### **Frame Work**

#### **I value morality.**

#### 

#### **Pleasure and pain are the starting point for moral reasoning—they’re our most baseline desires and the only things that explain the intrinsic value of objects or actions**

#### **Moen 16, Ole Martin (PhD, Research Fellow in Philosophy at University of Oslo). "An Argument for Hedonism." Journal of Value Inquiry 50.2 (2016): 267. SMLet us start by observing, empirically, that *a widely shared judgment about intrinsic value* and disvalue *is that pleasure is intrinsically valuable and pain is intrinsically disvaluable*. On virtually any proposed list of intrinsic values and disvalues (we will look at some of them below), pleasure is included among the intrinsic values and pain among the intrinsic disvalues. This inclusion makes intuitive sense, moreover, for *there is something undeniably good about* the way *pleasure* feels and something undeniably bad about the way pain feels, and neither the goodness of pleasure nor the badness of pain seems to be exhausted by the further effects that these experiences might have. “Pleasure” and “pain” are here understood inclusively, as encompassing anything hedonically positive and anything hedonically negative. 2 The special value statuses of pleasure and pain are manifested in how we treat these experiences in our everyday reasoning about values. If you tell me that you are heading for the convenience store, *I might ask: “What for*?” This is a reasonable question, for when you go to the convenience store you usually do so, not merely for the sake of going to the convenience store, but for the sake of achieving something further that you deem to be valuable. You might answer, for example: “To buy soda.” This answer makes sense, for soda is a nice thing and you can get it at the convenience store. I might further inquire, however: “What is buying the soda good for?” This further question can also be a reasonable one, for it need not be obvious why you want the soda. You might answer: “Well, I want it for the pleasure of drinking it.” If I then proceed by asking “But what is the pleasure of drinking the soda good for?” the discussion is likely to reach an awkward end. *The reason is that* the *pleasure is not good for anything further*; it is simply that for which going to the convenience store and buying the soda is good. 3 As Aristotle observes: “*We never ask* [a man] *what* his *end is in being pleased, because we assume* that *pleasure is* choice *worthy in itself*.”4 Presumably, a similar story can be told in the case of pains, for if someone says “This is painful!” we never respond by asking: “And why is that a problem?” We take for granted that *if something is painful, we have a sufficient explanation of why it is bad*. If we are onto something in our everyday reasoning about values, it seems that *pleasure* and pain are both places where we *reach the end of the line in matters of value*. Although pleasure and pain thus seem to be good candidates *for intrinsic value* and disvalue, several objections have been raised against this suggestion: (1) that pleasure and pain have instrumental but not intrinsic value/disvalue; (2) that pleasure and pain gain their value/disvalue derivatively, in virtue of satisfying/frustrating our desires; (3) that there is a subset of pleasures that are not intrinsically valuable (so-called “evil pleasures”) and a subset of pains that are not intrinsically disvaluable (so-called “noble pains”), and (4) that pain asymbolia, masochism, and practices such as wiggling a loose tooth render it implausible that pain is intrinsically disvaluable. I shall argue that these objections fail. Though it is, of course, an open question whether other objections to P1 might be more successful, I shall assume that if (1)–(4) fail, we are justified in believing that P1 is true itself a paragon of freedom—there will always be some agents able to interfere substantially with one’s choices. The effective level of protection one enjoys, and hence one’s actual degree of freedom, will vary according to multiple factors: how powerful one is, how powerful individuals in one’s vicinity are, how frequent police patrols are, and so on. Now, we saw above that what makes a slave unfree on Pettit’s view is the fact that his master has the power to interfere arbitrarily with his choices; in other words, what makes the slave unfree is the power relation that obtains between his master and him. The difﬁculty is that, in light of the facts I just mentioned, there is no reason to think that this power relation will be unique. A similar relation could obtain between the master and someone other than the slave: absent perfect state control, the master may very well have enough power to interfere in the lives of countless individuals. Yet it would be wrong to infer that these individuals lack freedom in the way the slave does; if they lack anything, it seems to be security. A problematic power relation can also obtain between the slave and someone other than the master, since there may be citizens who are more powerful than the master and who can therefore interfere with the slave’s choices at their discretion. Once again, it would be wrong to infer that these individuals make the slave unfree in the same way that the master does. Something appears to be missing from Pettit’s view. If I live in a particularly nasty part of town, then it may turn out that, when all the relevant factors are taken into account, I am just as vulnerable to outside interference as are the slaves in the royal palace, yet it does not follow that our conditions are equivalent from the point of view of freedom. As a matter of fact, we may be equally vulnerable to outside interference, but as a matter of right, our standings could not be more different. I have legal recourse against anyone who interferes with my freedom; the recourse may not be very effective—presumably it is not, if my overall vulnerability to outside interference is comparable to that of a slave— but I still have full legal standing.68 By contrast, the slave lacks legal recourse against the interventions of one speciﬁc individual: his master. It is that fact, on a Kantian view—a fact about the legal relation in which a slave stands to his master—that sets slaves apart from freemen. The point may appear trivial, but it does get something right: whereas one cannot identify a power relation that obtains uniquely between a slave and his master, the legal relation between them is undeniably unique. A master’s right to interfere with respect to his slave does not extend to freemen, regardless of how vulnerable they might be as a matter of fact, and citizens other than the master do not have the right to order the slave around, regardless of how powerful they might be. This suggests that Kant is correct in thinking that the ideal of freedom is essentially linked to a person’s having full legal standing. More speciﬁcally, he is correct in holding that the importance of rights is not exhausted by their contribution to the level of protection that an individual enjoys, as it must be on an instrumental view like Pettit’s. Although it does matter that rights be enforced with reasonable effectiveness, the sheer fact that one has adequate legal rights is essential to one’s standing as a free citizen. In this respect, Kant stays faithful to the idea that freedom is primarily a matter of standing—a standing that the freeman has and that the slave lacks. Pettit himself frequently insists on the idea, but he fails to do it justice when he claims that freedom is simply a matter of being adequately (and reliably) shielded against the strength of others. As Kant recognizes, the standing of a free citizen is a more complex matter than that. One could perhaps worry that the idea of legal standing is something of a red herring here—that it must ultimately be reducible to a complex network of power relations and, hence, that the position I attribute to Kant differs only nominally from Pettit’s. That seems to me doubtful. Viewing legal standing as essential to freedom makes sense only if our conception of the former includes conceptions of what constitutes a fully adequate scheme of legal rights, appropriate legal recourse, justiﬁed punishment, and so on. Only if one believes that these notions all boil down to power relations will Kant’s position appear similar to Pettit’s. On any other view—and certainly that includes most views recently defended by philosophers—the notion of legal standing will outstrip the power relations that ground Pettit’s theory.**

#### 

#### **Thus, the standard is maximizing expected well-being. Prefer additionally –**

#### 

#### **[1] All other frameworks collapse –**

#### **a)** **Actor specificity – Only util solves tradeoffs because we aggregate based on consequences – outweighs since the res is a question of government obligations.**

#### **b)** **Lexical pre-requisite – focusing on extinction precludes all other ethics – you can’t uphold moral values if you’re dead.**

#### 

#### **[2] Framework defines what obligations are – that means it’s also a topicality issue, so we must theoretically defend our interpretation – I defend ought as the standard text. Prefer it:**

#### **a)** **Ground – all impacts function under util whereas other ethics flow to one side exclusively – makes util the fairest.**

#### **b)** **Topic ed – util forces debates about what happens in the real world because we must analyze consequences of the plan – increases topic ed because it forces research on the effects of the resolution – key to education because we use it in the real-world to talk about current topics. Outweighs phil ed – we can learn about Kant on other topics or at camp, but topical debate only happens now.**

## 

### **Adv: Commercial Space**

#### **Centuries of empirics prove strong property rights are the key driver of investment – specifically true for the space economy**

**CEA 21** [Council of Economic Advisers, executive agency advising the president on economic policy, 2021, “Exploring New Frontiers in Space Policy and Property Rights,” Economic Report of the President, https://www.govinfo.gov/content/pkg/ERP-2021/pdf/ERP-2021-chapter8.pdf]/Kankee

Historical Examples of Property Rights Evolution Historical examples of the development of property rights establish that without these extra sticks in the property rights bundle, we should expect to see **higher costs** and **lower benefits** from investments in the space economy, potentially hindering future developments in outer space. The early history of oil drilling provides an example of how resources are likely to be wasted if property rights are not established in a timely manner. Until the early 20th century, oil was not considered property until it was extracted. This led to what Libecap and Smith (2002) call extractive anarchy. Companies drilled wells without concern for maximizing the amount of oil produced from a well, but instead sought to be the first to extract and claim ownership of the oil. Oil flows from a well because of the pressure inside the reservoir; if too many wells are drilled into one reservoir, then the pressure escapes too quickly to push the oil in the reservoir up the well. As a result, less oil is extracted. By 1914, the director of the Federal Bureau of Mines estimated that a quarter of the value of all petroleum production was being wasted due to the race to extract oil. Further, due to oil and natural gas being found together in a reservoir, the lower-valued natural gas was often vented into the atmosphere to ensure that the oil was extracted and thus ownership was secured. As time went on, the structure of property rights for oil and gas has changed to allow for increased value to be created from investments in resource extraction. Without clear in situ property rights for subsurface resources, space could see a repeat of this behavior for its natural resources. Many elements that are common in space are frequently used in important technologies. Iron, aluminum, and titanium are elements critical to the production of electrical components. Silicon is a raw material for solar panels and computers. Extracted water can be broken down into hydrogen and oxygen to meet a variety of needs—oxygen is breathable, recombining hydrogen and oxygen generates electrical power, and liquid hydrogen and liquid oxygen can serve as propellants (Butow et al. 2020). Though it may sound futuristic, we can imagine a situation where mining expeditions **recklessly** extract resources from various celestial bodies, severely depleting the deposit of resources and **diminishing** the **r**eturns **o**n future **i**nvestment in mining. Therefore, defining property rights now to ensure the responsible use of resources in space could lead to future **higher** levels of **demand** and **investment** in exploration and a more **sustainable** space economy. A similar story emerges for mineral rights in Nevada during the 19th century (Libecap 1978). As new deposits of minerals were found, especially those deposits further underground requiring increased investment for extraction, the specification and enforcement of property rights increased. One of the largest deposits in Nevada, the Comstock Lode, was discovered while Nevada was still a Federal territory. Property rights for discoveries on Federal lands were lacking at the time, so citizens created a series of local laws and eventually founded the State of Nevada to ensure these property rights. Libecap (1978) shows that as deposits increased in value, local property rights specification also increased. It may seem difficult to imagine how local property rights would be formed in space as in territorial Nevada, given the lack of settlements in space. However, this history implies that it is important to set these rules as economic actors spend extended time in space in order to maximize the future investment in the space economy.

Investment Responses to Property Right Enhancement All the space policy developments discussed above have improved the ability of investors to set expectations for the manner in which benefits flow from investments in space. The historical examples given argue that further specifying property rights will **bolster** **investment** in the space economy. Increased investments in the space economy will lead to advances in space technology. In this subsection, we discuss the economics literature that addresses the effects of setting and strengthening property rights on both investment and economic growth. The research presented here aims to convey that the benefits for economic activity from improved setting of expectations that clarifies property rights is universal and not just due to specific circumstances of time and/or place. Losses from short-term decisionmaking. A growing concern for future space exploration activities arises from a lack of property rights security leading to **short-term** decisionmaking, which may **inhibit** long-term human activity. Many empirical studies show that insecure property rights lead to investment decisions with lower values. Many of these studies have come from analyses of water rights in the western United States. In what is known as the Prior Appropriation Doctrine, water rights are handed out based on a “first in time, first in right” principle. Given that the amount of water available changes each year due to precipitation patterns, water rights holders that were, earlier in time, known as senior rights holders are more likely to receive their water allocation each year than those that were later in time, known as junior rights

holders. Leonard and Libecap (2019) argue that the Prior Appropriation Doctrine, with its clear rights for senior rights holders, allowed for investment in irrigation technologies. Given the climate of the western United States, large-scale investment in irrigation is required to maximize the productivity of large swaths of land. Leonard and Libecap estimate that 16 percent of western States’ income in 1930 is attributable to investments made in irrigation that would not have occurred without secure property rights. Another concern with insecure property rights is that owners of natural resources **rush to extract** them to ensure that they accrue the benefits of their investments. This rush to extract resources has a **detrimental** effect on the value obtained from those resources and other **negative spillover** effects on society. One example is the increase in the rate of deforestation that occurs when property rights for the land are insecure (Bohn and Deacon 2000). Ferreira (2004) finds that those countries with clearly defined property rights experience less deforestation than those with weaker protections. Kemal and Lange (2018) find that a reduced chance of oil well expropriation in Indonesia lowered the rate of extraction by up to 40 percent. If short-term decisionmaking prevails in the initial incursions into space, the future of the space economy could be **seriously harmed**. Depleting the resources necessary to **sustain** life in space would mean having to transport these resources from Earth at a prohibitive cost and complexity. Therefore, protecting and responsibly using the resources available in space is more efficient in the long term. If done prudently, establishing property rights in space could **diminish** the risk of short-term decisionmaking and strengthen the ability of humans to receive benefits from space.

Enhanced investment and asset value. Frameworks such as the U.S. Commercial Space Launch Competitiveness Act and the Artemis Accords enhance property rights by providing **clear expectations** of the benefits one can receive from their investment and providing a list of principles that partner nations will follow as a way to encourage economic activity in space. One branch of the economics literature uses legal or legislative decisions that **enhance** or diminish property rights to determine how investment and asset values respond to a change in property rights specification. We discuss this literature here. Later in the chapter, we apply the conclusions of these studies to estimate the value of enhancing property rights in space. Alston and Smith (2020) measure the effect of uncertain property rights resulting from the manner in which Northern Pacific Railroad’s land ay without recourse, their assets have lower values relative to New Zealand’s firms. In an additional analysis, Grainger and Costello (2014) show that the increased security of property rights with the settling of an ownership dispute between native New Zealanders, known as the Maori, and New Zealanders of European descent improved the perpetuity value of fishing quotas by 50 percent. Ensuring that property rights will be **honored** is **very important** for market participants in understanding the value of their asset. Galiani and Schargodsky (2010) use a court case in Argentina to estimate the effect of secure property rights for one’s home on household decisions. Their results show that households that gained secure property rights increased their investments in the home structure. Investment in walls and roofs increased by 40 percent and 47 percent, respectively, as a

result of households being granted title to the home. Though not directly related to space assets, the available **evidence** demonstrates that more secure property rights lead to other **spillover benefits** that are not directly related to the assets on which a property rights are granted. Galiani and Schargodsky (2010) find that when households had increased property rights security, they increased investment in their children’s education. Children in households who obtained the secure property rights on their land achieved an extra 0.7 year of schooling on average. This is an important spillover effect given the large individual and societal benefits of extra years of education (see chapter 7 of this Report). Telecommunications satellites orbiting Earth provide an example of positive spillovers from ensuring secure property rights in space. The International Telecommunication Union (ITU) is an organization that standardizes rules and regulations for a wide range of communications. Through the ITU, the United States was able to operate satellites that used specific frequencies to transmit information to Earth, thereby allowing companies to invest in utilizing those signals for commercial purposes. Communications satellites in geosynchronous orbit rely on the ITU to secure access to specific orbital slots as well as specific frequencies.

Protection against expropriation. A number of nongovernmental organizations produce indices that measure property rights protections or general institutional quality. The indices attempt to quantify the relative level of property rights characteristics, such as the rule of law or protection against expropriation risk, that are consistent across countries and time. A large body of economics literature uses these country-level indices of institutional quality to determine the extent to which improvements in property rights enforcement affect economic outcomes. Policies initiated under the Trump Administration would likely alter these indices in a measurable way if there were a property rights index for space. Seminal work by Acemoglu, Johnson, and Robinson (2001) shows that improving the enforcement of property rights, in this case property rights that protect against expropriation risk, has **large effects** on gross domestic product (GDP). In their analysis, the authors show that a one-unit improvement in the protection against expropriation risk would lead to **more than doubling** GDP per capita 10 years later. Similar results are found when researchers examine specific industries. For example, Cust and Harding (2020) show that firms drill for oil **twice** as often in countries with stronger property rights enforcement relative to t of the last year’s space policy developments on future investment, given the available evidence. Table 8-2 summarizes the effects of most of the studies discussed in the previous section. All these effects are large in magnitude. Another data point is the increase of investment in the space economy in the United States with the passage of the U.S. Commercial Space Launch Competitiveness Act in 2015 relative to investments in other countries. Using the Space Capital data discussed in the second section, and the historical examples given above, the CEA estimates the increase in investment in the United States due to the improved property rights specification in 2015. Controlling for country and time period effects, the data show a statistically **significant** increase in investment of **92 percent**—or roughly **double**—in the United States since passage of the U.S. Commercial Space Launch Competitiveness Act relative to countries that did not improve property specification. Together, these small improvements in the security of property rights have the potential to lead to **large** **increases** in investment. As an approximation, the CEA assumes that these improvements in property rights security will **double** the amount of investment in space. This number is in line with the evidence that has been discussed here. To project the effect of the enhancements of property rights security that the Trump Administration’s policies have achieved, the CEA starts with data from Space Capital on total private investment in space activities. Figure 8-4 illustrates the increasing rate of private investment in space activities. The review of the literature discussed above shows that further property rights specification leads to increased investment and further economic activity. In figure 8-4, the diverging lines from 2020 to 2028 project the expected path of private investment as a result of policy developments in 2020. The Space Capital data suggest that a linear projection of private investment in space would reach $23 billion in 2028, which is illustrated by the blue dashed line in figure 8-4. However, this does not take into account property rights enhancements that occurred in 2020 or will be occurring in the future. Therefore, the CEA projects that private investment in space will reach $46 billion by 2028. This projection is based on a doubling of investment over the eight-year period, which is in line with empirical estimates in the academic literature discussed above. Establishing rights to distant resources with the goals of incentivizing economic development and investment has not always produced the desired results. The above-mentioned examples demonstrate how property rights specification and security can lead to increased investment. However, aligning incentives is a necessary but not sufficient condition in the short term. For example, the leading asteroid mining companies that were supporting the space resources language in the Commercial Space Launch Amendments Act of 2004 have both failed, despite the benefit of positive Federal legislation. In addition, the Deep Seabed Hard Mineral Resources Act, which was passed in 1980, established a legal system for extracting resources from the deep seabed with hopes of achieving economic viability before 2000. Forty years after the law’s passage, the deep seabed mineral extraction industry still lacks the technology for economical extraction and does not bolster the argument that enhanced property rights typically unlock commercial value. Certain similarities do exist with the space industry, such as the need for technological innovation, the considerable distance to the resources, and some uncertainty about the types of resources for extraction. Moreover, the space resource extraction industry currently lacks a customer base other than national governments, and even government demand will not become substantive until robust human and robotic operations on the lunar surface and elsewhere can be established. However, several key differences would support a space resource extraction industry. First, the commercial space industry benefits from public investment in civil space exploration, which might result in a decreased amount of investment necessary for the development of basic technologies. In addition, space exploration and research remain a national priority for many countries, which may drive further development of the industrial base. Moreover, space resource extraction potentially offers more valuable resources than deep sea mining (Barton and Recht 2018). Looking Ahead

#### **OST non-appropriation regs wreck legal certainty required for investor confidence in asteroid mining**

**Campo 21** [Jose A. Martin del Campo, J.D. Candidate at Texas A&M University School of Law, 3-23-2021, “Finders K Finders Keepers: Who Has Say Over Private Property in Space,” Texas A&M Journal of Property Law, https://scholarship.law.tamu.edu/cgi/viewcontent.cgi?article=1155&context=journal-of-property-law]/Kpels the search for extraterrestrial materials such as water and minerals.4 According to NASA, minerals found in the asteroid belt between Mars and Jupiter contain an estimated value of approximately $100 billion for every person on Earth.5 However, **uncertainty** lingers because private entities are **unsure** that they will possess **property rights** to their payload or the mined celestial body.6 Celestial bodies refer to naturally occurring objects in w is a combination of agreements with the foundation of space law consisting of the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (“Outer Space Treaty”).9 At the time of signing, the Outer Space Treaty hoped to foster cooperative and peaceful exploration of outer space without discrimination of any kind.10 However, **Article II** of the **O**uter **S**pace **T**reaty contains the bane of private property rights in outer space, which **forbids** the **national appropriation** of the moon and other celestial bodies.11 While the Outer Space Treaty explicitly mentions the prohibition of public entities claiming celestial bodies, private enterprises risk **failing** to have their interest in property rights **recognized** by the global community. Private entities and investors grapple with the issues pertaining to their rights to mine and extract resources from outer space legally. Without further international **recognition** of their property rights, private entities may **shy away from** exploring the concept of celestial mining. The issue of not knowing what laws are **applicable**, or to whom private companies are accountable, **impedes** the **progress** private entities make in achieving their goal of harvesting extraterrestrial resources. Private entities fear that the **non-appropriation** clause of Article II of the Outer Space Treaty, the epicenter of the issue, will **strip** them of the right to transport their mined resources back to Earth. A new legal regime will likely need to be formed that facilitates the continuation of innovation and promotes the exploration of outer space. Whether or not past private and public international doctrines, i.e., the law of the sea, may provide guidance in creating a new doctrine of space law is yet to be determined. The advancement in modern technology, along with the depletion of natural resources, creates a unique opportunity for private entities to resolve this issue through the exploitation of outer space. Space law is once again relevant due to its inadequacies in protecting the property rights of said entities in space. Part II will explore the different treaties and principles that gave rise to space law, and Part III will analyze whether the application of such principles should continue, or if the establishment of a new regime offers a more beneficial long-term solution. Part IV will then explore the structure of a new outer space regime and the enforcement of property rights. II. LEGAL PRINCIPLES INFLUENCING THE DEVELOPMENT OF SPACE LAW

#### **Strong property rights protected internationally are key for investment**

**Foster 17** [Craig Foster, J.D., University of Illinois College of Law and attorney, 2017, “EXCUSE ME, YOU’RE MINING MY ASTEROID: SPACE PROPERTY RIGHTS AND THE U.S. SPACE RESOURCE EXPLORATION AND UTILIZATION ACT OF 2015,” JOURNAL OF LAW, TECHNOLOGY & POLICY, http://illinoisjltp.com/journal/wp-content/uploads/2016/11/Foster.pdf]/Kankee

B. Technological Advancements Minerals on asteroids are ripe for the taking, but space-mining technology is still in its infancy. People who sought riches of gold in the mid-1800s sped to California with dreams and primitive tools. The available technology was sufficient to allow even the layperson to extract small bits of gold from the ground.20 The same is not true with asteroid mining. Quite simply, dreams of asteroid mining are bountiful, but the tools needed to do it simply do not exist yet.21 Some estimate that it will be a decade or more before a company is actually able to extract anything of value from an asteroid.22 Not surprisingly, the development of these tools **costs** an extraordinary amount of money—possibly into the **billions** of dollars.23 So costly, in fact, that some believe the lead to launches of larger and more sophisticated satellites—the Arkyd 200 Series Interceptor and Arkyd 300 Series Rendezvous Prospector—that will be able to orbit asteroids and obtain very specific information that is currently impossible to acquire.34 Finally, PR recently announced its newest technology, the Ceres system.35 The Ceres, based upon the Arkyd 100, is a satellite system made up of ten smaller g way to go before it becomes a reality, especially for commercial purposes. C. The Current State of International Law and Property Rights in Space

Many applaud efforts being made to mine asteroids and cite its potential to greatly enhance the Earth’s economy and reduce reliance on fossil fuels.86 Without the promise that extracted resources will be able to be sold for profit, though, private companies like PR, DSI, and KESE will have **little incentive** to continue their asteroid mining efforts. So, what assurances currently exist for these companies to believe that they will be conveyed ownership of resources mined from asteroids? The short answer is that current international laws seem to **frown upon** owning celestial materials, but precedent suggests that the practical effect of these laws on ownership of space materials is minimal.87 1. International Treaties Space is understood as a global commons owned by all of humankind— like the high seas, polar regions, and the atmosphere.88 The doctrine of the “global commons” refers to n and claim formerly unclaimed property in the public domain.104 In the western world, this doctrine came to be most useful in the mining context. Pedis Possessio Doctrine is a principle of mining law which says that a qualified person who peaceably and in good faith enters a land in the public domain in search of valuable minerals may hold the place exclusively against others having no better title provided s/he remains in continuous exclusive occupancy and diligently and in good faith prosecutes work towards making a discovery. This principle provides a person exploring an area freedom from fraudulent or forcible intrusions while actually working on the site.105 The **O**uter **S**pace **T**reaty makes appropriation of celestial bodies **impossible**,106 but it might be argued under the doctrine of pedis possessio that, because asteroids are within the public domain, prospectors are granted the exclusive and unimpeded right to any resources they seek to extract.107 “Regarding claiming ownership over asteroidal resources, it appears that the ancient Roman law of pedis possessio will apply. Pedis possessio is the basis for Western law on ownership, and analogies have long existed in other parts of the world as well.”108 3. Historical International Precedent There is some historical precedent that suggests that the international community might be open to the commercialization of space resources. In 2004, the International Institute of Space Law (IISL), an independent nongovernmental organization, released a statement affirming that private appropriation of entire space bodies is **prohibited** under the Outer Space Treaty.109 Notwithstanding this prohibition, the IISL also acknowledged that “other private activities on the Moon and other celestial bodies are permitted.”110 The IISL stated, “Article VI of the Outer Space Treaty affirms that nongovernmental entities, including private individuals, companies, and organizations, have the right to conduct activities in space in accordance with international space law, and subject to the authorization and continuing supervision of the appropriate State Party.”111 Additionally, both the U.S. and Russia have removed rock and dust from the Moon without facing legal repercussions.112 In fact, small lunar particles, brought back on the Soviet Luna 16 probe in 1970, were sold at auction for $442,500 in 1993.113 President Nixon even handed out plaques to 192 foreign dignitaries that contained lunar dust from the Apollo 11 mission.114 Congress also passed a law in 2012 that allows U.S. astronauts to own and sell various mementos from their time in space—a number of which are caked with lunar dust.115 The law, though, explicitly prohibits them from selling lunar rocks and other lunar materials.116 III. ANALYSIS A. Need for Legislation Even if companies are able to mine precious resources from asteroids, it is not entirely clear that they have any **ownership rights** to those resources. Mining on Earth, especially in the U.S., is heavily regulated.117 There are complex and well-developed laws governing every part of the process—both at the federal and state level.118 By contrast, as already discussed, the existing international law on property acquired in space is **vague**.119 This poses a number of problems for companies and nations as they make strides to mine from asteroids. The most obvious problem is whether a mining entity can legally claim ownership of resources mined from asteroids.120 A related concern for companies— especially in the early stages of technology development—is funding.121 If asteroid mining is to be encouraged, then companies will need to **convince** potential investors that the resources obtained can be claimed and sold to make a profit.122 **Investor confidence** will be **greatly enhanced** by such ownership protections.123 Conflict and jurisdiction are additional **concerns**. What happens if two **competitors** or **nations** try to mine from the same asteroid? What if a company causes irreparable damage to the asteroid or the equipment of a competitor? What country’s laws govern a conflict between two nations? One can imagine a swarm of similar conflicts that might arise. Such **conflicts** could be greatly mitigated with proactive legislation, both at the national and international levels. Finally, there is also concern about diving headlong into mining without considering the effects on the space environment. Namely, the “space debris problem” is concerning to some scientists who note that the area around the Earth is already filling up with debris from spacecraft and missions.124 This debris can threaten humanity’s ability to safely leave Earth’s atmosphere, as well as the ability for satellites (which are used in everyday life for a multitude of reasons) to move effectively in orbit.125 If a modern gold rush in space is in the near future, this debris problem could grow exponentially worse without regulations to protect against it. It is easy to imagine many other problems that would **arise** if nations do not develop laws to govern the asteroid-mining process. With this in mind, this Part will analyze the recently adopted U.S. Space Resource Exploration and Utilization Act and consider how it compares to the law governing deep seabed mining. B. Recently Passed U.S. Legislation

#### **The aff bans asteroid mining**

**Hlimi 14** [Tina Hlimi, Canadian lawyer with a Bachelors and Masters Degrees in Environmental Sciences from McGill University, 2014, “THE NEXT FRONTIER: AN OVERVIEW OF THE LEGAL AND ENVIRONMENTAL IMPLICATIONS OF NEAR-EARTH ASTEROID MINING,” ANNALS OF AIR AND SPACE LAW, https://papers.ssrn.com/sol3/papers.cfm?abstract\_id=2546924]/Kankee

demics realised that the international space law framework was unable to handle private entity development in outer space. As Lee provides: The framers of the treaties in the 1960s had not envisaged that artificial satellites would orbit the world before the end of the century and deliver many services that people now take for granted. These activities, such as remote sensing, weather prediction, direct television broadcasting, telecommunications, global positioning systems and human settlement on permanent space stations have torn apart the thin fabric of the existing space law framework [...]52 The initial focus on peace preservation resulted in the **inflexibility** of international space law and its **inability** to deal with present day realities like commercial mining.53 This has resulted in **volatility** and **uncertainty** for NEA mining entities and potential NEA investors, as it leaves their **legal rights** and liabilities in **limbo**. 54Although most NEA mining firms are still adamant about developing NEA resources, some **experts** like Wayne White advise that "If you really are talking about a **multibilliondollar endeavor**, if I were the lawyer for that company, I would say, **'Don't make that investment** until we have legislation in place". 55 White's statement rings true as private-entities have to surpass **numerous hurdles** concerning liability, natural resource **appropriation** and environmental contamination, in order to successfully mine NEAs. A. LIABILITY AND NEA MINING

Given the novelty encompassing NEA mining endeavours, space liability is a vital consideration for private entity NEA mining firms. At present there is no precedential case law in the area of space liability. The only case which had the potential of raising a liability claim is the Cosmos954 economic development. Article 1 of the OST corresponds with Article 4 of the Moon Agreement [emphasis added]: Article I: Outer Space Treaty The 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. Outer space, including t the right of another commercial entity from freely accessing the same celestial body. 73 The concept unquestionably jeopardises NEA commercial harvesting as terrestrial mining rights are often exclusive. The only exception to the free access provision is if the private entity were to start mining on the same asteroid in a manner, which interfered with the operations of the other party. However, if the "asteroid were large enough to accommodate two independent mining operations, both could likely proceed, each gaining ownership of whatever material they extract." 74 The solution seems to lie in celestial extraction and not the extraction of a whole NEA, which is what private entities are anticipating. C. THE OUTER SPACE TREATY AND THE APPROPRIATION OF CELESTIAL BODIES

A regime of real property rights would provide **legal** and **political certainty**. Investors and settlers could **predict the outcome** of a conflict with greater certainty by analogizing to terrestrial property law. Settlers and developers would also be **reassured** knowing that other nations would **respect** their right to remain at a given location.75 The appropriation of celestial bodies is a contentious and unresolved area of the law, stemming back to the 1945 United Nations Charter where the drafters aspired to "save succeeding generations from the scourge of war". 76 Regions that were previously considered terra nullius (e.g. the Moon and the deep seabed) were subsequently labelled common heritages of mankind (CHM) due to the looming conflicting proprietary and resource claims. Although the Antarctic Treaty makes reference to common interest, ("[r]ecognizing that it is in the interest of all mankind that Antarctica [...] shall not become the scene or object of international discord") 77 it has nevertheless deferred addressing the issue of title and sovereignty to a later time, similar to the Moon Agreement's Article 11 (5) on the CHM. Scott explains: The agreement to disagree regarding sovereignty has been reconfirmed in agreements concluded subsequent to the Antarctic Treaty. Despite a Third World push in the 1980s and early 1990s to have the Common Heritage of Mankind principle accepted as the basis for a new international Antarctic regime, the unresolved question of national sovereignty continues to underpin debate on all Antarctic issues, including current concerns such as the management of tourism and establishment of a secretariat.78 Nevertheless, the idea of non-appropriation for reasons of international relations has long been advocated, thus resulting in present day setbacks for the appropriation of natural resources in space. Hence, the international space legislation governing celestial natural resources is extremely complex, particularly in light of the multifaceted nature of international space law treaties (e.g. OST, Moon Agreement) and the endless interconnectedness of treaty provisions in conformity with Article 31(3) of the Vienna Convention on the Law of Treaties (VCLT), which requires subsequent treaties to be considered in light of the antecedent treaty for guidance.79 Since most private entities plan to harvest NEAs by 2020, fewer than seven years remain to sort through the legal ambiguities currently plaguing international space law and thwarting NEA appropriation and investment. Article II of the OST is one of the most widely cited provisions regarding celestial natural resource appropriation. The outdated provision **prohibits** the **appropriation** of outer space (which includes the Moon and other celestial bodies) through national appropriation. Article II Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means. [Emphasis added] At first glance Article II seems to bans any prospective State-run NEA harvesting mission. This is a highly controversial provision, as it is perhaps the most significant barrier to State and private entity mining. Various sources claim that private entities fall under "national appropriation" whereas others argue that private entities do not, thereby leaving this matter unresolved and possibly creating a legal loophole for private entity mining. Art Dula is a firm believer that non-state entities have the right to mine celestial bodies. He also believes that the OST's statement of "use" (Article I and II) permits exploitation and that nothing in the OST bans non-state entities from mining the resources, despite the phrase "national appropriation". Nevertheless, opponents argue that "what applies to sovereign States probably also applies to private companies" 80 notwithstanding the wording "national appropriation". This is fitting in light of other articles in the OST as well as the Registration and Liability Conventions. For instance Article VI of the OST, which assigns liability asserts "State Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by nongovernmental entities [...]". 81 Again, in accordance with Article 31(3) of the VCLT, 82 all subsequent treaties must take public-private affiliation into consideration, thereby eliminating the textual loophole created by Article II on "national appropriation". Thus, based on Article VI, opponents have claimed that the non-appropriation doctrine implicitly includes private entities, accordingly prohibiting private appropriation. In line with this interpretation, Francis Lyall and Paul Larsen jointly interpret Article II of the OST to mean that no one, "neither a government nor a person", may claim title over a celestial body and specifically an asteroid and the mineral resources housed within. 83 To support this proposition, they cite Gregory William Nemitz vs. NASA,et al, 84 a recent US decision from the Court of Appeals for the Ninth Circuit regarding the appropriation of a celestial body. The facts of the case are simple: Nemitz registered a claim on the asteroid 433 Eros, so when NASA sent a satellite to probe the asteroid Nemitz demanded that NASA pay parking fees for landing its satellite on "his property". NASA refused to pay citing Article II of the OST on non-appropriation by a private entity. Despite the outcome, it is nevertheless important to emphasise that this is an American decision which concerns complete, as opposed to partial, asteroid ownership— an unprecedented state of affairs.85 In addition to utilising Article II of the OST, the 1979 Moon Agreement closed the ostensibly private entity loophole on "national appropriation" by enacting Article 11(3) which prohibits "State, international intergovernmental or non-governmental organization, national organization or nongovernmental entity or of any natural person" from claiming property rights to "the surface nor the subsurface of the Moon, nor any part thereof or natural resources in place". This means that in addition to States being unable to appropriate the Moon or other celestial bodies, neither can private entities like Nemitz. Nevertheless, the miniscule ratification figures render the Moon Agreement feeble in international space law, which has regrettably resulted in academics and scientists frequently overlooking the Agreement.86 In addition to these varying perspectives regarding the appropriation of celestial bodies there are three prevailing viewpoints on Article II and the appropriation of natural resources: First, the OST does not permit private entity (nor State) appropriation of extraterrestrial material, as discussed above; second, the OST permits private entity appropriation of small amounts of extraterrestrial material (through the "national appropriation" loophole) and; third, the OST permits private entity appropriation of extraterrestrial materials (e.g. the entire asteroids).

#### **Asteroid mining is affordable**

**Hlimi 14** [Tina Hlimi, Canadian lawyer with a Bachelors and Masters Degrees in Environmental Sciences from McGill University, 2014, “THE NEXT FRONTIER: AN OVERVIEW OF THE LEGAL AND ENVIRONMENTAL IMPLICATIONS OF NEAR-EARTH ASTEROID MINING,” ANNALS OF AIR AND SPACE LAW, https://papers.ssrn.com/sol3/papers.cfm?abstract\_id=2546924]/Kankee

II. NEAR EARTH ASTEROID: DESCRIPTION AND BENEFITS OF MINING A Near-Earth Asteroid (NEA), oftentimes mistaken for a meteoroid (e.g. a shooting star), a meteorite (e.g. meteoroid which enters Earth's atmosphere and lands on the surface) or a comet (e.g. a small object with ice which vaporizes creating a tail of dust and gas)14 is a rock formation, smaller than a planet. Accordingly, asteroids are occasionally considered minor planets, planetoids or space debris. They are often called the latter, as it is thought they are remnant fragments of the Solar System. It is alleged that the majority of asteroids are composed of "material which never accreted to form planets". 15 Hence, asteroids are ancient rock formations (up to 4.6 billion years in age), akin to ancient fossil fuels reserves on Earth, 16 and it is the antiquity of NEAs which heightens their mineral composition and economic value. Perhaps the most **significant benefit** of NEAs is the financial returns which commercial entities anticipate upon harvesting. For instance, fragments of the Chelyabinsk, Russia asteroid-meteorite, which entered the atmosphere on February 2013 at an astounding 66,000 km/hour and exploded over Russia's Ural region, have been sold to American laboratories17 for prices upwards of US $10,000.18 Around the same time, another asteroid, 2012 DA14, worth a staggering USD $195 billion came very close to the Earth's orbit. If such asteroids are harvested, the returns could be **significant** for commercial entities, notwithstanding the logistical costs of exploring and extracting the minerals. NEAs are also **extremely sought after** by commercial entities as they are **closer to the Earth** than other celestial bodies, including the Moon. Planetary Resources, one of the leading NEA exploration and mining entities asserts that "[s]ome near-Earth objects are the **most accessible destinations** in the Solar System". In addition to their prime location, NEAs often have **minute gravitational fields**, when compared to other celestial bodies. Thus, modest propulsion (e.g. as opposed to the Moon) is required to deploy and return mining spacecraft to and from NEAs, minimising costs for corporations looking to protect their bottom-line.19 Propulsion may also be **circumvented**; in the 1980s researchers developed a "mass driver" magnetic catapult which could launch recovered natural resources into the Earth's orbit from either the Moon or another celestial body (e.g. a NEA), thus making it a "[**c**]**heap** and **efficient** means of transporting mined resources". 20 Other benefits of NEA mining include accessibility to superior water resources and mineral ore as well as advancing and enhanced scientific knowledge and familiarity with asteroid composition. NEA exploitation will also inevitably spur economic development through **job creation** and **business growth** (e.g. terrestrial/extraterrestrial refineries, spacecraft construction, engineers, operators etc.) if and when legal ambiguities are settled.21At present, the technologies for NEA exploitation are also becoming economical and will continue to depreciate in time.22 The sole noteworthy repercussion of NEA mining emanates from environmental pollution and degradation as discussed in greater detail in the following sections. III. TECHNOLOGICAL AND ECONOMIC PROGRESS SPURRING THE NEW SPACE RACE The present world is driven predominantly by commercial interests, which are in turn driven by the demands of a global market economy. Accordingly, it is clear that sufficient developments in spacecraft design, propulsion systems and robotic mining systems [...] already exist to enable some form of robotic prospecting and mining of asteroids.23 Since the start of the Cold War era and the space rivalry between the Soviet Union and the United States,24 the world has entered the space age. Noteworthy developments have included: the launch of Sputnik-1 by the Soviet Union and the first artificial satellite, the enactment of the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (OST), 25 the US moon landing, the 1979 adoption of the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement), 26 the launch and inhabitation of the International Space Station, the use of unmanned devices to explore planets like Mars, space tourism for ordinary civilians, 27 and the recent exploration and imminent exploitation of NEAs for mineral and hydrologic resources.28 Space-faring activities were first tweaked in the 1970s and 1980s with the emergence of intergovernmental players in the sphere of telecommunications, 29 thus shifting the playing field from State monopolised space exploits to intergovernmental organisations.30 Indeed, in the last 20 years, state-funded programmes like NASA have dramatically declined, and NASA is currently managing its lowest federal budget since the 1960s.31The private sector has accordingly assumed the lead in research and technology, with the objective of reaping profitable returns in the realm of NEA harvesting. NEA mining is an attractive opportunity for private sector commercial entities as terrestrial resources may only be reused a number of times due to purity loss, even with the most advanced recovery mechanisms. In 1955, Dr. Edward Price argued: [t]he thermodynamic law of entropy indicates that unavailability is the ultimate tendency of recurring mineral usage as they eventually become too dispersed or impure during each use to be recoverable. 32 Similar to reuse, recycling also results in lost purity and is also an energyintensive process utilizing fossil fuels.33 For this reason, there has been a surge of extraterrestrial technological advances to inhibit resource declination, thus stimulating a new space race amongst private entities; in contrast to the conventional and once dominant States. Jakhu and Buzdugan premise that NEA harvesting is **economically feasible** as some large-scale terrestrial projects (e.g. hydroelectricity and rare-Earth mineral mining) are **more costly** to operate or comparable in cost to launching a NEA spacecraft into space. The authors believe that NEA harvesting will occur if there is a market for the mineral and hydrologic resources (which is now emerging), practical payback times (e.g. usually less than five years in order to attract and sustain investors), controllable risks (e.g. environmental and legal) and the legal protection of **property rights** for commercial claims.34 In addition to the economic prerequisites, varying technological advances will permit NEA mining, including the simple identification and characterisation of viable NEAs and the anticipated use of powerful and enduring cosmic rays to fuel spacecraft and overcome propulsion and gravitational concerns. The private entity NEA contenders currently include US incorporated Deep Space Industries and Planetary Resources. Deep Space Industries' vision statement asserts that the corporation: [b]elieves the human race is ready to begin harvesting the resources of space both for their use in space and to increase the wealth and prosperity of the people of planet Earth. The rival start-up, Planetary Resources, has greater media presence due to its backing by Google Inc. founders Larry Page and Eric Schmidt and director James Cameron. 35 In June 2013, Planetary Resources managed to raise US $1 million through an online crowd funding campaign. The funds are to be allocated towards the construction of their ARKYD space telescope.36 The telescope will permit Planetary Resources to monitor and identify NEAs for future mining, in addition to developing the robotic spacecraft required to seize and return asteroids to Earth. 37 Hence, Deep Space Industries and Planetary Resources comprise the next generation of non-State entrepreneurs, which will soon compete for celestial resources, while swimming through pages of legal and regulatory requirements relating to property rights, liability and environmental law. IV. THE GENERAL LEGAL ATMOSPHERE AND NEA MINING

#### **Asteroid mining solves climate change, resource shortages, and environmental degradation – independently its key to space colonization that solves every existential crisis**

**Hlimi 14** [Tina Hlimi, Canadian lawyer with a Bachelors and Masters Degrees in Environmental Sciences from McGill University, 2014, “THE NEXT FRONTIER: AN OVERVIEW OF THE LEGAL AND ENVIRONMENTAL IMPLICATIONS OF NEAR-EARTH ASTEROID MINING,” ANNALS OF AIR AND SPACE LAW, https://papers.ssrn.com/sol3/papers.cfm?abstract\_id=2546924]/Kankee

A. THE ENVIRONMENTAL BENEFITS OF NEAR EARTH ASTEROID HARVESTING Let us recapitulate what we have already found. Shortage of resources is not a fact; it is an illusion born of ignorance. Scientifically and technically feasible improvements in launch vehicles will make departure from Earth **easy** and **inexpensive**. Once we have a foothold in space, the mass of the **asteroid belt** will be at our **disposal**, permitting us to provide for the material needs of a **million times** as many people as Earth can hold. **Solar power** can provide all the energy needs of this vast civilisation (10,000,000 billion people) from now **until the Sun expires**. Using less than one percent of the helium-3 energy resources of Uranus and Neptune for fusion propulsion, we could send a **billion interstellar arks**, each containing **a billion people**, to the stars. There are about a billion Sun-like stars in our galaxy. We have the resources to **colonise** the **entire Milky Way**. 122 In addition to demystifying the legal doctrine governing outer space natural resource appropriation it is also necessary to weigh the benefits and detriments of space-faring activities. Foremost, States around the world are developing at **unprecedented rates** and the human population is mounting in conjunction with demand for natural resources to sustain the current and newly established western standard of living. One of the fastest growing nations, China, is experiencing unhindered growth facilitated by **fossil fuel** use from coal and extensive mining. This has caused **substantial** water, soil and air degradation. In the face of these troubles, NEA mining could be the **key** to preserving the Earth's bounty and replenishing contaminated water supplies. The influx of natural resources could **thwart** the burning of dirty coal and fossil fuels, thereby **mitigating** the effects of **climate change**, such as, rising sea level, atmospheric pollution, melting of sea ice and rising temperatures. NEA harvesting could also protect the ocean and the fragile and largely unexplored deep seabeds 123 from oil and gas drilling. It could furthermore protect ecosystems from rare-earth mineral mining predominantly used to fuel the electronics sector. 124 NEA mining is especially pertinent as China restricted its global exports of rare-earth minerals in 2009, incongruously citing the need to protect the environment. Unfortunately, the supply cuts have forced dependent States like Japan, the United States and South Korea to heighten rare-Earth mineral exploration. This accordingly led to Japan's 2011 discovery of rare-earth minerals in the ocean-bed deposits of the Pacific Exclusive Economic Zone (PEEZ) thereby necessitating risky, deep-sea mining techniques, which may result in marine pollution if not carefully designed and developed. Other States, which have joined the **environmentally destructive** rare-earth mineral exploration movement include India, Canada, Tanzania, Australia, Brazil and Vietnam., There is accordingly much competition and exploration for rare-earth minerals which could result in **significant exploitation** of untouched areas like the PEEZ seabed and Mongolia.125 Other regions which may soon be targeted for mineral and hydrological resources include Antarctica and the Arctic. With the advent of technological advances, environmentally destructive practices such as refining may soon occur in outer space, **sparing the** **Earth** of pollution. 126 Accordingly, NEA mining is a viable technology for preserving the Earth's environment by curbing atmospheric and marine pollution, enhancing water supply and quality and mitigating the effects of climate change; all while allowing humankind to maintain and even improve their standard of living through increased technologies, consumption and population growth. B. THE ENVIRONMENTAL CONSEQUENCES OF NEAR EARTH ASTEROID MINING

#### **Climate change is the worst impact – contrary models are incorrect.**

Specktor 19 [Brandon; 6/4/19; Writes about the science of everyday life for Live Science, and previously for Reader's Digest magazine, where he served as an editor for five years; "Human Civilization Will Crumble by 2050 If We Don't Stop Climate Change Now, New Paper Claims," livescience, <https://www.livescience.com/65633-climate-change-dooms-humans-by-2050.html>] Justin

The current climate crisis, they say, is larger and more complex than any humans have ever dealt with before. *General climate models* — like the one that the [*United Nations' Panel on Climate Change*](https://www.ipcc.ch/sr15/) (IPCC) used in 2018 to predict that a global temperature increase of 3.6 degrees Fahrenheit (2 degrees Celsius) could put hundreds of millions of people at risk — *fail to account for the* ***sheer complexity of Earth's many interlinked geological processes*;** as such, they fail to adequately predict the scale of the potential consequences. The truth, the authors wrote, is probably far worse than any models can fathom. How the world ends What might an accurate worst-case picture of the planet's climate-addled future actually look like, then? The authors provide one particularly grim scenario that begins with *world governments "politely ignoring"* the advice of *scientists* and the will of the public to decarbonize the economy (finding alternative energy sources), resulting in a global temperature increase 5.4 F (3 C) by the year 2050. At this point, *the world's ice sheets vanish; brutal droughts kill many of the trees in the* [*Amazon rainforest*](https://www.livescience.com/57266-amazon-river.html) (removing one of the world's largest carbon offsets); *and the planet plunges into a feedback loop of ever-hotter*, ever-deadlier *conditions*. "*Thirty-five percent of the global land area, and* ***55 percent of the global population, are subject to more than 20 days a year of*** [***lethal heat conditions***](https://www.livescience.com/55129-how-heat-waves-kill-so-quickly.html)***,*** *beyond* the threshold of human *survivability*," the authors hypothesized. Meanwhile, *droughts, floods and wildfires regularly ravage the land. Nearly* ***one-third of the world's land surface turns to desert****.* Entire ***ecosystems collapse****, beginning with the* ***planet's coral reefs,*** *the* ***rainforest and the Arctic ice sheets*.** The world's tropics are hit hardest by these new climate extremes, *destroying the region's agriculture and turning more than 1 billion people into refugees.* This mass movement of *refugees — coupled with* [*shrinking coastlines*](https://www.livescience.com/51990-sea-level-rise-unknowns.html) *and severe drops in food and water availability — begin to* ***stress the fabric of the world's largest nations*,** including the United States. *Armed conflicts over resources, perhaps* ***culminating in nuclear war, are likely.*** *The result*, according to the new paper, *is "outright chaos" and perhaps "the end of human global civilization as we know it."*

#### **Private appropriation is key to colonization – otherwise, common ownership leads to a fear of expropriation and a tragedy of the commons**

**Collins 8** [David Collins, Professor of International Economic Law at the City University of London with a PhD in international economic law from Maastricht University, 2008, “EFFICIENT ALLOCATION OF REAL PROPERTY RIGHTS ON THE PLANET MARS,” Boston University Journal of Law and Technology, https://www.bu.edu/jostl/files/2015/02/Collins\_142.pdf]/Kankee

III. THE CURRENT LEGAL REGIME FOR PROPERTY IN OUTER SPACE In order to frame the discussion of future real property claims on Mars, this article will briefly discuss existing law on property in space. There are currently two relevant international treaties: The Outer Space Treaty and the Moon Treaty, both of which establish that Mars (and the other planets) are res communis: common property owned by the people of Earth. The former agreement, signed in 1967 as the result of efforts of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), establishes that space is “the province of all mankind” and “free for exploration and use by all states without discrimination of any kind, on a basis of equality” and also that there should be “free access to all areas of celestial bodies”, 16 clearly precluding the exclusivity of possession that is the foundation of ownership. Celestial bodies, including Mars, cannot be the subject of national appropriation by claims of sovereignty.17 The Outer Space treaty was signed by the United States, the USSR and 89 other nations and as such it can be viewed as a legally binding commitment in international law. The later Moon Treaty, ratified by only seven countries, establishes that all resources outside the earth are the “common heritage of mankind” and that no entity, either public or private can exclusively own any space resource,18 and that there must be “equitable sharing” by all state parties in the benefits derived from space resources, taking into consideration the needs of developing countries.19 This language of public ownership mirrors The Law of the Sea convention, which establishes that no nation can own the world’s oceans.20 The Moon Treaty permits the retention of “samples” taken from planetary bodies, although it encourages that such materials be made available to other nations for the purposes of scientific experiment.21 The laws of space, interpreted by some to allow for commercial mining, thus recognize the concept of personal property.22 Although the Moon Treaty allows parties to retain ownership of the equipment, vehicles and installations that they place there23 this is not true ownership in the common law sense since there is no right to exclude because Article XV requires that all vehicles, installations and equipment shall be open to use by all other parties. This partial acknowledgement of private personalty may hold the potential for “quasi-sovereignty” involving ownership of objects on the surface of planets by individuals or corporations.24 The simple delineation between equipment and land may be difficult to draw on Mars, however, because the planet’s atmosphere necessitates artificial construction, such as a greenhouse, in order to render the surface agriculturally productive or habitable. According to the common law, a chattel (in which ownership is retained in space) loses its status as a chattel and becomes a fixture when it is so affixed to land that it becomes part of the land,25 and evidently according to treaty at that point ownership is lost. In this way a base built upon the soil or rock of Mars for the purpose of habitation or as a greenhouse, even if it is resting upon the planet’s surface under its own weight without attachment, as long as it is intended to permanently improve the land, will become a fixture26 and is therefore common property. Thus, there is a **strong risk** that an **investment** such as a base that possibly costs **billions** of dollars in preparation and transportation would become **public property** once it was placed upon the planet’s surface. Together the space treaties embody the now widely-criticized notion27 that every human, as represented by the states in which they are members, has an effective “right” to Mars. Under this regime the allocation of Martian resources, possibly including land itself, will be determined by the “administrative model” in which each nation decides the distribution based on each country having an equal vote, much like the current United Nations regime.28 Not surprisingly, the United States and the Soviet Union rejected the limitations on the use of space resources, refusing to sign the Moon Treaty. Indeed none of the signatories of the Moon Treaty has space travel capability, suggesting that it does not reflect any practical concerns in space exploration and development. Rather, the Moon Treaty illustrates resistance to the idea of private advancement through the acquisition or use of space resources as expressed through the voting dominance of less-developed nations in intergovernmental organizations.29 Still, as many legal commentators have noted, the benefit sharing doctrines enunciated in the treaties are fortuitously vague and as such have little force in international law. At best they are loose policy guidelines, not concrete obligations.30 Interestingly, the treaties also present inconsistent principles: the Moon Treaty’s common ownership concept contradicts the prohibition against national appropriation found in the Outer Space Treaty,31 although this is little more than a semantic distinction. The ambiguity of these treaties and the fact that the Moon Treaty has not been ratified by space-faring nations suggests that property law in space remains, hopefully for the purpose of incentivization, clouded. Many commentators, notably Carl W. Christol, further assert the need to clarify and formalize the law of space exploration generally.32 An internationally recognized legal regime for property rights on Mars is **essential**; otherwise **uncertainty** (if not the fear of **expropriation** in the name of mankind) will **endanger** financial investment both in reaching and then colonizing the planet. IV. OWNERSHIP AS AN INCENTIVE FOR PRODUCTIVE USE In order to clarify the best regime for property on Mars it is first necessary to clarify how real property is treated on Earth, at least in Common Law jurisdictions. The Common Law views property as a bundle of rights: the right to use, to exclude others from use and to transfer those rights to others. As such, owning the planetary body of Mars in the legal sense would include the right to mine or build upon the planet’s surface, to deny permission to land upon it from space, possibly to put something in orbit around it, and to sell or otherwise transfer those rights to someone else. Property law also recognizes the distinction between public and private property, but this crucial distinction is problematic when applied to such a vast area as an entire planet because such rights cannot be readily categorized as either public or private goods. Mars is a private good in that it may (and likely does) contain valuable mineral resources. These are private goods by definition because they can only be consumed by one person to the exclusion of others.33 It has already been suggested that the existing treaties may acknowledge mining rights on the planets as such resources can be extracted and removed from the planet. On the other hand the land itself, the vast terrain of the planet’s surface, could be viewed as a public resource like a National Park or the Atlantic Ocean because it can be used in a non-rivalrous way.34 However, the land on Mars is **naturally inhospitable** to humans and agriculture as we know it. The land must be altered through the establishment of infrastructure, like environmentally controlled bases or artificially irrigated greenhouses, before it can be useful in any practical sense. Because of the enormous technological commitment involved, land uses of this nature will be relatively restrictive (at least at first) and probably of small dimension compared to the entire surface of the globe. Such uses are therefore exclusive and rivalrous because there is limited room to live in a constructed base, limited soil under a greenhouse roof, limited artificially liberated oxygen (from the carbon dioxide atmosphere) for breathing and limited melted water for drinking. In that sense the land of Mars should also be viewed as a private good. The incentive to make these productive uses of the land of Mars necessitates non-communal ownership because private property rights encourage the maximization of resource potential due to the prospect of higher individual gains. The cost of monitoring property is also negated through a regime where private entitlements are enforced by law.35 Similarly, it has now been widely and effectively argued36 that the recognition of property rights will be a **strong incentive** for space exploration because the expectation of future profit, such as derived from property claims, **legitimizes** the enormous expense from a rational cost-benefit perspective. Missions to Mars are particularly needful of such clear incentivization because of the high costs and uncertain benefits. Recent estimates suggest that a manned mission to Mars would cost $55 billion.37 The establishment of bases or other such infrastructure could cost significantly more, and the value of such improved land is at best uncertain, especially since its expected utility may depend on some as yet unknowable future eventuality on Earth. In contrast, equal distribution of Martian land in line with the Common Heritage principle would lead to no profit in the economic sense and would inevitably result in the “**tragedy of the commons**,” the risk of **self-interested over-exploitation** or under-exploitation of shared resources if there is **no enforcement** mechanism that ensures each user pulls their own weight.38 If each nation or person has equal claim to Mars as a matter of right and not as a function of contribution, then non-space faring nations and their taxpayers will avoid contributing to the efforts to reach and develop Mars. No country is likely to undertake the **enormous risks**, economic and otherwise, associated with Mars colonization without the legal **certainty** that their rewards will not be distributed to others.39 The private property rights to exclude others from specific developed areas of Mars, to transfer that right to others in a market, and to use the land in a productive manner are **crucial incentives**. A key advantage of recognizing private ownership of real property on Mars is that non-state bodies could become committed to the productive use of land on the planet. Financing a Mars mission as a business venture could be an efficient way to reach the planet and to establish human habitation there.40 Individuals or organizations could buy shares in the Mars mission to be compensated by land claims on the planet that would rise in value in proportion to the extent of colonization. The uncertain legal framework of the existing treaty regime would undermine optimal investment since there would be fear of **uncompensated expropriation** under the auspices of the UN or some other international organization favoring absolute common ownership of all extra-planetary resources. Thus, as Hoffstadt has noted, a stable legal regime is required in order for investment in space exploration to be viable.41 A clear and consistent legal regime will induce productive private capitalization of Mars missions in the future and would be advantageous in the development of Mars.42 While the negotiation of a legal framework fostering investment in extra planetary land has the potential itself to be costly, it is expected that the relative costs will only increase over time as more nations and corporations become involved, suggesting that earlier settling of legal entitlements is favorable. Although at present it seems unlikely that interplanetary travel, let alone planetary colonization, could be achieved by a corporation or other private body due to insufficient resource consolidation, there are signs that private space exploration is becoming more relevant. Growing interest in private space exploration is evidenced by the numerous non-market initiatives to encourage a non-state role in space exploration, such as the Ansari X prize for suborbital spaceflight and Google’s recent To the Moon prize to be awarded to the first individual to successfully place an object on the Moon.43 Recent successful advancements in private space flight, such as SpaceShipOne and the voyage of tourist Dennis Tito to the International Space Station, may be indicative of future trends for involvement of private enterprise in this field.44 Non-state space exploration has the economic advantage of capitalization from sources that would be unavailable to a publicly funded agency like NASA, such as selling the broadcast rights to video and audio images of the mission. The Mars Rover and Mars Explorer photographs were among the most popular images on the Internet for some time.45 It is unlikely that private space exploration initiatives, such as ones involving the development of land on Mars, would occur without the prospect of economic recovery if not surplus profit. Single state or private enterprise ownership of land on Mars is more efficient than an international regime of common ownership as envisioned by the Outer Space treaty because the transaction costs of international public action are much higher than those of private entities, or even single state governments. Epstein termed this “negativism;” without **unanimous agreement** from all members of society on how to exploit a common resource, it may remain unused.46 Indeed, space exploration is a notorious example of the difficulty in achieving collective international action.47 Common ownership of Mars demands **international** regulatory **unanimity** that would be both **prohibitively expensive** and potentially **impossible to implement**. In contrast, private, or single sovereign ownership of a resource such as organizing colonization or a terraforming project on Mars, tends to result in the most efficient administration of that resource because bargaining among smaller groups tends to result in **cooperation**.48 In this way, the first expeditions to Mars will be undertaken by the party that can do so at least cost. The costs should be lower for single states or private entities because fewer resources will be expended on decision-making than in an international initiative, even one coordinated by a centralized body such as the United Nations. A Mars expedition will be undertaken when the expected benefit exceeds the cost. However, the fact that NASA and other agencies have already expended resources in Mars’ exploration without economic gain illustrates that most, if not all, of the benefits derived from space exploration so far are nonmarket benefits, like the advancement of scientific knowledge and the satisfaction of curiosity. Similarly, a significant component of the cost of manned space exploration is the risk of human safety, which also cannot be readily quantified for the purposes of cost-benefit assessment. While the expense of a manned Mars mission would be much higher than the robotic missions to date, one might expect that such costs and human risks will decline over time because of corresponding increases in technology. The expected gains from a Mars expedition should also increase over time because technology should augment the extent and quality of knowledge that can be gained from such missions. Also, technology should enhance the degree to which the planet can be developed profitably, for example, with improved methods of transforming deuterium ice into a ready energy supply. Thus, the initial missions emerge as the least efficient from a cost-benefit perspective. Yet, property law suggests that the initial missions are the most important for the purpose of establishing a claim, although this may depend upon what activities count as possessory. V. LAND CLAIMS ON MARS VIA FIRST POSSESSION

#### **Commercial space is comparatively more innovative then the DoD**

**Werner 19** [Debra Werner, correspondent for SpaceNews with a bachelor’s degree in communications from UC Berkeley and a master’s degree in Journalism from Northwestern, 10-9-2019, "Military turns to private sector for rapid space innovation," SpaceNews, https://spacenews.com/warfare-satellite-innovation-2019/]/Kankee

Decades ago, the U.S. Defense Department led innovation in communications and remote sensing technology. Increasingly, U.S. military agencies are turning to the private sector for innovative communications and Earth observation products and services, according to government and industry executives at the Satellite Innovation 2019 conference here. “In terms of cost, capacity and volume, it would be **hard** for the military to beat what commercial industry is doing,” Rick Lober, vice president and general manager for Hughes Network Systems’ Defense and Intelligence Systems Division, told SpaceNews. The Defense Department is trying to speed up access to innovative commercial technologies through a variety of contracting mechanisms like other transaction authority as well as pilot and pathfinder programs aimed at testing new technologies and system architectures. U.S. Air Force Space Command, for example, is focused on replacing stove-pipe communications networks with enterprise architectures. Air Force Space Command took over responsibility in December for procuring the Defense Department’s commercial satellite communications services from the Defense Information Systems Agency. “We have a number of initiatives that our office has put in effect with more to come,” said Mike Nichols, chief of commercial satellite communications for Air Force Space Command’s Satellite Solutions Branch. Gen. John Raymond, who leads Air Force Space Command, “told us get after it: enterprise architecture, real-time provisioning, real-time situational awareness,” Nichols said. However, the Defense Department faces cultural challenges when it tries to quickly adopt commercial technology, said Ken Peterman, Viasat Government Systems president. Private sector innovation in space, cybersecurity and mobile networking are prompting changes in acquisition policy, practice and culture, Peterman said. “An acquisition system predicated on invention has to turn into one that can assess, adopt, apply and then evolve more effectively than ever before,” he added. As an example, Peterman points to Apollo program. “When we put a man on the moon, there were probably 10,000 NASA contracts to invent everything from aluminum foil to Tang, the breakfast drink,” Peterman said. “If NASA wanted to put a man or woman on Mars today, the **fastest**, **most effective** way to do that, might be to write a one or two-page statement of objectives and let Elon Musk, [Jeff] Bezos, Richard Branson and some others bid on that.” If government agencies don’t embrace commercial innovation, the consequences could be grave, according to a panel of experts discussing the implications of space as a warfare domain. “The U.S. government’s ability to **maintain dominance** in space will be **heavily dependent** on their **ability** to work quickly to **take advantage** of all the commercial innovation we’re talking about here,” said Chris DeMay, HawkEye 360 chief technology officer and co-founder. “We see enemy nations investing in their own companies with parallel capabilities that will **exceed** ours if the U.S. government can’t continue to invest at a faster rate.” Rajeev Gopal, advanced programs vice president for Hughes Network Systems’ Defense and Intelligence Systems Division, suggested government agencies gain access to commercial innovation with brief documents describing their needs instead of publishing 100 pages of requirements. He also suggested the government award fixed price contracts. “Give the high-level requirements and let commercial solutions emerge,” Gopal told SpaceNews. “With fixed price contracts, there is some risk but there is also flexibility to innovate.” Hughes has found that flexibility in its work applying artificial intelligence and machine learning to improve interoperability and network management, Lober said.

#### **Innovation through commercial space is key to deterrence by denial and space dominance – that is key to US military power projection and hegemony**

**Broad 21** [William J. Broad, science journalist and senior writer for the NYT, 5-6-2021, "How Space Became the Next ‘Great Power’ Contest Between the U.S. and China," NYT, https://www.nytimes.com/2021/01/24/us/politics/trump-biden-pentagon-space-missiles-satellite.html]/Kankee

Beijing’s rush for antisatellite arms began 15 years ago. Now, it can **threaten** the orbital fleets that give the United States military its technological edge. Advanced weapons at China’s military bases can fire warheads that smash satellites and can shoot laser beams that have a potential to blind arrays of delicate sensors. And China’s cyberattacks can, at least in theory, cut off the Pentagon from contact with fleets of satellites that track enemy movements, relay communications among troops and provide information for the precise targeting of smart weapons. Among the most important national security issues now facing President Biden is how to contend with the threat that China poses to the American military in space and, by extension, terrestrial forces that rely on the overhead platforms. The Biden administration has yet to indicate what it plans to do with President Donald J. Trump’s legacy in this area: the Space Force, a new branch of the military that has been criticized as an expensive and ill-advised escalation that could lead to a dangerous new arms race. Mr. Trump presented the initiative as his own, and it now suffers from an association with him and remains the brunt of jokes on television. But its creation was also the culmination of strategic choices by his predecessors, Presidents George W. Bush and Barack Obama, to counter an emboldened China that raised bipartisan alarm. “There’s been a dawning realization that our space systems are **quite vulnerable**,” said Greg Grant, a Pentagon official in the Obama administration who helped devise its response to China. “The Biden administration will see more funding — not less — going into space defense and dealing with these threats.” The protective goal is to create an American presence in orbit **so resilient** that, no matter how deadly the attacks, it will function **well enough** for the military to **project power** halfway around the globe in terrestrial reprisals and counterattacks. That could **deter** Beijing’s strikes in the **first place**. The hard question is how to achieve that kind of strong deterrence. Lloyd J. Austin III, a retired four-star Army general who was confirmed last week as Mr. Biden’s secretary of defense, told the Senate that he would keep a “laserlike focus” on sharpening the country’s “**competitive edge**” against China’s increasingly powerful military. Among other things, he called for new American strides in building “space-based platforms” and repeatedly referred to space as a war-fighting domain. “Space is already an arena of **great power competition**,” Mr. Austin said, with China “the **most significant threat** going forward.” The new administration has **shown interest** in tapping the **innovations** of space entrepreneurs as a means of strengthening the military’s hand — what Mr. Austin in his Senate testimony called “partnerships with commercial space entities.” The Obama and Trump administrations both adopted that strategy as a uniquely American way of sharpening the military’s edge. Experts clash on whether the United States is doing too little or too much. Defense hawks had lobbied for decades for the creation of a military Space Corps and called for more spending on weapons. But arms controllers see the Space Force as raising global tensions and giving Beijing an excuse to accelerate its own threatening measures. Some go further and call it a precipitous move that will increase the likelihood of war. In decades past, especially during the “Star Wars” program of the Reagan administration, conflict in space was often portrayed as shootouts in orbit. That has changed. With few exceptions, the weapons are no longer seen as circling the planet but as being deployed from secure bases. So, too, the targets are no longer swarms of nuclear warheads but fleets of satellites, whose recurring, predictable paths while orbiting the Earth make them far easier to destroy. A main question is whether the antisatellite moves and countermoves will lower or raise the risks of miscalculation and war. That debate is just beginning. Beijing’s Surge For years, the Chinese studied — with growing anxiety — the American military, especially its invasions of Afghanistan in 2001 and Iraq in 2003. The battlefield successes were seen as **rooted in** space **dominance**. Planners noted that thousands of satellite-guided bombs and cruise missiles had rained down with **devastating precision** on Taliban forces and Iraqi defenses. While the Pentagon’s edge in orbital assets was clearly a threat to China, planners argued that it might also represent a liability. “They saw how the U.S. **projected power**,” said Todd Harrison, a space analyst at the Center for Strategic and International Studies, a Washington think tank. “And they saw that it was largely undefended.” China began its antisatellite tests in 2005.It fired two missiles in two years and then made headlines in 2007 by shattering a derelict weather satellite. There was no explosion. The inert warhead simply smashed into the satellite at blinding speed. The successful test reverberated globally because it was the first such act of destruction since the Cold War. The whirling shards, more than 150,000 in all, threatened satellites as well as the International Space Station. Ground controllers raced to move dozens of spacecraft and astronauts out of harm’s way. The Bush administration initially did little. Then, in a show of force meant to send Beijing a message, in 2008, it fired a sophisticated missile to shoot down one of its own satellites. Beijing conducted about a dozen more tests, including ones in which warheads shot much higher, in theory putting most classes of American spacecraft at risk. China also sought to diversify its antisatellite force. A warhead could take hours to reach a high orbit, potentially giving American forces time for evasive or retaliatory action. Moreover, the speeding debris from a successful attack might endanger Beijing’s own spacecraft. In tests, China began firing weak laser beams at satellites and studying other ways to strike at the speed of light. However, all the techniques were judged as requiring years and perhaps decades of development. Then came the new idea. Every aspect of American space power was controlled from the ground by powerful computers. If penetrated, the brains of Washington’s space fleets might be degraded or destroyed. Such attacks, compared with every other antisatellite move, were also remarkably inexpensive. In 2005, China began to incorporate cyberattacks into its military exercises, primarily in first strikes against enemy networks. Increasingly, its military doctrine called for paralyzing early attacks. In 2008, hackers seized control of a civilian imaging satellite named Terra that orbited low, like the military’s reconnaissance craft. They did so twice — first in June and again in October — roaming control circuits with seeming impunity. Remarkably, in both cases, the hackers achieved all the necessary steps to command the spacecraft but refrained from doing so, apparently to reduce their fingerprints. Space officials were troubled by more than China’s moves and weapons. The modern history of the American military centered on building global alliances. Beijing was rushing ahead as an aggressive loner, and many officers feared that Washington was too hidebound and burdened with the responsibilities of coalition-building and arms-control treaties to react quickly. “The Chinese are starting from scratch,” Paul S. Szymanski, a veteran analyst of space warfare, argued in an Air Force journal. They’re not, he added, “hindered by long space traditions.” Washington’s Response In its second term, the Obama administration made public what it called an “offset strategy” to respond to China and other threats by capitalizing on America’s technological edge. Just as the United States had developed, first, a vast nuclear arsenal and, second, smart weapons, this so-called third offset would seek an advantage by speeding the rise of robotics, high-speed arms and other breakthroughs that could empower the armed forces for decades. Unlike earlier offsets, officials said, the objective was to rely less on federal teams than the tech entrepreneurs who were fast transforming the civilian world. “We must really capture the commercial sector,” Robert O. Work, a deputy secretary of defense, said in a 2015 speech explaining the new initiative. The advances in space were to be defensive: swarms of small, relatively cheap satellites and fleets of recycled launchers that would overwhelm Beijing with countless targets. For Mr. Obama, innovative leaps were to do for American space forces what Steve Jobs did for terrestrial gadgets, **run**ning **circles** around the calcified ministries of authoritarian states. After decades in which adversaries — from stateless terrorists to those with traditional militaries — sought to exploit narrow advantages over the more powerful United States, the Pentagon was now finding an unconventional edge all its own. The Obama administration was already applying the commercial philosophy to NASA, turning the space agency into a major funder of entrepreneurial strides. It was pumping billions of dollars into the development of private rockets and capsules meant to carry astronauts into orbit. The military joined in. The beneficiaries included Elon Musk, the founder of Tesla, and Jeff Bezos, the founder of Amazon. Their space companies — Mr. Musk’s SpaceX and Mr. Bezos’s Blue Origin — sought to turn rocket launchers from throwaways into recyclables, slashing their cost. Military officials believed that the new system would make it possible to quickly replace satellites in times of war. The third offset also sought to shrink the size of satellites. Over decades, the big ones had grown into behemoths. Some cost $1 billion or more to design, construct, outfit, launch and keep in service. One type unfurled an antenna nearly as large as a football field. But civilians, inspired by the iPhone revolution, were building spacecraft as small as loaves of bread. Military planners saw smaller, cheaper, more numerous craft as making antisatellite targeting vastly more difficult — in some cases impossible — for an adversary. The initiative aided companies such as Planet Labs, which sought to build hundreds of tiny Earth-observing satellites, and Capella Space, which designed small radar-imaging satellites meant to see through clouds. It also bolstered SpaceX, where Mr. Musk envisioned a fleet of thousands of communication satellites. The administration, increasingly worried about Beijing’s strides, also raised its spending on offensive space control — without saying exactly what that meant. Federal investment in the tech entrepreneurs totaled $7.2 billion, most of it during the Obama years, according to a NASA report. It said the funds went to 67 companies. The approach differed from the usual Pentagon method, which dictated terms to contractors. Instead, the private sector **led the way**. As predicted, the small investments made a **big difference**. By the end of the Obama administration, SpaceX was firing payloads into space and successfully returning booster rockets to Earth in soft landings. Mr. Obama tweeted his congratulations in April 2016 when, for the first time, a SpaceX booster landed successfully on a platform at sea.**US space dominance caps the initialization and escalation of conflicts – space arms control removes less escalatory measures that ensure conflicts go nuclear**

**Yoo 20** [John Yoo, Emanuel S. Heller Professor of Law at the UC Berkeley School of Law, Visiting Fellow at the Hoover Institution at Stanford, and Visiting Scholar at the American Enterprise Institute, 2020, “RULES FOR THE HEAVENS: THE COMING REVOLUTION IN SPACE AND THE LAWS OF WAR,” UNIVERSITY OF ILLINOIS LAW REVIEW, https://papers.ssrn.com/sol3/papers.cfm?abstract\_id=3511471]/Kankee

But nations are unlikely to agree to treaties to limit these technologies until they are more certain of their impact on war and the balance of power.306 Moreover, these new methods of warfare may serve wider humanitarian concerns that are more significant than the legality of killing off-battlefield terrorists. If space weapons can strike with more precision, they will reduce death and destruction among both combatants and civilians. If a nation uses space weapons to disrupt the financial or transportation networks of their rivals, it will advance its ability to **coerce** the enemy with far less bloodshed and far less risk. Nations will see little virtue in the alternative of restricting themselves to conventional warfare that endangers the lives of more of their own troops. Space weapons could reduce the overall human cost of war, while a ban could have the opposite effect. Anti-satellite weapons do not directly kill anyone, because the targets themselves have no human crews. Anti-ballistic missile systems have the same feature because they destroy unmanned ICBMs. The operators of both sit at a remove of hundreds if not thousands of miles away.307 Precision ASAT or ABM weapons will also reduce civilian and collateral harm by restricting combat to uninhabited space.308 The effect of a ban on space weapons does not happen **in a vacuum**; if nations still use force to pursue their goals, they will turn to **more destructive** and less precise alternatives, with the result that armed conflict will become more harmful. Space weapons could play an even more significant systemic role in international relations than simply reducing the destructiveness of conflicts after they have begun. A rational bargaining approach to war suggests that such weapons could help nations settle their disputes **without** resort to wider armed conflict. We can illustrate with the model developed by Robert Powell and James Fearon to explain why rational nations still engage in costly conflicts, which some legal scholars have used to analyze the laws of war.309 Rational states will seek to defend their security against competitors or gain new resources near their territories. They will seek to reduce harms to their populations from pollution, drugs, terrorism, or disease. Disputes will arise when nations collide in pursuing these rational self-interests. Two nations may both want the same territory or resources, or one might want to engage in economic activity that causes harms in another. Rational states should choose a negotiated settlement over armed conflict to resolve their disputes. Both sides would be better off by agreeing to a settlement and avoiding the deadweight costs of war. A rational peace settlement should mirror the balance of forces between the two nations. Suppose Nation A is locked in a dispute with Nation B, and that Nation A has the stronger military. If Nation A threatens to use force, Nation B must decide whether to withdraw or resist. A war will give either Nation A or Nation B control of the disputed resource or territory, but the outcome is uncertain. Both nations have an expected value of going to war. That value is the expected benefit of a conflict (a function of the probability that it will prevail in any conflict times the value of controlling the territory) minus the expected cost of fighting.310 A more powerful nation, therefore, will have a higher expected value of going to war, because its probability of winning is greater (and hence its expected benefit is greater). If Nation A’s expected value of winning is higher than its expected costs, it should go to war. But Nation B will have a lower expected value, because its probability of winning will be the inverse of Nation A’s probability.311 Nation B should withdraw because Nation B would likely lose a conflict and also suffer the costs of fighting. If perfect information exists, both nations should agree to a settlement rather than reach the same result through conflict. An agreement will result in the same outcome, but both Nation A and Nation B will avoid the deadweight costs of fighting. Both nations are better off, because the agreement will mirror the likely outcome of the armed conflict (Nation A win), without the harms of war.312 But several obstacles can prevent this peaceful settlement. While nations may act irrationally or hold idiosyncratic values, the main point here is rational nations might still go to war. Asymmetric information can prevent nations from accurately estimating important variables. Nation A, for example, will know the value it places on disputed territory. It will also know its own military capabilities and political resolve. But it will have imperfect information about Nation B’s military strength and political will. Without this knowledge, leaders cannot accurately measure the other side’s probability of winning and the expected benefits and costs from conflict. Getting these variables wrong could prevent the parties from negotiating a settlement and instead going to war.313 Both nations could solve this problem by credibly revealing their military capabilities and political support. Bluffing, however, undermines the ability of nations to communicate credible information. If Nation A, for example, successfully exaggerates its military resources, it can trick Nation B into underestimating the latter’s probability of winning a conflict. Bluffing allows Nation A to seize a greater share of the benefits of a peace agreement. Nations have a strong incentive to bluff to win a better outcome than they should receive, but they—and the international system as a whole—would benefit over the longer term if there were a way for all nations to credibly communicate information. A similar problem besets litigation. Litigants will encounter uncertainty about the facts and law of a case, which will create an obstacle to a settlement. The domestic legal system solves this problem with discovery, which ensures that parties share truthful information about the facts, under threat of judicial sanction.314 Because of the lack of a supranational government with coercive enforcement powers, nations do not have available a legal procedure equivalent to discovery. Some international relations scholars believe that costly signaling can provide an alternate means to credibly communicate information. Diplomatic threats or political demands do not send much information because they cost little. Coercive measures **short of war**, however, can reveal the military capabilities and political resolve that determine the odds of winning. A nation not only might issue a demand but also deploy heavily armed troops to a disputed border. Dispatching military forces sends a costly signal because it uses resources, places units at risk, and threatens a spiral of escalation. The more expensive the signal, the more credible the information. Escalating threats of force can send progressively more costly signals because more deployments consume even more resources that a state would be less likely to waste if it were bluffing. “Audience costs” provide another means of communicating information credibly.315 Audience costs refer to the political costs incurred by political leaders who make a threat of force and then fail to carry it out.316 Such moves will have more credibility because the leaders risk political losses at home by sending it. Leaders, for example, can make threats of war and send military forces into a disputed area. But if they back down, their domestic political standing will suffer. Theorists argue that audience costs encourage democratic leaders to be more selective in choosing wars and more committed to avoiding defeat.317 Beyond the challenge of imperfect information, commitment problems may pose an even greater obstacle to peaceful dispute settlement. Nations may prove reluctant to reach an agreement because they cannot compel compliance. In an **anarchic** international system defined by weak institutions, however, nations **cannot** depend on a supranational body to compel compliance to a settlement.318 These problems become even more acute in disputes over territory or resources. A change in possession of the resource could itself shift the balance of power underlying a settlement by giving one side an advantage for future conflicts through an improved strategic position or greater resources.319 If Nation A were to cede population or territory in a peace settlement, for example, it might fear that a strengthened Nation B would renege and seek an even better deal. It might decline to make such a deal in the first place. Space weapons could help nations overcome some of these problems. Most importantly, they can **improve signaling** between nations and increase the prospects of a peaceful settlement. Space weapons could inflict varying levels of harm in between economic, nonviolent measures and those that put lives at risk. Nations, for example, can use ASAT weapons to temporarily disable an opponent’s communications or surveillance networks without loss of life. They could even destroy satellites outright or use space-based weapons to strike ground targets. Nations could also use space weapons defensively to send signals. They could deploy an anti-missile shield to defend against ICBM or other forms of long-range attack. Space weapons give nations the ability to send **more credible** **signals** by providing **more discrete** levels of force against a **broader range** of targets. Banning or limiting space weapons would have the opposite effect. It would **narrow** the range of targets. This could force nations to use **blunter methods** to send signals that pose a greater risk of damage and death. Rather than disable an opponent’s communications satellites, for example, a nation might have to destroy manned **c**ommand and **c**ontrol facilities on the ground. Instead of deploying an ABM system, a nation might consider a preventive attack on an enemy’s ICBM launch sites. Reducing the types of targets and limiting the means to attack them **increases** the odds of war by giving nations fewer options to reveal private information about capability and resolve. The more steps up an **escalatory ladder**, on the other hand, the **more opportunity** to **jump off** before reaching a **full-blown war**. Conflicts can result because rivals have uncertain information about their opponents. The Cuban Missile Crisis, for example, could have resulted in direct war because the superpowers could not rely on information about each other’s intentions.320 The U.S. did not know whether the Soviet Union might launch its medium range nuclear missiles, while the U.S.S.R. did not know whether the United States might destroy the missile sites or even invade Cuba.321 During the crisis, President John F. Kennedy even looked for guidance to Barbara Tuchman’s The **Guns of August**, which claimed that the great powers had miscalculated their way to war.322 Kennedy decided to **gradually escalate** the American response to the Soviet deployment of MRBMs in order to communicate U.S. resolve to force nuclear weapons out of Cuba, but also to give Moscow the opportunity to reach a peaceful settlement of their differences.323 The United States sent armed aircraft over Cuban airspace, mobilized regular armed forces for an invasion, imposed a naval “quarantine” of Cuba, and raised the **alert status** of its **nuclear forces**.324 Eventually the superpowers reached a deal: the U.S.S.R. withdrew its MRBMs from Cuba while the U.S. removed similar missiles from Turkey and, according to some, secretly pledged not to invade Cuba.325 Space weapons could provide the opportunity for an even greater menu of credible signals. Without space, great powers might have to signal credibly by choosing among air and missile strikes on manned targets, blockades, or ground assaults. With space, nations could choose less destructive steps such as attacking satellites networks, launching precision attacks against ground targets, deploying defensive ABM systems, or using satellites to enhance the precision and speed of ground operations. Less provocative measures could avoid a **rapid escalation** of hostilities. American leaders, for example, currently favor air strikes as a means of placing pressure on another government.326 They could choose to target an enemy’s space assets instead, which removes the element of combat deaths and reduces the scope of destruction. Even if leaders wish to attack ground targets, space weapons provide certain advantages. With air attack, U.S. doctrine first calls for neutralizing enemy anti-aircraft defenses and achieving air superiority. Air superiority is also seen as a necessary precondition for successful ground and naval operations.327 Both tasks call for destroying manned missile and air bases and shooting down enemy manned aircraft. Space-based weapons, however, could allow strikes against enemy targets without risking pilots, and therefore removing the need to destroy a nation’s air defense system and manned aircraft. Rational nations should peacefully settle their disputes and avoid the deadweight loss of war. A bargain will reflect their relative power positions, which create each side’s expected values from a conflict. In order to reach a deal, they must reveal their military capabilities and political will, which requires them to send credible signals. More types of force, at varying levels of harm, provide nations with a greater spectrum of more finely tuned gradations of coercion. Attacks on space-based systems can provide ways for nations to use limited, coercive force against each other without causing the death and destruction of terrestrial combat. Space weapons provide nations with greater ability to reveal reliable information about their abilities and intentions, and thus create more room for negotiation. V. SPACE WEAPONS AND INTERNATIONAL STABILITY