missile defenses and thus hindering their first-strike posture. However, for a state that uses early warning satellites to enable a “hair trigger” or launch-on-attack posture, the interference with such a satellite might instead be interpreted as a precursor to a nuclear attack. It may accelerate the use of nuclear weapons rather than inhibit it.

Misperception and dual-use technologies

Some space technologies and activities can be used both for relatively benign purposes but also for hostile ones. It may be difficult for an actor to understand the intent behind the development, testing, use, and stockpiling of these technologies, and see threats where there are none. (Or miss a threat until it is too late.) This may start a cycle of action and reaction based on misperception. For example, relatively low-mass satellites can now maneuver autonomously and closely approach other satellites without their cooperation; this may be for peaceful purposes such as satellite maintenance or the building of complex space structures, or for more controversial reasons such as intelligence-gathering or anti-satellite attacks.

Ground-based lasers can be used to dazzle the sensors of an adversary‘s remote sensing satellites, and with sufficient power, they may damage those sensors. The power needed to dazzle a satellite is low, achievable with commercially available lasers coupled to a mirror which can track the satellite. Laser ranging networks use low-powered lasers to track satellites and to monitor precisely the Earth‘s shape and gravitational field, and use similar technologies. 21

Higher-powered lasers coupled with satellite-tracking optics have fewer legitimate uses. Because midcourse missile defense systems are intended to destroy long-range ballistic missile warheads, which travel at speeds and altitudes comparable to those of satellites, such defense systems also have inherent ASAT capabilities. In fact, while the technologies being developed for long-range missile defenses might not prove very effective against ballistic missiles—for example, because of the countermeasure problems associated with midcourse missile defense— they could be far more effective against satellites. This capacity is not just theoretical. In 2007, China demonstrated a direct-ascent anti-satellite capability which could be used both in an ASAT and missile defense role, and in 2009, the United States used a ship-based missile defense interceptor to destroy a satellite, as well. US plans indicated a projected inventory of missile defense interceptors with capability to reach all low earth orbiting satellites in the dozens in the 2020s, and in the hundreds by 2030.22

Discrimination

The consequences of interfering with a satellite may be vastly different depending on who is affected and how, and whether the satellite represents a legitimate military objective. However, it will not always be clear who the owners and operators of a satellite are, and users of a satellite‘s services may be numerous and not public. Registration of satellites is incomplete23 and current ownership is not necessarily updated in a readily available repository. The identification of a satellite as military or civilian may be deliberately obscured. Or its value as a military asset may change over time; for example, the share of capacity of a commercial satellite used by military customers may wax and wane. A potential adversary‘s satellite may have different or additional missions that are more vital to that adversary than an outsider may perceive. An ASAT attack that creates persistent debris could result in significant collateral damage to a wide range of other actors; unlike terrestrial attacks, these consequences are not limited geographically, and could harm other users unpredictably.

In 2015, the Pentagon‘s annual wargame, or simulated conflict, involving space assets focused on a future regional conflict. The official report out24 warned that it was hard to keep the conflict contained geographically when using anti-satellite weapons:

As the wargame unfolded, a regional crisis quickly escalated, partly because of the interconnectedness of a multi-domain fight involving a capable adversary. The wargame participants emphasized the challenges in containing horizontal escalation once space control capabilities are employed to achieve limited national objectives.

Lack of shared understanding of consequences/proportionality

States have fairly similar understandings of the implications of military actions on the ground, in the air, and at sea, built over decades of experience. The United States and the Soviet Union/Russia have built some shared understanding of each other‘s strategic thinking on nuclear weapons, though this is less true for other states with nuclear weapons. But in the context of nuclear weapons, there is an arguable understanding about the crisis escalation based on the type of weapon (strategic or tactical) and the target (counterforce—against other nuclear targets, or countervalue—against civilian targets).

Because of a lack of experience in hostilities that target space-based capabilities, it is not entirely clear what the proper response to a space activity is and where the escalation thresholds or “red lines” lie. Exacerbating this is the asymmetry in space investments; not all actors will assign the same value to a given target or same escalatory nature to different weapons. For example, the United States is the country most heavily dependent on military space assets. Its proportionally higher commitment to expeditionary forces make this likely to be true well into the future. So while the United States seeks to create a deterrence framework, punishment-based deterrence would not likely target its adversary‘s space assets. But then there is difficulty finding target on the ground that would be credible but also not unpredictably escalate a crisis. If an American military satellite were attacked but without attendant human casualties (‗satellites have no mothers‘), retaliation on an adversary‘s ground-based target is likely to escalate the conflict, perhaps justifying the adversary‘s subsequent claim to self-defense, even if the initial satellite attack didn‘t support such a claim.

Little experience in engaging substantively in these issues

Related to this issue is that there is relatively little experience among the major space actors in handling a crisis with the others. The United States and the Soviet Union, then Russia, have had a long history of strategic discussions and negotiations. This built up a shared understanding of each other‘s point of view, developed relationships between those conducting those discussions, and created bureaucracies and expertise to support those discussions. This experience and these relationships are important to interpreting events and to resolving disputes before they turn into a crisis, and to managing one once it begins. There is nothing like this level of engagement around space issues between these two states, and much less between the US and China.

One of the participants in a 2010 US space war game, a diplomatic veteran, imagined25 how things would play out if one or more militarily important US satellites failed amidst a crisis with an adversary known to have sophisticated offensive cyber and space capabilities:

The good news is that there has never been a destructive conflict waged in either the space or cyber domains. The bad news is that no one around the situation room table can cite any history from previous wars, or common bilateral understandings with the adversary, relating to space and cyber conflict as a guide to what the incoming reports mean, and what may or may not happen next.

This is the big difference between the space-cyber domains, and the nuclear domain. There is, in this future scenario, no credible basis for anyone around the president to attribute restraint to the adversary, no track record from which to interpret the actions by the adversary. There is no crisis management history: the president has no bilateral understandings or guidelines from past diplomatic discussions, and no operational protocols from previous incidents where space and cyber moves and counter-moves created precedents. Perhaps the adversary intended to make a point with one series of limited attacks, and hoped for talks with Washington and a compromise; but for all the president knows, sitting in the situation room, the hostile actions taken against America‘s space assets and information systems are nothing less than early stages of an all-out assault on US interests.

#### The plan pushes talks over the edge by granting UN COPUOS new authority in line with existing OST principles – any other process fails.

Qizhi 86 [He Qizhi, member of the Governing Board of the Chinese Society of International Law, “On strengthening the role of COPUOS: Maintaining outer space for peaceful uses,” 1986, *Space Policy*, Vol. 2, Issue 1, https://www.sciencedirect.com/science/article/abs/pii/0265964686900032, EA]

The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) is the first and foremost among multinational organs working for the promotion of peaceful uses of space science and technology. COPUOS has become the forum for elaborating internationally accepted legal principles governing space activities. It has produced five international conventions on the exploration and peaceful uses of outer space, constituting the fundamental body of international space law. A number of other legal items - such as the draft principles on remote sensing from space, the elaboration of rules concerning the use of nuclear power sources in outer space, the definition and delimitation of outer space, and the principles on the use of geostationary orbit- remain on the agenda of the Legal SubCommittee, one of the two subordinate bodies. All of these questions have important bearing on the interests of every country. The most advanced question is establishing the principles of remote sensing; these discussions have entered a final stage and consensus may be reached in the near future, if a spirit of compromise and cooperation continues to prevail among the negotiating states.

In the field of technical cooperation in space affairs, COPUOS and its other subordinate body, the Scientific and Technical Sub-Committee, have also done much work and achieved considerable successes. The United Nations Space Application Programme has greatly contributed to the dissemination and exchange of space technology for economic and social development. A series of training seminars and workshops on applications of space technology has been held under its auspices for participants from developing countries. Through this programme, technical advice is available on request.

Viewed as a whole, the historic role of COPUOS is significant; however, there are deficiencies in its work and effectiveness. In order to maintain outer space for peaceful uses in the interests of all countries, particularly the developing countries, the Committee should be further strengthened to play a more productive and important role in expanding international cooperation.

Legal framework

It is useful here to provide a summary of the general legal regime upon which the peaceful uses of outer space have functioned. Its basic principles and rules are enshrined in the 1967 Outer Space Treaty - the main space law instrument of our times - and further developed in the four additional international treaties. All these documents were negotiated and concluded by COPUOS, and contain the following general provisions relating to the maintenance of outer space for peaceful uses.

The exploration and use of outer space shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all humankind.

Outer space shall be free for exploration and use by all states without discrimination, and is not subject to national appropriation by claim of sovereignty, by means of use or occupation or by any other means.

Activities in the exploration and use of outer space shall be carried out in accordance with international law, including the Charter of the United Nations, in the interests of maintaining international peace and security and promoting international cooperation and understanding.

Astronauts shall be rendered all possible assistance in the event of accident, distress or emergency. This provision was further elaborated by the 1968 Agreement on the Rescue of Astronauts and the Return of Objects Launched into Outer Space.

States shall bear international responsibility for national space activities, whether carried out by governmental or non-governmental entities. This provision was further developed as the 1972 Covention on International Liability for Damage Caused by Space Objects.

The launching state shall inform the Secretary-General of the United Nations of the required information concerning the space objects, and the state of registry shall retain jurisdiction and control over such objects and any personnel thereof. In support of this provision, the 1975 Convention on Registration of Objects Launched into Outer Space was elaborated.

The fifth legal instrument, the 1979 Agreement Governing the Activities of States on the Moon and other Celestial Bodies (the Moon Agreement), is largely an elaboration of the general provisions of the 1967 Outer Space Treaty in the specific context of the Moon and other celestial bodies. It contains a new and important principle, that the Moon and its natural resources are the "common heritage of mankind', and that states party to the agreement shall establish an international regime to govern the exploitation of the natural resources of the Moon as such exploitation is about to become feasible'.

These are the general principles and rules relevant to the peaceful uses of outer space. For instance, the principle of common benefit, though requiring further specification, constitutes a duty upon each member not to misuse outer space in a way which would lead to the detriment of the interests of humankind. So do the principle that international law (including the United Nations Charter) applies to space, and other principles. All of these contribute to the satisfactory functioning of peaceful activities in outer space.

Two-pronged approaches

To ensure outer space for peaceful uses, it is necessary not only to elaborate general principles as mentioned above, but also to make specific provisions directly involved with the protection of a peaceful environment in outer space which is the province of humankind.

With regard to the destructive possibilities in outer space, foremost among them is the growing danger of militarization. This has deeply concerned the international community, even more than other possible harmful developments such as contamination, pollution and space debris. The 1967 Outer Space Treaty took a two-pronged approach in dealing with these direct dangers.

First, foreseeing that outer space might become a battleground of the major space powers, the treaty lays down certain restrictions on military activities in outer space, thus providing some degree of arms control and disarmament. Paragraph I of Article IV stipulates: "states parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies or station such weapons in outer space in any other manner'. Paragraph II provides for general demilitarization of the Moon and other celestial bodies, and declares that they shall be used exclusively for peaceful purposes. The 1979 Moon Agreement makes further and far-reaching provisions for demilitarization of the Moon and other celestial bodies. It came into force in 1984, but has not been ratified by either of the two major space powers.

It is clear from the existing provisions that, although prohibitions are placed on nuclear weapons and weapons of mass destruction, there is no express prohibition on the introduction of other kinds of weapons in outer space. It is generally held that this is a lacuna of the Outer Space Treaty which should be further discussed in the United Nations and eventually be filled.

Second, in dealing with other potential dangers, Article IX of the Outer Space Treaty obliges its members (1) to conduct their space activities with due regard to the corresponding interests of all other states; (2) to avoid harmful contamination and adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter; (3) to undertake international consultations if such activities would cause potential harmful interference with activities of other states.

Thus the Outer Space Treaty lays down principles of a general nature establishing as international obligation not to undertake activities which would adversely affect the space environment, while leaving concrete and detailed measures and provisions to be further elaborated in additional legal instruments.

Considerations and conclusion

The COPUOS, as the major United Nations organ dealing with space matters, has a key role to play in preserving outer space for peaceful uses. The following considerations could be raised with a view to increasing the contribution of COPUOS to the achievement of this lofty goal.

One: strengthening and expanding the role of COPUOS in accordance with its mandate. In a resolution in 1961, the United Nations General Viewpoint Assembly decided that COPUOS should provide a focal point for international cooperation in the peaceful exploration and use of outer space. Thus, it is vital not to bypass COPUOS, nor to weaken its function by entrusting what falls within its terms of reference to a new forum or other organs.

Two: reviewing the existing internationally accepted legal document by COPUOS and its Sub-Committees, with a view to supplementing or expanding the relevant principles to meet new developments. It has been pointed out that there are weaknesses and loopholes in the existing treaties. The best way to deal with these seems to be to retain the provisions covering related matters in the existing treaties as general principles, while elaborating supplementary rules by additional instruments. In this way, the original treaty could remain intact, with additional protocols being concluded consistent with the aim and principles of the main treaty.

Three: reviewing the working method of COPUOS and its two Sub-Committees in order to find the best way to make them more effective. New relevant items, both technical and legal, could be placed on the agenda of COPUOS and the two Sub-Committees through consultation and discussion by the parties. This would help to keep COPUOS in accordance with its mandate as the only intergovernmental body exclusively concerned with all aspects of the peaceful uses of outer space.

Four: involvement of COPUOS and its Legal Sub-Committees in the demilitarization of outer space, which is an essential condition for maintaining outer space for peaceful uses. COPUOS, while focusing its attention on peaceful uses, cannot but touch upon the other side of the question: the prevention of an arms race in outer space. Although the primary role of space arms control was entrusted to the Conference on Disarmament, COPUOS as the parent body of the Outer Space Treaty could also play a supportive role in the negotiations on space weapons. This would in turn add new impetus to international cooperation in the peaceful uses of outer space and progressive development of space law.

In conclusion, the role of COPUOS should be strengthened in order to establish further the conditions essential for maintaining peaceful uses of outer space. In addition to general basic conditions, there are issues of control and elimination of destructive interferences: foremost among these is the growing danger of militarization of outer space. The issues of contamination, pollution and space debris have also to be dealt with. Only by properly solving these issues can the peaceful uses of outer space really be ensured.

## Framework

#### The standard is maximizing expected wellbeing.

#### 1] Actor spec – governments must use util because they don’t have intentions and are constantly dealing with tradeoffs—takes out calc indicts since they are empirically denied.

#### 2] Death is bad and outweighs – a] agents can’t act if they fear for their bodily security which constrains every ethical theory, b] it destroys the subject itself – kills any ability to achieve value in ethics since life is a prerequisite which means it’s a side constraint since we can’t reach the end goal of ethics without life

#### 3] Extinction outweighs – magnitude, irreversibility, uncertainty.

MacAskill 14 [William MacAskill, Associate Professor in Philosophy and Research Fellow at the Global Priorities Institute, University of Oxford, “Normative Uncertainty,” 2014, University of Oxford PhD Thesis, http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.677.4121&rep=rep1&type=pdf]

However, even if we believe in a moral view according to which human extinction would be a good thing, we still have strong reason to prevent near-term human extinction. To see this, we must note three points. First, we should note that the extinction of the human race is an extremely high stakes moral issue. Humanity could be around for a very long time: if humans survive as long as the median mammal species, we will last another two million years. 188 On this estimate, the number of humans in existence in the future, given that we don’t go extinct anytime soon, would be 2×10^14. 189 So if it is good to bring new people into existence, then it’s very good to prevent human extinction.

Second, human extinction is by its nature an irreversible scenario. If we continue to exist, then we always have the option of letting ourselves go extinct in the future (or, perhaps more realistically, of considerably reducing population size). But if we go extinct, then we can’t magically bring ourselves back into existence at a later date.

Third, we should expect ourselves to progress, morally, over the next few centuries, as we have progressed in the past. So we should expect that in a few centuries’ time we will have better evidence about how to evaluate human extinction than we currently have.