# **AC**

### Inherency

#### **Ambiguities in the OST that allow private appropriation have kicked off a race to develop space, causing a debris crisis, land grabs, and the domination of space by unaccountable billionaires. Current laws fail due to lax rules and forum shopping.**

Dovey 21 [Ceridwen Dovey, “Space Exploration At What Price?,” Readers Digest Asia Pacific, 5/1/21. <https://www.pressreader.com/australia/readers-digest-asia-pacific/20210501/281487869174485>] CT

One environmental risk all stakeholders agree on is that posed by space debris. There’s already about 5000 satellites in orbit around Earth, of which roughly 2000 are operational, plus hundreds of millions of tiny pieces of debris. Ninety-five per cent of the stuff in low-Earth orbit is classified as ‘space junk’. More space debris makes accessing space costlier in terms of loss of equipment (and possibly of human life). There’s also the risk of the Kessler effect: a cascade of collisions, to the point where the most useful orbital slots become permanently clogged. “We are in the process of messing up space, and most people don’t realise it because we can’t see it the way we can see fish kills, algal blooms or acid rain,” Michael Krepon, an expert on nuclear and space issues, said in 2015. Maybe we’ll understand only when it’s too late, “when we can’t get our satellite television and our telecommunications ... when we get knocked back to the 1950s”. The current clashes over space are rooted in the nitty-gritty of international space law. There are five multilateral UN treaties governing space, most importantly the 1967 Outer Space Treaty (OST), which has been ratified by 109 states, including all major spacefaring nations. It defines outer space as a global commons, the province of all humanity, free to be used and explored “for the benefit and in the interests of all countries”, “on a basis of equality” and only for “peaceful purposes”. Article II of the OST has become the major sticking point in the new space race. It forbids “national appropriation by claim of sovereignty, by means of use or occupation, or by any other means”. No nation can make a territorial claim on the Moon or on any other celestial bodies, such as asteroids. While the OST contains no explicit ban of appropriation by private enterprise, Steven Freeland, a professor specialising in space law at Western Sydney University and Australia’s representative to the UN Committee on the Peaceful Uses of Outer Space (COPUOS), says discussions at the time of the OST negotiations clearly show the states parties, including the US, were “of the opinion that Article II prohibited both public and private appropriation”. Yet this perceived legal uncertainty is the loophole that commercial companies are now exploiting. They’ve actively lobbied for an interpretation of OST Article II in the domestic space law of certain countries, to allow for private ownership of resources extracted from the Moon or other celestial bodies. They argue that, because the OST declares all humans are free to “use” space, companies can exercise this right by mining anywhere they like. They won’t claim ownership of the land itself, but will claim ownership of the resources they mine there. They’ve already had a major win in this regard. The space industry lobby in the US put pressure on members of Congress to reinterpret the US’s obligations under international space law, to become more ‘business friendly’. The outcome was the 2015 Commercial Space Launch Competitiveness Act, signed into law by President Obama. Since then, companies owned by US citizens have been given the right to claim ownership of – and sell – any resources they mine off-Earth. Further emboldened by the Trump administration, the “commercial [space] industry is becoming far more aggressive in how it lobbies for its own interests” in the US, Freeland says. There have been Acts proposed in recent years to enable a corporate space culture of “permissionless innovation”, with little regulatory oversight. In a 2017 speech, President Trump’s space law adviser Scott Pace said, “It bears repeating: outer space is not a ‘global commons’, not the ‘common heritage of mankind’, not ‘ res communis’ [area of territory that is not subject to legal title of any state], nor is it a public good.” Even if you accept the US government’s interpretation of Article II – that space resources, but not the territory on which they’re located, can be owned – what happens if someone mines an asteroid out of existence, which is an act of outright appropriation? Should the public trust that companies mining in space will do the right thing? We’re still uncovering the full extent of terrestrial mining companies’ cover-ups. For instance, inhouse scientists at Exxon – now Exxon-Mobil, one of the biggest oil and gas companies in the world – knew long ago that burning fossil fuels was responsible for global warming, but they actively buried those findings and discredited climate change science for decades. We live in a world where ‘meta-national’ companies can accrue and exercise more wealth and power than traditional nation-states. Silicon Valley is believed to be becoming more powerful than not only Wall Street but also the US government. Branson and other space billionaires like to reassure the masses they’re “democratising” space: just as plane travel started out for the wealthy and gradually became cheaper, so too will space travel. Yet this conveniently overlooks the fact that railroads, airlines and now space industries have all been heavily subsidised by taxpayers. “When we take a step back and notice that private corporations are often even less accountable than governments, then it seems mistaken to say these decisions have been democratised,” Ryan Jenkins, an emerging sciences ethicist at California Polytechnic State University, says. “They’ve merely been privatised.” Lenient supervision. In 2017, Luxembourg – already a corporate tax haven, complicit in international investor tax avoidance and evasion – followed the US’s lead and passed a space-resources law that allows companies to claim resources they extract from space as private property. Guardian journalist Atossa Araxia Abrahamian recounted a chilling comment from an American space executive: “We just want to work with a government who won’t get in the way.” Companies anywhere in the world can stake resource claims in space under this new law; their only requirement is an office in Luxembourg. This sets a murky precedent of ‘regulatory forum-shopping’, where companies choose to incorporate in states where they’ll be most leniently supervised. In 2018, a Silicon Valley start-up called Swarm Technologies illegally launched four miniature satellites known as CubeSats into space from India. They’d been refused launch permission in the US due to safety concerns over whether the satellites could be tracked once in orbit. Fined US$900,000 by the US Federal Communications Commission, the company was subsequently given permission to start communicating with its satellites, and launched more CubeSats as part of a payload on a SpaceX rocket that November. In January 2019, the company raised $25 million in venture capital. Space start-ups that are prepared – unlike Swarm Technologies – to play by the rules are nonetheless still proposing to launch their own swarms of hundreds or thousands of satellites into very low orbits around Earth. SpaceX has already launched over 1000 internet-beaming Starlink satellites, aiming to have a constellation of at least 30,000 in orbit eventually. The UK’s Royal Astronomical Society said these satellites will “compromise astronomical research” due to light pollution, and questioned why there’d been no proper consultation with the scientific community before launch.

### Advantage 1(1:21)

#### Increasing space debris levels inevitably set off a chain of collisions.

Rao and Rondina 2/16 [Akhil Rao(Middlebury College) & Giacomo Rondina (University of California, San Diego) “Open access to orbit and runaway space debris growth,” arXiv preprint arXiv:2202.07442 (February 16, 2022). <https://arxiv.org/pdf/2202.07442.pdf>] CT

In this paper we present a dynamic physico-economic model of orbit use under rational expectations with endogenous collision probability and Kessler Syndrome. We show how both economic and physical parameters drive equilibrium short- and long-run orbital-use patterns, derive the marginal external cost of a satellite, explore the multiplicity and stability of open access steady states, and examine the relationships between open-access orbit use, optimal orbit use, and Kessler Syndrome. We then calibrate the model to an important region of LEO and estimate the likely times when Kessler Syndrome will occur under different patterns of satellite industry economics. We highlight three messages regarding orbital-use management. First, under open access too many firms will launch satellites because they won’t internalize the risks they impose on other orbit users. Though profit maximizing satellite owners have incentives to reduce launches as the risk of a collision grows, they do not respond to debris growth or collision risk optimally. This inefficiency is independent of whether Kessler Syndrome is possible or not. Unlike many other bioeconomic commons problems, higher discount rates can induce less (rather than more) open-access overexploitation. Second, Kessler Syndrome is possible as long as debris objects can collide with each other and generate new fragments, i.e the new fragment formation debris coupling exists. Engineering studies indicate that this coupling does in fact exist. Due to open access, even profit maximizing firms with rational expectations may continue to launch satellites despite recognizing their role in causing Kessler Syndrome and even after the Kessler threshold has been crossed. Third, under open access Kessler Syndrome is more likely as the excess return on a satellite rises, even if firms will respond to orbital congestion by launching fewer satellites. As launch costs fall and new commercial satellite applications become viable, LEO is thus increasingly and inefficiently likely to experience Kessler Syndrome. While it may seem paradoxical that the very changes which make orbit use profitable can also increase the risk of resource collapse, such dynamics occur frequently in bioeconomic commons problems. Calibrated simulations reveal that space economy growth rates projected by investment banks and industry associations are consistent with Kessler Syndrome occurring as early as 2035. Our results suggest that, absent institutional reform, continued growth of the space economy may trigger Kessler Syndrome in the near future. This can occur even in regions perceived to have relatively high rates of natural renewability, providing new evidence that compliance with the 25-year rule is insufficient to ensure sustainable orbit use.

#### Privatization makes Kessler Syndrome mathematically inevitable - runaway collisions compound probability and will quickly render orbits unusable.

Rao and Rondina 2/16 [Akhil Rao(Middlebury College) & Giacomo Rondina (University of California, San Diego) “Open access to orbit and runaway space debris growth,” arXiv preprint arXiv:2202.07442 (February 16, 2022). <https://arxiv.org/pdf/2202.07442.pdf>] CT

1 Introduction

Satellite services are increasingly important in the modern world. As humans launch more satellites, the risk of collisions between orbiting objects increases. Such collisions can destroy satellites and produce orbital debris, further increasing the risk of future collisions, threatening active satellites and the future of human use of outer space. The worst-case scenario is runaway debris growth, known as Kessler Syndrome, wherein the production of debris due to collisions between orbiting bodies becomes self-sustaining and irreversible. In such a scenario valuable regions of orbital space may become unusable and impassable for decades, centuries, or longer. While a social planner may wish to avoid such a scenario, the current legal and institutional regime is one of open access: anyone with a suitable rocket can place a satellite in any orbit they choose. How will open access to orbit affect orbital debris accumulation, satellite collision risk, and the occurrence of Kessler Syndrome? How do short-run economic dynamics transition to long-run outcomes in orbit? If current institutions persist, when is Kessler Syndrome likely to occur? These questions are underexplored in economics and in the engineering and legal literatures.1 In this paper, we build a quantitative dynamic economic model of satellite launching and conduct theoretical and numerical analysis to explore the consequences of open access to orbit. Our model is “fully coupled”, allowing satellite and debris stocks to interact with themselves and each other. This feature is critical to understanding how and when economic behavior may cause or avoid Kessler Syndrome. We highlight three main findings about open-access orbit use. First, we show the open access equilibrium collision probability is determined by the excess rate of return on a satellite. This generates an equilibrium manifold as long as satellites can be destroyed by debris or other satellites. Open-access paths lead to the manifold, subject to initial conditions and launch rate constraints. Second, when collisions between debris produce more debris, Kessler Syndrome can occur along open-access paths. We show conditions under which open-access orbit users will cause Kessler Syndrome. We also derive the social planner’s solution, decompose the steady-state marginal external cost, and numerically illustrate the inefficiency of open-access Kessler Syndrome. Third, we calibrate our model to an important region of low-Earth orbit and show that sectoral growth projections from investment banks and industry associations are consistent with open-access Kessler Syndrome occurring as early as 2035. To contextualize our results and motivate our core model features, we offer some physical and institutional detail on orbit use. Satellites produce debris over their lifecycle. Launching satellites produces orbital debris (spent rocket stages, separation bolts), satellites can produce some debris while in orbit (paint chips, lost tools, etc.), and satellites which are not deorbited or shifted to disposal orbits at the end of their life become debris. Satellites struck by debris can shatter into thousands of hazardous debris fragments.2 Compounding the problem, collisions between debris objects can generate even more hazardous high-velocity debris. Debris accumulation can cause a cascading series of collisions between orbital objects, creating a growing field of debris which can render an orbital region unusable and impassable for decades, centuries, or longer. Engineers call this phenomenon “collisional cascading” or “Kessler Syndrome” (Kessler and Cour-Palais, 1978). Kessler Syndrome can cause large economic losses, both directly from damage to active satellites and indirectly from limiting access to space (Bradley and Wein, 2009; Schaub et al., 2015). Existing estimates of debris growth indicate that the risk of Kessler Syndrome is highest in low-Earth orbit (LEO), where it threatens current and future imaging and telecommunications satellites and can reduce access to higher orbits (Kessler et al., 2010; Lewis, 2020). In the worst-case scenario Kessler Syndrome could completely block human access to space, marking an eventual end to services like GPS and satellite imaging. In 2019, the cost of a temporary GPS outage to the US private sector alone was estimated to be on the order of $1 billion per day, and as much as 50% higher if it occurred during the critical planting season (O’Connor et al., 2019). Long-run disruption of satellite services will make it harder to measure economic activity, reduce weather-related uncertainty, measure environmental degradation and respond to natural disasters, monitor environmental policy compliance, and meet conservation goals (Donaldson and Storeygard, 2016; Sullivan and Krupnick, 2018; Baragwanath et al., 2019; Jain, 2020; Cooke and Golub, 2020; Stroming et al., 2020; Bernknopf, Steinkruger, and Kuwayama, 2021). Further, development of the space economy is expected to contribute to terrestrial growth globally (Crane et al., 2020). Some estimates show debris production due to debris-debris collisions in higher reaches of LEO has already crossed the self-sustaining growth threshold (Liou and Johnson, 2008). Existing legal frameworks for orbit use such as the Outer Space Treaty (OST) complicate the process of establishing orbital property rights and hinder debris cleanup efforts.3 We offer a new perspective on how these institutions interact with orbital mechanics to make Kessler Syndrome possible, and a model environment in which alternative management institutions can be explored quantitatively.4 As Stavins (2011) notes, management of the commons is among the central issues of economics. While open access problems have been well-studied in terrestrial settings such as fisheries, forests, climate, oil fields, traffic, and invasive species management (Gordon, 1954; Scott, 1955; Nordhaus, 1982; Libecap and Wiggins, 1985; Bohn and Deacon, 2000; Duranton and Turner, 2011; Huang and Smith, 2014), open access to orbital resources is not as well understood. Though results from these other settings provide some helpful intuition, open access and the orbital mechanics governing collision risk and debris production create unique physico-economic feedback loops. We extend the literature on how open access and a lack of property rights affects resource use and management to a new, increasingly-relevant context. Commons problems, particularly in biophysical commons, often involve dynamic externalities and nonconvexities (Haveman, 1973; Brown Jr, 1974; Levhari and Mirman, 1980; Reinganum and Stokey, 1985; Farzin, 1996; Sherstyuk et al., 2016). Such issues also occur in arms races, growth, lake management, climate management, industrial development, and other settings with strategic or dynamic interactions and tipping points (Simaan and Cruz, 1975; Boldrin, 1992; Henderson, 1997; Mäler, Xepapadeas, and de Zeeuw, 2003; Hein, 2006; Lemoine and Traeger, 2014; Chavas, Grainger, and Hudson, 2016; Beaudry, Galizia, and Portier, 2020). Though results from other settings again offer helpful intuition, the unique physical properties of orbits create a novel dynamic externality problem which illuminates the natures of congestion and pollution more generally, particularly in the face of tipping points. We add to the literature on decentralized and optimal responses to interacting dynamic externalities by showing how profit-maximizing responses to congestion can limit pollution production, and biophysical conditions under which profit maximization leads to runaway pollutant accumulation due to a fold bifurcation. The bifurcation emerges due to fragment-generating collisions between debris objects (i.e. autocatalytic pollutant production), but is modulated by the degree to which debris reduces satellite profitability in the short run (i.e. pollution-induced congestion). We also identify an important difference between resource-use dynamics when the relevant capital stock is provided by nature (e.g. fish in fisheries) and when it is provided by humans (e.g. satellites in orbits): while increases in the discount rate make optimal resource collapse more likely for natural capital, they have the opposite effect for artificial capital. Active satellites provide services to individuals, firms, governments, research agencies, and other entities. They tend to be information services like mobile broadband, images of the Earth, and positioning/timing. Adilov, Alexander, and Cunningham (2015) account for orbital product differentiation in a two-period setting. To focus on the dynamics of collisions and debris, we ignore such differentiation. Our paper bridges the short-term and long-term physical and economic dynamics of perfectly-competitive open-access and socially-optimal orbit use in a physically-general environment where Kessler Syndrome can occur over multiple periods, and is the first to provide economically-grounded estimates of the time until Kessler Syndrome occurs. While Sandler and Schulze (1981) account for collision risk when studying geostationary belt position allocation, debris accumulation and general orbital regions are not considered. Our analysis generalizes those presented in Macauley (2015); Adilov, Alexander, and Cunningham (2015, 2018), Grzelka and Wagner (2019), and Rouillon (2020) in the physical dimensions by allowing non-stationary dynamics and runaway debris growth, and clarifies the sources of external effects by explicitly considering the economics of general forms of couplings between physical state variables. While our model is most similar to that of Rouillon (2020), we generalize the analysis by considering a planner who owns both the current stock of satellites in orbit as well as the rights to launch to that orbit in perpetuity, and by allowing debris to collide with other debris. The former generalization allows us to decompose the marginal external cost of satellites into three channels (congestion, pollution, and debris persistence), while the latter generalization is relevant for analyzing long-run orbit use (Lewis, 2020). Unlike Rao (2018), Grzelka and Wagner (2019), Rao, Burgess, and Kaffine (2020), and Béal, Deschamps, and Moulin (2020), we focus primarily on economic dynamics rather than policy instrument design. However, as is the case with climate management, the positive feedbacks we incorporate are likely important for optimal orbital-use policy design (Lemoine and Traeger, 2016; Daniel, Litterman, and Wagner, 2019; Dietz et al., 2021b,a). Because we explicitly model the physical processes leading to Kessler Syndrome, we are able to calibrate our model to an important region of LEO and estimate the time when Kessler Syndrome occurs under continued open-access management and historically-plausible sectoral growth patterns. Though prior work has established that the open-access launch rate exceeds the sociallyoptimal launch rate and results in excess collision risk and debris production (Adilov, Alexander, and Cunningham, 2015; Rouillon, 2020), our framework yields the novel insight that an open-access equilibrium manifold can exist due to couplings between satellites and debris in the collision risk function. This manifold contains all of the steady states and, combined with initial conditions and launch rate constraints, determines the steady-state approach paths. Under certain conditions open-access paths can cause Kessler Syndrome, in which case a steady state will never be reached. Our results contrast with those in Adilov, Alexander, and Cunningham (2018), where open access is found to never cause Kessler Syndrome as orbits become economically unprofitable before they become physically unusable (“economic Kessler Syn5 drome”). The contrast is due to our differing definitions of Kessler Syndrome and degrees of physical generality. Adilov, Alexander, and Cunningham (2018) consider a definition of Kessler Syndrome where satellites are destroyed with probability one (“unusable orbits”) and disallow collisions between debris objects—as long as the collision probability is below one this definition states Kessler Syndrome has not occurred, and as long as launch activity ceases the debris stock eventually decays. We define Kessler Syndrome as states where the debris stock diverges to infinity (“runaway debris growth”) and allow collisions between debris objects. Both features are critical for understanding orbit-use dynamics, as collisions between debris are becoming increasingly likely and are expected to dominate the long-run dynamics of the orbital environment (Davenport, 2020; Lewis, 2020). Once runaway debris growth occurs in our model, the collision probability will eventually reach one (runaway debris growth eventually renders orbits unusable), but it may only happen over a span of decades or centuries. Though launch activity may cease before orbits are unusable, if the Kessler threshold has been crossed this will not stop ongoing debris accumulation. Thus, our definition encompasses the one in Adilov, Alexander, and Cunningham (2018) while allowing Kessler Syndrome to occur over time due to dynamic feedbacks. Finally, the physical detail of our model allows us calibrate parameters to an important region of LEO and estimate the likely time when Kessler Syndrome will occur under continued open-access management. As in Rouillon (2020); Rao, Burgess, and Kaffine (2020), and Béal, Deschamps, and Moulin (2020), we use constant payoffs and costs per satellite to derive theoretical results. However, to calibrate the model and estimate the time till Kessler Syndrome occurs we allow both to vary over time and allow the per-period payoff to depend on the satellite stock. We find that the average growth of returns to operating a satellite and the “orbital occupancy elasticity of satellite payoffs” are key economic parameters determining whether and when Kessler Syndrome occurs under open access.

#### Loss of satellites escalates to nuclear war.

Blatt 20 [Blatt, Talia. "ANTI-SATELLITE WEAPONS AND THE EMERGING SPACE ARMS RACE." Harvard International Review, vol. 41, no. 3, 2020, pp. 29-34. ProQuest, <https://marlborough.idm.oclc.org/login?url=https://www.proquest.com/scholarly-journals/anti-satellite-weapons-emerging-space-arms-race/docview/2581550024/se-2?accountid=3672>.] CT

Despite their deterrent functions, ASATs are more likely to provoke or exacerbate conflicts than dampen them, especially given the risk they pose to early warning satellites. These satellites are a crucial element of US ballistic missile defense, capable of detecting missiles immediately after launch and tracking their paths. Suppose a US early warning satellite goes dark, or is shut down. Going dark could signal a glitch, but in a world in which other countries have ASATs, it could also signal the beginning of an attack. Without early warning satellites, the United States is much more susceptible to nuclear missiles. Given the strategy of counterforcing-targeting nuclear silos rather than populous cities to prevent a nuclear counterattack-the Americans might believe their nuclear weapons are imminently at risk. It could be twelve hours before the United States regains satellite function, which is too long to wait to put together a nuclear counterattack. The United States, therefore, might move to mobilize a nuclear attack against Russia or China over what might just be a piece of debris shutting off a satellite. Additionally, accidental warfare, or strategic miscalculation, is uniquely likely in space. It is much easier to hold an adversary's space systems in jeopardy with destructive ASATs than it is to sustainably defend a system, which is expensive and in some cases not technologically feasible because of limitations on satellite movement. Space is therefore considered offense-dominant; offensive tactics like weapons development are prioritized over defensive measures, such as improving GPS or making satellites more resistant to jamming. As a result, countries are left with poorly defended space systems and rely on offensive posturing, which increases the risk that their actions are perceived as aggressive and incentivizes rapid, risky counterattacks because militaries cannot rely on their spaced-based systems after first strikes. There are several hotspots in which ASATs and offensive-dominant systems are particularly relevant. Early warning satellites play a central role in US readiness in the event of a conflict involving North Korea. News of North Korean missile launches comes from these satellites. Given North Korea's history of nuclear provocations, unflinchingly hostile rhetoric towards the United States and South Korea, and diplomatic opacity, North Korea is always a threatening, unknowable adversary, but recent developments have magnified the risk. With the health of Kim Jong-un potentially in jeopardy, a succession battle or even civil war on the peninsula raises the chances of loose nukes. If the regime is terminal, traditional MAD risk calculus will become moot; with nothing to lose, North Korea would be incentivized to attempt a nuclear lash-out against the United States. Or, China might decide to seize military assets and infrastructure of the regime. If the US does not have its early warning satellites because they have been taken out in an ASAT attack, the US, South Korea, and Japan are all in imminent nuclear peril, while China could be in a position to fundamentally reshape East Asian geopolitics. The South China Sea is another hotspot in which ASATs could risk escalation. China is developing Anti-Access Area Denial (A2/AD) in the South China Sea, a combination of long range radar with air and maritime defense meant to deny US freedom of navigation in the region. Given the disputed nature of territory in the South China Sea, the United States and its allies do not want China to successfully close off the region. But the most effective way to break an A2/AD system would be with anti-satellite weapons. ASATs could neutralize the maritime surveillance China relies upon to deny access to the region and guide cruise missiles. Thus, China is extremely wary of US ASAT development: risks to Beijing's South China Sea strategy are seen as threats to China itself because of territorial sovereignty claims that are deeply important to the regime and have only become more pronounced under President Xi Jinping. If a Chinese satellite went dark, Beijing might perceive it as a US ASAT designed to undermine the A2/AD approach, and escalate with conventional force. An Even Greater Risk Many of these conflict scenarios start with the loss of satellite function, which may seem unlikely. But ASATs threaten satellites through more than just direct attack. ASAT testing, rather than deployment, risks the exponential accumulation of debris, which endangers satellites and creates a host of other problems. KE-ASATs rely on smashing satellites into thousands of pieces, so each test adds tremendous amounts of space debris. The 2007 Chinese KE-ASAT test alone increased the number of objects in orbit by 20 percent, producing more than two thousand pieces of debris large enough to be tracked and likely thousands more too small to be counted that will remain in orbit for centuries. Even the smallest pieces of debris can do great damage; traveling at more than 15,000 miles per hour, they can crash into other debris in a proliferation known as the Kessler Syndrome. The situation in space could approach a critical mass in which collision cascading occurs even if all launches were halted, choking orbits with debris until all satellites are destroyed and spaceflight rendered impossible. Compared to the negligible debris created during commercial launches, ASAT tests-especially if the arms race continues to escalate and countries with less developed space programs join with cruder designs-may accelerate the debris in space closer and closer to this critical mass. If debris knocks out a satellite, an increasingly likely possibility in a world with ASAT tests, then the aforementioned conflict scenarios become more likely. Conflict aside, ASAT-based debris clouds are terrifying in their own right. Public health, transportation, climate science, and a litany of other crucial infrastructures are dependent on satellites that are now at risk. Satellite GPS is a cornerstone of the modern economy; some pundits believe that the slightest glitch in GPS satellites could shock the stock market and further destabilize an unstable global economy. During the pandemic, satellites are playing a crucial role in geospatial data collection for infectious disease modeling. Essentially, it is hard to imagine a world without satellites, but that is a possible outcome given that there are no reliable methods of withdrawing debris from space.

### Advantage 2 (2:00)

#### National Appropriation -- Private appropriation guts the prohibition on national appropriation since states are obligated to authorize and supervise their own citizens in space, which is the exercise of sovereignty. AND, if states don’t actively restrict private appropriation national appropriation is inevitable, triggering interstate conflict – legal precedent, responsibility to supervise, and economic incentives. Counterplans don’t solve.

Ferreira-Snyman 21 [Anél Ferreira-Snyman, "Challenges to the Prohibition on Sovereignty in Outer Space - A New Frontier for Space Governance" PER / PELJ 2021(24) – DOIhttp://dx.doi.org/10. 17159/17273781/2021/v24i0a8685] CT

The role of the state in the establishment of private property rights in space cannot be ignored, however. Article VI of the Outer Space Treaty determines that states parties to the Treaty shall bear international responsibility for national activities in outer space including when such activities are carried on by non-governmental entities. The activities of nongovernmental entities in outer space, including on the moon and other celestial bodies, must also be authorised and continuously supervised by the appropriate state. Both the American and Luxembourg legislation on space resource extraction confirm this role of the state. Thus, since the state exerts control over the private company, the latter's activities may be attributed to the state.182 In this sense, the lines between private ownership and state sovereignty become blurred, as both require control over the space object to the exclusion of others. Therefore, de facto appropriation by private companies could arguably become legal once states start to recognise such rights,183 as already illustrated by the American and Luxembourg laws’ recognition of at least private appropriation of space resources. In this regard, Pershing submits that the acceptance of resource appropriation may lay the foundation for a "second shift" 184 in customary international law's interpretation of the non-appropriation principle:185

Should States buckle to private commercial pressure or independently recognize the economic benefits of domestic companies obtaining private property in celestial territory, States would have a newfound interest in recognizing and protecting in situ rights. The legal justifications for de jure or de facto cooperation in non-recognition would likely become subordinate to economic incentives – spurring the adoption of new legal arguments to support shifting State interests.

It therefore seems inevitable that once a private company has de facto control over a space object such as the moon or an asteroid, such control may become legal once the majority of states recognises or at least does not object to such appropriation. Arguably, this may open the door for a state to assert sovereignty (at least over time) over the space objects occupied by the private companies that are authorised and supervised186 by the particular state. In other words, the state could thus achieve "extraterrestrial sovereignty through its citizen's actions."187 In this regard Durkee188 argues that "private companies are themselves developing the international law of outer space." She explains this "attributed lawmaking" as follows:189

When a corporation whose activity is attributed to the state publically asserts a legal rule and acts on it and a nation does nothing, the nation implicitly accepts the corporate rule. In the absence of direct evidence if a nation's acts and assertions in support of a customary rule, the actions of private companies – which are attributed to the nation – become the best evidence of a nation's embrace of a particular interpretation of the Outer Space Treaty. The result … is that private companies may be forcing development of an international legal rule that is permissive to appropriation of space resources.

It has been suggested by some that the rule of first possession would inevitably be applied in outer space, analogous to the "first in time, first in right" property principle that was applied on Earth for centuries.190 In this regard Gruner even submits191 that the existing outer space treaty regime lacks legal certainty pertaining to property issues since it "overturns centuries of international law by rejecting the longstanding principle of national sovereignty."192 He therefore proposes applying the first possession rule in outer space by implementing a new concept of property where the discovering nation declares the particular space object res nullius humanitatus

meaning that it is a place where people can still have individual property rights and be rewarded for their labor based on first possession, but where settlers will act on behalf of the interests of humanity rather than a single terrestrial nation. In this manner, res nullius humanitatus would guarantee all humans equal access to the rewards offered by outer space, rather than a de facto equal share in the rewards reaped from such exploration and exploitation simply because they are human.193

The above suggestion thus still adheres to the principle of the common heritage of humankind, but argues for a wider interpretation of the principle, allowing for individual property rights.194 It remains to be seen, however, whether the major space-faring nations would be willing to consider such a suggestion, especially since the United States' executive order on space resources specifically states that the USA does not consider outer space to be a global commons.

Although the rule of first possession have been criticised for promoting a space race, colonialism and the possibility of an "unmitigated land rush", 195 it is agreed with arguments that this principle, if properly regulated, might provide the basis for establishing a property rights regime in outer space. As MacWhorter proposes:196

To avoid the conflicts inherent between rivalrous nations, though, acknowledging only limited rights in property through first possession is the appropriate first step. By ensuring that private property will be enforced once a mining venture has brought space material back to Earth, many of the practical consequences of total first possession incorporation may be avoided.

To circumvent the non-appropriation principle, a number of other alternatives to create some kind of sui generis right of ownership have been suggested 197 that could make the commercial development of outer space possible and viable for developers. These suggestions include certain "property-like rights" not constituting ownership, such as "concessions, mining licences, prospecting rights, and certain contractual rights"; 198 a "credit-swap" system;199 the leasing of outer space to nations and private companies;200 the creation of a public trust to manage property in outer space; 201 a hybrid property regime; 202 stewardship’ 203 lotteries; tradable credits; 204 and tenders.205 None of these proposals is without criticism and all of them require some involvement of the state, opening the door once again for the establishment of sovereignty through the activities of private entities under the control of the state. Nevertheless, suggestions like these are at least indicative of the dire need to start re-evaluating property rights in outer space law.

3 The way forward for space governance?

In response to the adoption of the United States Commercial Space Launch Competitiveness Act, the Board of Directors of the International Institute of Space Law stated as follows:206

Whether the United States interpretation of Art. II of the Outer Space Treaty is followed by other states will be central to the future understanding and development of the non-appropriation principle. It can be a starting point for the development of international rules to be evaluated by means of an international dialogue in order to coordinate the free exploitation and use of outer space, including resource extraction, for the benefit and in the interest of all countries.

Different suggestions have been made by commentators on the way international legal rules pertaining to the use and development of outer space should be developed. These vary from adapting or amending the current Outer Space Treaty207 and/or Moon Agreement208 to developing a completely new legal framework209 to address specific issues.

The urgency of the need to clarify and develop legal rules relating to the exploitation of outer space, including the establishment of property rights, is vividly illustrated by the USA's recent unilateral release of the Artemis Accords.210 The Accords – named after NASA's Artemis programme, which aims to send the first women and the next man to the moon by 2024 - is a set of standards for the exploration of the moon211 and is intended to create a framework agreed on by the United States and its partners212 in the Artemis programme by clarifying some of the lacunae in the Outer Space Treaty. 213 The idea is to create an agreement without utilising the often cumbersome and long treaty-making process in the United Nations.214 Instead, the USA aims to reach agreement with "like-minded" nations since, according to American officials, working with non-space faring states would be unproductive.215 The unilateral creation of the Artemis Accords, however, has already been sharply criticised by Russia as an attempt by the United States to side-line the United Nations and to invade the moon in a manner similar to that in which it invaded Iraq and Afghanistan.216 It is also to be expected that China will not react favourably to the Accords,217 which are perceived by some academic commentators as expressing an "ambition for space hegemony" 218 by the United States. In addition, the deliberate exclusion of non-space-faring states from the creation of the legal framework is another clear confirmation of the United States' stance that outer space is not a global commons.

At first glance, the guiding principles of the Artemis Accords merely confirm the current outer space treaties, for example by determining that space activities must be conducted for peaceful purposes, that assistance must be provided to astronauts in distress and that space objects must be registered. The most controversial issues provided for in the Accords are the extraction and use of space resources219 and the intended establishment of so-called "safety zones" 220 around lunar landing sites.

Although the Artemis Accords do not mention property rights explicitly, they confirm the United States' interpretation of the Outer Space Treaty as expressed in its domestic legislation and subsequent executive order on the exploitation of space resources by determining that "space resource extraction and utilization can and will be conducted under the auspices of the Outer Space Treaty." 221 Therefore, by signing the Accords partners agree with this interpretation made by the United States. Should this interpretation be generally accepted by space-faring nations through bilateral and multilateral agreements, these rules for space mining and property rights may eventually become customary international law. This remains to be seen, however, since Russia has already indicated that any attempts to privatise space would be unacceptable.222

To avoid harmful interference with space activities, the Artemis Accords make provision for the establishment of safety zones around lunar bases. Although American officials have indicated that these zones do not technically amount to a territorial claim over the affected areas,223 it may be argued that such zones at least display some characteristics of territorial sovereignty by exerting control over a particular area on the moon to the exclusion of others. As Weaver points out, "'commercial' appropriation is much more subtle than outright legal appropriation" since the claimant does not make any (explicit) proclamation of sovereign control to the international community.224 Nevertheless, the outcome is in essence the same, since the benefits are gathered to the exclusion of others. The establishment of lunar safety zones seems to be similar to the rule of first possession, which strengthens the earlier argument that the principle of "first in time, first in right" might provide the basis for establishing property rights in space. According to American officials, a state nearing another state's operations in a safety zone has to consult the latter state first to prevent damage or interference.225 Although the Artemis Accords confirm that outer space must be used for peaceful purposes, one might expect that the United States' Space Force226 would play some role in the protection of American safety zones. This has obvious implications for the prohibition on the (active) militarisation and, even more seriously, weaponisation of outer space.227 One may also expect that states would want first to stake their claims to those lunar areas that are the richest in resources, a tendency which may create conflict between competing states.

The practical implications of the Artemis Accords remain to be seen. However, in order to prevent that outer space "turns into the Wild West of the twenty-first century", 228 legal rules for the exploitation of outer space bodies have to be developed under the auspices of an international institution and not left to individual states or, for that matter, selected private companies. This would not only result in the fragmentation of outer space governance, which could create more legal uncertainty,229 but might also encourage "forum-shopping" by commercial operators to find domestic systems with minimum regulation of their activities.230

Given that time is of the essence, it is suggested that the UNCOPUOUS as an established body that has been specifically created to address issues relating to outer space is best suited to addressing this task. Although it may be argued that the UNCOPUOS's decision-making processes, which are based on the rule of consensus, are too slow, it is currently the only multilateral forum for the discussion of outer space matters.231 The creation of a completely new international law-making body to address urgent space issues is simply not realistic and would take even longer. Once the rules have been established, a permanent regulatory body, perhaps similar to the International Seabed Authority, could be created to oversee their implementation,232 also by means of states' national legislation, and to protect the rights of developing states.

After the conclusion of the core UN space treaties in the 1960s and 1970s it became apparent that states were no longer willing to adopt further binding obligations regulating space activities and that international space law could therefore be developed only by adopting "soft law" instruments.233 Because of their non-mandatory character, these instruments are generally more easily negotiated by states than is the case with treaties.234 Thus, soft law235 documents are currently the main instruments for further developing and defining the norms of outer space.236 It is therefore to be expected that the rules for exploiting outer space bodies would also (initially at least) be in the form of soft law. Nevertheless, soft law guidelines have a legal value237 as they impact on the international law-making process by providing the premises from which customary international law might develop, and might eventually lead to the conclusion of a treaty.238 The work of the Hague International Space Resources Governance Working Group239 could play an important role in this process. The Working Group reflects a so-called bottom-up approach to norms development240 by representing the wider outer space community, including industry, states, international organisations, academia and NGOs. On 12 November 2019 the Working Group adopted the "Building Blocks for the Development of an International Framework on Space Resource Activities".241 The Building Blocks could thus form the basis for multilateral discussions on the development of softlaw rules for the regulation of commercial activities in outer space.

The unregulated exploitation of outer space is not only a catalyst for conflict between states, but could also cause irreparable harm to the outer space environment because of human contamination and the creation of more space debris.242 The international community will have to act swiftly if the aspirations of using outer space for peaceful purposes and preserving it for future generations are to be fulfilled.

#### Private appropriation unravels the institutions of space law which have maintained peace in space – triggers conflict.

Tronchetti 08 [Fabio Tronchetti (LL.M Bologna University & Lecturer at the International Institute of Air and Space Law) “The Non-Appropriation Principle as a Structural Norm of International Law: A New Way of Interpreting Article II of the Outer pace Treaty,” Air & Space Law, Vol XXXIII/3 (June 2008).] CT

1. The Non-Appropriation Principle: The Basis of Space Law

The non-appropriation principle is the fundamental pillar on which space law is built. It provides direction and guidance to all activities in outer space. Since the first satellite was launched States agreed to renounce any sovereignty claims in outer space and to consider outer space as non-appropriable. The space era was seen as a unique opportunity for all mankind and as a possible instrument to improve the quality of life of all people on Earth. The presence of the nonappropriation principle represented the best guarantee that this ‘humanitarian’ and idealistic approach to the management of the space environment was put in practice. Its presence, indeed, was a clear commitment made by States to perform space activities on a cooperative basis and to carry out the exploration and use of outer space for the benefit of all.

2. Predominance of the Non-Appropriation Principle over the Other Space Law Rules

The non-appropriation principle represents the premise for the putting into practice and realization of the other principles set forth in the Outer Space Treaty. Firstly, the freedom of exploration and use by all States of outer space may exist only in the presence of the non-appropriation principle. If each State was allowed to extend territorial rights over parts of outer space, the freedom to accede to and use outer space would be reduced or completely abolished. The non-appropriation principle, indeed, is to be considered the crucial component of the res communis idea. Secondly, if national appropriation in space was al-lowed, the preservation of outer space for peaceful purposes would be put in serious danger. As previously analysed, the prohibition to appropriate outer space has prevented territorial conflicts and rivalries in outer space so far. The removal of such prohibition would generate the opposite effect. Moreover, if States were free to 'nationalize' parts of outer space there is serious doubt that the principle of cooperation and mutual assistance (Article IX of the Outer Space Treaty) would continue to guide the activities of States in outer space.

3. Evidences of the Structural Status of the Non-Appropriation Principle

It is possible to list several examples which support and confirm the structural status of the non-appropriation principle. These examples come both from the past, namely from the process leading to the setting up of space law, and from the current practice of States and private operators in space. Therefore, I have classified such evidences as either historical or modem.

3.1) Historical Evidences

The res communis omium nature of outer space found support in legal theory and in official declarations since the beginning of the space era. Already in 1947, D. Manuilsky, UN Delegate of the USSR, proposed to submit a resolu-tion to the UN declaring outer space 'an international entity'." Such proposal did not find any positive answer. However, in the literature of the pre and post satellite era there was a generally accepted view that outer space could not be subject to national appropriation. For instance, in 1965 Professor Jenks in 1965 affirmed that: 'Space beyond the atmosphere is and must always be a res extra commercium incapable of appropriation by the protection into such space of any particular sovereignty based on a fraction of the Earth's surface',32 while in 1959 M.S. Smimoff stated: 'The right of occupation and discovery does not exist in space which is considered as res communis'." The non-appropriative na-ture of outer space was also affirmed in the 1960 Resolution of the International Law Association declaring that: outer space may not be subject to the sover-eignty or other exclusive rights of any State',' and in the 1962 Draft Code of the David Davies Memorial Institute providing: 'Outer space, and the celestial bodies, therein, are recognized as being res communis omnium ... and neither outer space nor celestial bodies in it are capable of appropriation or exclusive use by any State'." As to official statements, already in 1958 Senator Johnson addressed the United Nations by declaring that: 'We of the United States have recognized and recognize, as most all men, that the penetration into outer space is the concern of all mankind. If nations proceed unilaterally, then their penetration into space becomes only extension of their policies on Earth. Today outer space is free. It is unscarred by conflict. No nation holds a concession there. It must remain that way'. On 14 September 1959, the Soviet space device Lunik-2 crashed on the surface of the Moon by carrying metal emblems bearing the coat of arms of the Soviet Union and the Soviet Republics. Shortly after the Lunik's reaching the Moon, the soviet academics L.I. Sedov and A.V. Topchiyev declared that the Soviet Union was not claiming any territorial right as a result of such opera-tion.' This statement was confirmed by Premier Khruschev who stated: 'The Soviet pennant as an old resident, will then welcome your pennant and they will live together in peace and friendship and as well as people should live who in-habit our common mother the Earth. ...We regard the sending of the rocket into outer space and the deliverance of our pennant to the Moon as our achievement and by this word "our" we mean the countries of the entire world, i.e., we mean that this is also your achievement and the accomplishment of all the people liv-ing on the Earth'." From the United States side, we can quote the declaration of President Eisenhower who, on 22 September 1960, addressed the United Nations General Assembly by indicating some basic concepts that in his opinion had to consti-tute the basis for international space cooperation. Among those there were the following principles: 'We agree that celestial bodies are not subject to national appropriation by any claims of sovereignty'." Later, as we have seen, the non-appropriation principle was incorporated in UNGA Resolution 1721 and 1962.

In June1966, both the United States and the Soviet Union submitted to the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) drafts of an instrument that would become the Outer Space Treaty. These drafts were based on the non-appropriative nature of outer space. In 1967, the non-ap-propriative nature of outer space was formally laid down in Article II of the Outer Space Treaty. Nine years after the signature of the Outer Space Treaty, an international case confirmed the importance of the non-appropriation principle. In 1976, eight equatorial States which were not parties to the Treaty, claimed, by means of the Bogota Declaration, sovereignty rights over the part of the geostationary orbit above their territory.39 These States affirmed their non-acceptance of the principles of the Treaty, particularly the non-appropriation provision. Their claim was rejected by the overwhelming majority of States on the ground that the non-appropriative nature of outer space was a rule binding all States irre-spectively of their being a party to the Treaty.

3.2. Modem Evidences

As previously analyzed in this paper, a large number of authors consider the non-appropriation principle the major obstacle to the commercial development of outer space. The reasons why the legal proposals of these authors are not ac-ceptable have already been explained. The important point to notice at this stage is that all these attacks on the non-appropriation principle symbolize a confirmation of the special status of this principle within the context of space law. The more such authors attack the non-appropriation principle, the more its im-portance and the need for keeping it as the basis of space activities emerge. The fact that these authors only focus on this principle and not on others, such as the one establishing that the exploration and use of outer space shall be carried out for the benefit and in the interests of all mankind, is an indication that it is the essence of the space law system. Apart from these theories, the other major threat to the non-appropriation principle comes from private companies which are selling plots on lunar and other celestial bodies'. These companies, which claim to be allowed to carry on such activities by relying on the idea that private operators are not subject to Article II of the Outer Space Treaty, substantially operate as if the non-appro-priation principle was not in force. Indeed, they promise to their customers the enjoyment of full property rights over the acquired acres. One of these compa-nies is Lunar Embassy, which has established the practice of setting up twin companies and nominating ambassadors from around the world. Recently a case involving the so-called Lunar Embassy in China, was decided upon by a Beijing court. In October 2005, Beijing industrial and commercial authorities suspend-ed the license of Lunar Embassy in China for having engaged in speculation and profiteering and fined it 50,000 Yuan. Lunar Embassy in China sued the Beijing Administration.49 The Haidian District People's Court ruled against the company in November 2005. Then, the company decided to appeal against the Court's decision.4' In March 2007, the Beijing First Intermediate People's Court ruled against the company, stating that no individual or State could claim own-ership of the Moon.42 In its judgment the Court cited the fact that, since 1983, China was a party to the Outer Space Treaty, which prohibits appropriation of outer space parts thereof. Another significant re-affirmation of the relevance of the non-appropriation principle is the 2004 'Statement of the Board of Directors of the International Institute of Space Law on Claims to Property Rights Regarding the Moon and Other Celestial Bodies'.43 The Statement reads: The prohibition of national appropriation ...precludes the application of any legislation on a territorial basis to validate a private claim. Hence, it is not sufficient for seller of lunar deeds to point to national law, or the silence of national authorities, to justify their claims'. The Statement also calls the State Parties to the Outer Space Treaty to `comply with their obligation under Articles II and VI of the Outer Space Treaty...under the duty to ensure that, in their legal systems, transactions re-garding claims to property rights to the Moon and other celestial bodies or parts thereof, have no legal significance or recognised legal effect'. The Statement on one hand rejects those theories supporting the national registration of private claims to the Moon and other celestial bodies and on the other restates the spe-cial obligation for States to respect and to ensure the respect of the non-appro-priative nature of outer space.

4. The Abrogation of the Non-Appropriation Principle will Result in the Collapse of the System of Space Law

If the non-appropriation principle would be abrogated, it is very likely that the system of space law as we know it would cease to exist. In a future space scenario without its presence, conflicting claims among States would arise. This situation would engender international tension and would increase the risk of conflicts in space. Moreover, it is not sure that the abrogation of the non-appropriation principle is a good move from an economic and profit-oriented point of view. As we have seen, if States were allowed to gain control over an area of a celestial body, there would be nothing to prevent such States to impose fees for the access and use of that area. The costs for using space resources and for carrying out exploitative activities would, thus, increase. Therefore, the dis-appearance of the non-appropriation principle would slow-down instead of stimulate, the commercial development of outer space.

5. Mandatory Requirements for a Theoretical Disappearance of the Non-Appropriation Principle

The non-appropriation principle constitutes the central rule of the space law system. It ensures the proper functioning of that system and gives all States the possibility to obtain benefits from the exploration and use of outer space. Its hypothetical disappearance could be acceptable only in the presence of another rule which is able to guarantee the same level of order and security as the non-appropriation principle has provided in the past 40 years. It is not sufficient to say that its disappearance will be a profitable move for space operators and will generate benefits for all. Evidence and valid legal arguments to prove and sup-port that proposition must be provided. As it has been shown, none of the proposals put forward so far is able to sufficiently demonstrate the advantages coming from the removal of the non-appropriation principle. Moreover, none of these proposals provides an alternative mechanism to guarantee the orderly and peaceful carrying out of space activities.

6. The Preservation of the Principle's Leading Role is the Pre-Requisite for the Further Development of Space Law

The non-appropriative nature of outer space was formally confirmed in 1967 by means of Article II of the Outer Space Treaty. Since then, space law has evolved in order to meet the changing needs of States and private entities operating in space. The new century poses a new challenge for space law, name-ly the commercial use of space resources. The presence of the non-appropriation principle does not present an obstacle to such use. As has been demonstrated, this principle has contributed to the successful and peaceful development of space activities so far. Thus, given its vital importance for the proper function-ing of space law, it is necessary that, also in the future, this fundamental role continues to be safeguarded. Therefore, I see the preservation of the non-appropriative nature of outer space as the pre-requisite for any possible evolution of the system of space law.

7. Special Responsibility and Consequences for the Violation of the Non-Appropriation Principle

As we have seen, if the non-appropriation principle were abrogated, the risk for armed conflict in outer space would be high. Therefore, States have a special duty to act in conformity with that principle. But what if a State would sudden-ly decide contrary to that principle, and to appropriate part of outer space? What would be the legal consequence of such behaviour? In view of the fact that Article III of the OST makes international law, including the Charter of the United Nations, applicable to the exploration and use of outer space and considering that Article I (1) of the UN Charter lays down the obligation to maintain peace and security, and to prevent or remove threats to the peace, the individual violation by a State of the principle contained in Article II of the OST should be considered as a threat to international peace. Such a State should be seen as responsible for a particularly serious act towards the whole community of States. As a result, in such a situation, other States would be entitled to act collectively through the United Nations to stop such behaviour and to remove this threat to peace. A joint effort and pressure to that effect would hopefully restore the status quo ante. The argument could be put forward that if a State should decide to withdraw from the Outer Space Treaty, it would no longer be bound by the provisions of Article II and thus could appropriate parts of outer space. This argument should be rejected because, even after that withdrawal, such a State would be obliged to respect the non-appropriation principle in view of its structural status.

#### Ownership disputes -- Private appropriation inevitably leads to overlapping claims causing armed conflict.

Tennen 10 [Leslie I. Tennen, Esq.\* “ Towards a New Regime for Exploitation of Outer Space Mineral Resources,” Nebraska Law Review, 88 (2010), 794. <https://advance-lexis-com.ezp-prod1.hul.harvard.edu/api/document?collection=analytical-materials&id=urn:contentItem:50MP-12V0-00CT-T042-00000-00&context=1516831>.] CT

a. Should Article II be Abrogated?

It has been asserted that the non-appropriation principle is an obstruction to the commercial development of space, and that article II, if not the entire Outer Space Treaty, should be abrogated. 61 The Outer Space Treaty permits states party to withdraw on one year's notice. 62 It seems unlikely that a major space power will seek to withdraw from the Outer Space Treaty in the foreseeable future, or that article II will be repealed anytime soon. Nevertheless, the abrogation of article II would not benefit the commercial development of space. First and foremost, the reasons which warranted the adoption of the non-appropriation principle in 1961 continue to be applicable today, notwithstanding the end of the Cold War. Abrogation of article II would result in a multitude of claims to orbits, locations, and entire moons and other celestial bodies. These claims would not have any uniformity in terms of method of discovery. That is, claims could be founded on any basis on which the claimant can assert that it was the first to "discover" the subject of the claim, 63 whether by exploration, use, landing, imaging, mapping, surveying, or telepossession. 64 As a matter of equity, the Russians, as successors to the Soviet Union, would have an historic justification to assert vast claims of ownership to near-Earth and cis-lunar space, and the Moon, Venus, and perhaps other celestial bodies, from their early triumphs during the initial days of the space age. However, claims would not be restricted to the technologically advanced states, as other nations would assert claims to space "properties." It can be anticipated that the Bogota Declaration, 65 [\*808] declaring claims to the geostationary orbit, would be resurrected in one form or another. In addition, private entities, if permitted to engage in appropriation, would overlay yet another level of claims, separate and distinct from the claims of states. Whether individual states would enact domestic laws recognizing and enforcing such private claims is a matter of pure speculation. It is difficult to envision a scenario whereby the various claims would not overlap and thereby conflict. Thus, it is foreseeable that international tensions between claiming states would arise, with the concomitant potential for the export of armed conflict from the confines of this planet to the heavens. 66 Pop has identified several theories which conceivably could give rise to claims to property, 67 but no matter what basis is utilized to provide theoretical justification for the assertion of claims, the enforcement of claims (i.e., the exclusion of others therefrom) in the final analysis ultimately devolves upon the successful application of military force. Armed conflict in space obviously would not engender an atmosphere conducive to private commercial ventures. Even where conflict or the threat of conflict may be averted, states claiming sovereign rights over space and celestial resources would be able to impose taxes, royalties, duties, auction fees, or other forms of economic tribute upon private entrepreneurs in exchange for the right to utilize the resources within the claimed territories, even where claims to those areas and resources overlap. 68 The corpus juris spatialis provides that states have the right to explore and utilize areas on or below the surface of celestial bodies. The abrogation of the non-appropriation principle of article II would transform the right to explore and utilize areas of celestial bodies into a commodity available only to those willing to pay the highest price. Monopolies and other anti-competitive practices could result. In this regard the non-appropriation principle is double-edged: article II not only prevents an entity from establishing a monopoly, it also prevents the competition from establishing one as well, and thereby creates a level playing field. 69 Those who advocate for the abrogation of article II fail to recognize that the non-appropriation principle is not solely dependent upon the Outer Space Treaty. As noted above, the prohibition on national appropriation was expressed by the community of nations in U.N. resolutions dating back to the early 1960s. The substance of article II of [\*809] the Outer Space Treaty was reaffirmed in article 11.2 of the Moon Agreement. More than 125 nations have signed or ratified the Outer Space Treaty; thus, the non-appropriation doctrine has received widespread acceptance among states for almost fifty years. In addition, state practice during the space age has been consistent with article II. 70 Thus, the non-appropriation principle has become part of customary international law, and as such, is binding on states independently of the Outer Space Treaty. 71 That is not to say, however, that a majority of the community of nations would not be able to agree to abrogate article II, or the entire Outer Space Treaty, if so inclined. However, there is no indication that states have expressed any official interest is so doing at this time.

#### Military-industrial complex -- Private appropriation in space inevitably causes militarization to protect corporate interests which triggers conflict.

Saah 21 [Jasper Saah, “War or peace in space? 2021 in review,” Liberation News, December 31, 2021. Accessed 2/7/21. https://www.liberationnews.org/war-or-peace-in-space-2021-in-review/] CT

2021 has been a record setting year for space development, accompanied by relentless capitalist propaganda to shape how people relate to the increasing importance of the space industry worldwide. China has made great strides in developing its own space exploration capacity, launching its own space station and landing a rover on Mars over the summer. U.S. hostility toward China and Russia has created the conditions for a new space race with parallel plans for lunar bases, crewed Mars missions, and additional Earth orbital stations coming from the United States on one hand and Russia and China on the other. U.S. emphasis on private development and militarization adds another layer of complexity to an already unstable situation. Bruce Gagnon is the coordinator of The Global Network Against Weapons and Nuclear Power in Space and sat down to discuss these crucial issues with Liberation News.

Privatization and militarization: Two sides of the same coin

Since 1969, the basis of international space law has been the Outer Space Treaty which provides that space, the Moon, and other celestial bodies be the “province of all mankind” and “not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.” Additionally, the treaty stipulates that the deployment or testing of weapons of mass destruction in space is prohibited along with the creation of military bases or installations. In recent decades, the limitations of this treaty and the related Moon Treaty have become apparent. Since 1981, the Prevention of an Arms Race in Outer Space Treaty has been forwarded by countries like Russia and China to expand the existing canon of international space law through the UN. This has been blocked by the United States repeatedly, and over the past decade in particular, the United States has also been moving rapidly to use it’s current dominant position in the space industry to set international norms on its own terms. In 2015, President Obama signed the Commercial Space Launch Competitiveness Act which permits U.S. companies to “engage in the commercial exploration and exploitation of space resources.” The U.S. government claims that this is not an attempt to exert national sovereign or exclusive rights, which is tied to the increasingly privatized landscape in the U.S. space industry. From the perspective of capital, President Trump took the next logical step in 2019 by establishing the U.S. Space Force as an independent branch of the military. The history of private property on Earth shows us that it always requires military might to ultimately back up the claim. As the United States seeks to allow private enclosure of the Solar System, militarization will inevitably develop apace. The risks of a space arms race is a terrifying prospect, but that is exactly what both the traditional NASA contractors and the new private launch companies want. SpaceX has already partnered with the Pentagon to provide rapid weapon delivery via rocket to any point on the planet in under an hour.

Record-setting year

The record for most people simultaneously in space was broken twice in 2021. For a weekend in September, there were 14 people spread across the International Space Station, China’s Tiangong Station, and SpaceX’s Inspiration-4 mission. While exceedingly brief in duration, on December 11 Blue Origin’s New Shepard 19 flight brought six TV personalities and venture capitalists to the edge of space, briefly setting a new record of 19 people. These “tourist” flights have been widely criticized even as the corporate-owned media breathlessly covers these short excursions of the ultra wealthy to the edge of space. In July, Forbes published a surprisingly critical column titled “Space Flight For Fun: Billionaire Egotism Trumps Sustainability.” Criticism from other large news outlets is along similar lines — the environmental cost of space launches, which is equivalent per flight to the lifetime emissions of billions of working people, cannot be justified. Despite the private ownership, both SpaceX and Blue Origin are built on decades of publicly funded research and development, as well as heavily reliant on NASA and Pentagon contracts for their funding. “This stuff is funded by destroying the social safety net” and the ever ballooning military budget, Bruce Gagnon emphasized. The development of a space tourism industry is the tip of an iceberg. China has had a strong year in space: the successful landing of a Mars rover on their first attempt, the launch and installation of Tianhe — the core module of a new space space station, Wang Yaping became the first Chinese woman to conduct a space walk, and China accounted for the most orbital launches of any country in 2021. Development of the next generation Long March 9 rocket, which will enable crewed lunar landings and more complex deep space missions, is nearing the end of its development stage. The United States is attempting to use its current position to set international norms while it remains the dominant space power in the world. A recent paper in the journal Science describes in detail the ways in which U.S. policy is undermining international cooperation in space: “Shortly after, NASA announced a plan for bilateral Artemis Accords, which, if accepted by many nations, could enable the U.S. interpretation of international space law to prevail and make the United States — as the licensing nation for most of the world’s space companies — the de facto gatekeeper to the Moon, asteroids, and other celestial bodies.”

The fight back

It’s just this rapid pace of development combined with the anarchy of capitalist production that concerns the Global Network Against Weapons and Nuclear Power in Space. The prospect of using nuclear reactors for power generation and propulsion has been gaining traction within NASA posing a multitude of potentially catastrophic risks when launching radioactive material from Earth. A conflict in space could set off a chain reaction of debris, called Kessler Syndrome, that could take out hundreds or thousands of satellites and fill low Earth orbit with debris for decades. While many of these concepts may still sound more like science fiction, the coming decade or two is the period where long lasting precedents for how humanity engages with the solar system will be set. The richest men on Earth are obsessed with establishing private space industries, whether Elon Musk’s longshot plan to colonize Mars or Jeff Bezos’ vision of moving industry to orbit, beginning with a private space station “business park.” The propaganda offensive goes beyond fawning coverage of ultra-rich tourist flights and fear mongering about Russia and China. The vision propagated by Jeff Bezos of moving industry to space coincidentally resembles greatly the world of the TV show The Expanse produced by Bezos’ Amazon where generations of exploited workers mining the asteroid belt have become second class humans, subject to brutal corporate colonialism. Similar dystopian visions of the future are commonplace across all sorts of popular culture, but they are not inevitable. “We have to get this right,” is the point Bruce Gagnon of the Global Network kept returning to

#### Space conflicts go nuclear- both fast and probable.

Grego 15 [Laura Grego, an expert in space weapons and security; ballistic missile proliferation, and ballistic missile defense, "Preventing Space War", Union of Concerned Scientists, 07-05-2015 <https://allthingsnuclear.org/lgrego/preventing-space-war>] JDN

So says a very good New York Times editorial “Preventing a Space War” this week. Sounds right, if X-Wing fighters come to mind when you think space conflict. But in reality conflict in space is both more likely than one would think and less likely to be so photogenic. Space as a locus of conflict The Pentagon has known that space could be a flash point at least since the late 1990s when it began including satellites and space weapons in earnest as part of its wargames. The early games revealed some surprises. For example, attacking an adversary’s ground-based anti-satellite weapons before they were used could be the “trip wire” that starts a war: in the one of the first war games, an attack on an enemy’s ground-based lasers was meant to defuse a potential conflict and protect space assets, but instead was interpreted as an act of war and initiated hostilities. The games also revealed that disrupting space-based communication and information flow or “~~blinding~~” could rapidly escalate a war, eventually leading to nuclear weapon exchange. The war games have continued over the years with increased sophistication, but continue to find that conflicts can rapidly escalate and become global when space weapons are involved, and that even minor opponents can create big problems. The report back from the 2012 game, which included NATO partners, said these insights have become “virtually axiomatic.” Participants in the most recent Schriever war games found that when space weapons were introduced in a regional crisis, it escalated quickly and was difficult to stop from spreading. The compressed timelines, the global as well as dual-use nature of space assets, the difficulty of attribution and seeing what is happening, and the inherent vulnerability of satellites all contribute to this problem. Satellite vulnerability & solutions Satellites are valuable but, at least on an individual basis, physically vulnerable. Vulnerable in that they are relatively fragile, as launch mass is at a premium and so protective armor is too expensive, and a large number of low-earth-orbiting satellites are no farther from the earth’s surface than the distance from Boston to Washington, DC.

### Plan – Commons (Delimiting and Liability)

#### Since, in a just world, outer space would be treated as a global commons, and a global commons model precludes appropriation by private entities, then the appropriation of outer space by private entities is unjust.

#### Thus, the plan: States ought to adopt a binding international agreement that bans the appropriation of outer space by private entities by establishing outer space as a global commons subject to regulatory delimiting and global liability.

#### The aff:

#### solves debris and conflict by ensuring the sustainable and equitable use of outer space resources.

* prevents circumvention by aligning the interests of state parties
* is normal means since it models numerous successful agreements governing all other global commons.
* Vollmer 20 [Sarah Louise Vollmer (St. Mary's University School of Law), “The Right Stuff in Geospace: Using Mutual Coercion to Avoid an Inevitable Prison for Humanity,” 51 ST. MARY'S L.J. 777 (2020). <https://commons.stmarytx.edu/thestmaryslawjournal/vol51/iss3/6?utm\_source=commons.stmarytx.edu%2Fthestmaryslawjournal%2Fvol51%2Fiss3%2F6&utm\_medium=PDF&utm\_campaign=PDFCoverPages> ]CT
* IV. NECESSITY FOR REGULATION TO PRESERVE THE HERITAGE OF MANKIND—A PROPOSAL
* Conceptually, all persons hold an implied property right in the space commons.111 As such, spacefaring entities and developing nations possess an equitable right to access and use orbital resources.112 But the sui generis nature of geospace presents a paradox requiring a unique regime for the sustainable usage of its resources.113 The international community cannot realize the advantages of the common heritage principle under a property regime because any conceivable assignment would violate the non-appropriation clause or unjustly enrich a particular interest.114 This means that only regulatory solutions can protect the interests inherent in a commons protected for the common heritage of mankind.
* A. The Motivations for International Compliance
* The crux of a workable treaty lies in the consent of the parties to the agreement.115 Thereafter, signatories internalize the agreement’s object and purpose into their domestic law, or in the case of international organizations, into an institutional framework.116 To implement a binding international instrument, we must therefore ask the question: Why do nations follow international law,117 and how can we use those behavioral realities to construct a workable framework to ensure geospace survives?118
* At the dawn of civilized society, depending on a particular jurisdiction’s values, the laws of nature and morality compelled obedience and social order.119 When nation-states concluded international agreements, it represented the coalescence of the various values-based systems, the overlap of which formed a universal understanding of the law of mankind.120 “[The] fundamental conceptual boundary between municipal and international law . . . view[s] international law largely in terms of contractual relations, therefore assigning to the ‘sovereign’ a central place in the construction of the two orders.”121 In other words, transnational cooperation operated through balancing the competing autonomy and values of the parties involved. Despite centuries of debate, values systems remain the principal motivating factor of compliance with international law.122 Effective regulatory regimes must, therefore, strike at the heart of what nation-states value the most, which is often related to national security.123
* When entering an international agreement, whether or not a nation-state will ratify it informs us of the value a nation-state places on the instrument’s subject matter. That value equates to the utility a nation-state places on certain allowances or prohibitions.124 Incorporating these motivating factors with Hardin’s regulatory solution, any freedoms infringed upon must manifest a higher utility than currently realized. If COPUOS proposes a protocol for sustainable uses of space, the provisions must either have a negligible effect on the global community’s perceived utility of space access or substantially increase that utility. Assuming the propositioned regulatory scheme aligns with the values system of each nation-state, the probability of internalizing such regulations through domestic codification is high.
* To ascertain the interests of nation-states, we must look to the factors motivating current space utilization. Routine access to space undeniably aids our technological advancement. The ISS’s antigravity environment provides unique conditions to study medicine.125 Satellites provide real-time tracking of environmental conditions and transmit crucial information for disaster recovery planning.126 Space telescopes track objects with the potential to cause the extinction of life of Earth.127 Free from the veil of our hazy atmosphere, satellites can produce better imagery and ascertain the composition of potential resource deposits on celestial bodies.128 And simply receiving satellite imagery of our planet forces us to confront the realities of our fragile existence. These benefits signify the tangible realization of the OST’s object and purpose, which flow to all members of the global community.129 If we do not begin active decontamination and mitigation of space debris, the utility of geospace will cease to exist. Imagining our existence without these advances is a potent method to stress the criticality of unabated pollution in geospace.
* B. Existing Proposals
* Legal scholars have formulated several frameworks to mitigate space debris. Some recommend implementing a market-share liability regime, which assigns liability according to the volume of each nation-states’ exploits.130 Opponents of this construction rightfully highlight the inequities inherent in such a scheme. Considering the United States, Russia, and China make up the bulk of spacefaring activity, market-share liability would unduly burden these nations, and coerce a categorical exit from the space industry or a repeat of the Moon Treaty.131 Another scholar advocates for an environmental law approach, asserting that the space commons would benefit from a protocol closely mirroring the Madrid Protocol.132 While prospective applications of such a model could prevent additional accumulations, it would not feasibly abate the current collection of debris.133 The strengths of Mary Button’s mitigation proposal lie in the binding nature of the Madrid Protocol and compulsory environmental impact requirements. And though it advocates for a more collaborative conference mechanism, rather than the strict unanimous consent required of UNCOPUOS’s resolutions, it still shies away from compulsory requirements for active debris removal. Along with the Antarctic Treaty (ATS), the Law of the Sea (UNCLOS) also served as a model for the Corpus Juris Spatialis. But oddly, the law of salvage was omitted from the treaties. Unlike abandoned objects at sea, once a nation-state places an object into space, ownership exists in perpetuity. Sandra Drago addressed removing the OST’s property-in-perpetuity mechanism134 so as to permit the active salvage of inoperable satellites.135 Drago’s proposal is vital to any mitigation framework. But while this removes a substantial bar currently restricting debris removal, it does not address free-riding, and spacefaring enterprises are free to choose more lucrative space activities other than salvage operations.136
* C. A Coercive Proposal
* Mutual coercion lies at the core of Hardin’s solution.137 To summarize, law-abiding citizens make concessions to regulatory social constructs in the interest of conserving some utility otherwise lost.138 The coercive element lies in relinquishing one’s ability to exploit some freedom, the detriment of which cannot be realized at that moment in time.139 Conceding to a regime that tempers free exploitation of the commons allows everyone to benefit from the positive externalities of individual usage. Equated to space, nation-states currently concede to non-appropriation in the interest of maintaining equitable access. But because of the sui generis nature of geospace, even non-participants receive a benefit from the use of the commons. In effect, beneficiaries are free-riding from the capital investment of spacefaring nations and entities. This informs the structure of the ensuing two-part framework: geospace delimitation and global liability
* 1. Geospace Delimitation
* The history of regulatory delimitation illustrates its effectiveness at balancing the rights of individuals, sovereigns, and mankind. Each instance explained in Part II infra, arose out of public necessity to ensure and protect the maximum utility of the global commons, without the deleteriousness of inhabitability, sovereign interference, or over-exploitation.140 The regimes governing Antarctica, the High Seas, the Atmosphere, and the radio-frequency spectrum evidence that mutually coercive delimitation can honor the common heritage of mankind, without encroaching on the peaceful enjoyment and benefits attributable to these areas.
* a. Antarctica
* In the 1950s, there was concern that Antarctica would succumb to Cold War hysteria, becoming a target for international discord and nuclear arms testing.141 In a move to reestablish global scientific exchange, the international scientific community hosted the International Geophysical Year project, and after identifying the potential of Antarctica, sought to protect it from any ruinous power posturing.142 This necessity for regulating permissible activity resulted in the formation of the ATS.143 Subsequent technological advancement revealed mineral deposits, triggering commercial interest in exploiting its natural resources. The threat catalyzed the promulgation of the Madrid Protocol.144 Again, these delimitations did not sever humanity’s utility in Antarctica. Rather, mankind conceded to the prohibition of deleterious usage in the interest of preserving its scientific utility.145
* b. The High Seas
* Similar to Antarctica, the High Seas faced threats in the 1960s when nation-states began unilaterally and arbitrarily, extending resource recovery activities further into the depths of international waters.146 In the interest of equity, particularly the interests of landlocked nations, UNCLOS delimited sovereign access to the seas, allowing usage only within the established exclusive economic zones (EEZs).147 An annex to UNCLOS provided a procedural framework in which resource recovery enterprises could operate in international common areas beyond the EEZs, precluding the unilateral capture of global resources by one nation.148 Once more, a mutually coercive framework removed certain freedoms in the interest of mankind without unjustly limiting equitable access to resources.
* c. The Atmosphere
* Divergent from the problems of the ice and sea, atmospheric regulation resolved an issue more analogous to geospace debris proliferation. Atmospheric utility is quite simple: breathable air and protection from deadly cosmic radiation. When satellite imagery revealed the sizable hole in the ozone layer, the Montreal Protocol to the Vienna Convention placed an outright ban on ozone-depleting chemicals in everyday consumables.149 This prohibition directly addressed the source of the negative externality, forcing humanity to internalize the externality through alternate investment in refrigerants. Recent evidence of the reduction of ozone loss validates the mutually coercive delimitation within the Montreal Protocol.150
* d. Regulating the Telecommunication Spectrum
* The business model and financial strategy of telecommunications entities influence satellite deployment planning. Typically, orbital placement aims to “maximize [a] potential user base,” and if that base happens to encompass, for instance, the continental United States, market competition drastically narrows the availability of slots for satellite positioning.151 Realizing that satellite acquisition becomes moot without conscientious “use of telemetry and control . . . required for spaceflight,”152 the Space Radiocommunication Conference convened to revise the Radio Regulations in 1963,153 granting the ITU authority to allocate radio frequencies among spacefaring entities.154 Originally, the ITU:
* [A]llocated orbits and frequencies solely through a first-in-time system. This led to concern that developed countries would secure all of the available slots before developing countries had the technological capacity to use them. Although some orbits and frequencies are still allocated on a first-in-time basis, each state is now guaranteed a certain number of future orbits and frequencies, regardless of its current technological capacity.155
* The FCC regulates the segment of the electromagnetic spectrum allocated to the United States.156 Arguably, the ITU and agencies like the FCC engage in de facto appropriation of the more highly sought-after orbits.157 Yet to an extent, the ITU’s delimiting of the radio-frequency spectrum remedied the negative externalities of non-appropriation in geospace, such as the overcrowding of active satellites and the resultant interference. Where the ITU’s scheme does not remedy the byproduct of geospace resource use, it succeeds in ensuring communication capabilities remain free from inequitable use.158
* e. The OST’s Ineffective Delimitations
* The recurrent theme among the aforementioned regulatory schemes is the preservation of utility within the commons concerned.159 The frameworks each provide a means to enjoy shared resources while removing the potential for destruction. The OST’s nonproliferation provisions properly regulate the usage of the space commons to further the enjoyment of space’s true utility: scientific discovery and telecommunications. Likewise, the Liability Convention reinforces the necessity to maintain heightened situational awareness to guarantee the mutual, uninterrupted enjoyment of activity in space.160 But nation-states exploit the loop-holes within these documents to avoid internalizing some of their externalities. Specifically, the Liability Convention only assigns liability for damage caused to space objects when fault can actually be determined.161 Though it would be simple to assign fault to a collision caused by an intact and inoperative satellite, it is virtually impossible to identify the owner of smaller pieces of debris. Further, while the ITU reserves slots for nations not represented in space,162 it does nothing to stop those capable of reaching geospace from littering the commons and destroying the utility of reserved slots.163 Holistically, none of the delimitations in the Corpus Juris Spatialis negate the cause of the growing belt of debris in geospace.
* As a sui generis resource, the mere occupation of LEO or GSO equates to the reduction of the overall utility of geospace. When an entity launches a rocket into space, the accompanying payload causes either (1) temporary reduction of the aggregate utility of geospace or (2) permanent reduction of the aggregate utility of geospace.164
* The first delimitation prong will recommend bifurcating the applicability of the Corpus Juris Spatialis, with separate regimes for outer space and geospace. While the commercialization of outer space is not overly injurious to the international commons or interests of developing nations, the overcrowding of affluent spacefaring entities vying for orbital acquisition puts immense pressure on the finite resources within geospace. Therefore, demarcating the upper limit of geospace will allow entities to continue exploring the universe without imposing the restrictions placed on those seeking geospace positioning.165 This modification will allow continued use of both regions, but coerce more sustainable usage of geospace with the assistance of the secondary prong below.
* 2. Global Liability
* Operating under the theory that humanity holds an implied property right in the global commons but limited under the non-appropriation clause to protect those interests through traditional property mechanisms, the logical alternative is to impose liability on actions violative of the global interest.166 Further, assuming humanity collectively benefits from utilization of this commons, then humanity likewise must internalize the cost of the negative externalities imposed.167 This means that spacefarers, as members of the global collective, hold both the right and obligation to protect that right for others.168 Therefore, anyone utilizing or benefitting from the utilization of the geospace commons has an equitable duty to ensure its sustainability. Under traditional tort theories, when one has a duty, breach of that duty causally linked to a measurable injury is actionable. In terms of the duty to humanity when utilizing geospace, the culmination of Kessler Syndrome represents the measurable injury.
* Kessler informed the scientific community in 1970 of the probable cataclysmic chain-reaction and destructive conclusion of unabated geospace debris pollution.169 This theory, reiterated consistently since its dissemination, materialized in 2009.170 Fundamentally, every spacefaring entity and approving launching state knows of this monumental threat to the utility of geospace. Yet to date, mitigation guidelines remain non-binding, and four-figure satellite constellations continue to receive approval.171 To incorporate a time-honored risk calculation method, the Hand Formula is instructive and evidences a trend toward unapologetic endangerment to the utility of geospace in isolation of the associated tort regime.
* Let us assume the burden to mitigate space debris is $18.5 million172 but the probable magnitude of not mitigating the accumulation of space debris equates to reverting our technological capabilities back to the 1800s. Considering the accumulation of debris from the accidental or intentional breakup of geospace satellites, the probability of Kessler Syndrome fully concluding in the absence of a comprehensive mitigation protocol is one hundred percent.173 While difficult to quantify, the value of our scientific progress attributable to the advent of space travel far outstrips the burden to mitigate space debris. Should Kessler Syndrome become our reality, the measurable injury is the cost of reestablishing global communications without the usage of satellite relays. To add insult to injury, the invaluable utility of geospace will cease to exist.
* A viable alternative would institute a regime of shared global liability which makes consideration of capital investors as well as nonparticipating beneficiaries in the interest of equity. That is, should the inevitable prison for humanity become a reality, the entire global community will be liable to pay an equitable share of the overall cost of recovery efforts.174 The Liability Convention should undergo a similar trifurcation, adding this new scheme to the current strict and absolute liability mechanisms.175 As such, shared global liability will consider the responsibility of nation-states and private entities in isolation.176 This will coerce cooperation among all agencies, nations, and private entities because the equitable share of responsibility will drive collective resolution.
* V. CONCLUSION
* In light of the emerging global sentiments regarding environmental conservation and sustainability, instituting a regime that clearly defines a legal consequence in the event of environmental ruin boasts greater coercive force than non-binding resolutions. 9 This international agreement aligns with the universal value that the international community places on the utility of geospace.177 In essence, it protects geospace by forcing the signatory to face the reality of their negative externalities. It is unlikely that a nation-state exists that does not value space exploration and the benefits attributable.
* In April of 2019, in the spirit of the Sustainable Development Goals (SDGs), COPUOS adopted an agenda that focused on the long-term sustainability of the space commons, space traffic management, equitable uses of GSO, and the mitigation of space debris.178 Mindful of space’s critical role in attaining many of the SDGs, the Committee put forth guidelines to facilitate capacity building without prejudice to any one nation-states’ economic capabilities. To be sure, the Guidelines for the Long-Term Sustainability of Outer Space Activities are an important step forward, but many delegates reiterated the importance of developing binding instruments, particularly in light of developments in “space resource exploitation, large constellations, and space debris remediation.”179
* Looking forward, research continues to advance the availability of debris mitigation mechanisms, such as the European Space Agency’s newly-commissioned ClearSpace-1 satellite.180 Mission objectives increasingly include end-of-life procedures to place satellites in appropriate orbits to decrease clutter in areas where active satellites operate.181 In the context of private entities, Planetary Resources—originally positioned to become a principle player in the space mining industry—merged with Consensys Space and quickly launched TruSat, a crowd-sourced situational awareness forum that compiles the reports of private citizens to track objects in geospace.182 These developments instill confidence in the international community’s sentiments toward ameliorating this ever-approaching catastrophe. It is with great hope that this trend continues, and COPUOS promulgates binding regulations to ensure the sustainability of geospace for the common heritage of mankind. “But we can never do nothing. That which we have done for thousands of years is also action. It also produces evils.”183

#### Since the national appropriation is banned by the OST, banning private appropriation would ipso facto result in space being a global commons, so the plan is not extra T and is normal means.

Neto 21 [Bittencourt Neto, Olava de O. “Chapter 1: Outer Space as a Global Commons and the Role of Space Law,” A Research Agenda for Space Policy, Edward Elgar Publishing, Cheltenham, UK, 2021. https://www.elgaronline.com/view/edcoll/9781800374737/9781800374737.00009.xml] CT

Over the past years, the proliferation of space activities and the diversification of space actors have offered plenty of opportunities but also posed challenges to outer space’s long-term sustainability. The rapidly transforming space sector and growing global space economy have enabled many satellite applications and services, while outer space and orbital slots have become more congested with an increasing space debris population. The commercialization of space activities has denounced a growing interest in private, non-governmental uses of outer space, including space resources. As such, outer space continues to prove itself as a strategic domain from scientific, economic, and security standpoints. As far as international law is concerned, novel debates have emerged about the ontological nature of outer space. Incredibly vast, magnificent, and complex by nature, it constitutes a unique domain, unlike anywhere else on Earth. Throughout the years, outer space has been subject to a specific international framework based on legal principles established at the dawn of the Space Age, notably open access to and non-appropriation of outer space. Space law treaties and international instruments govern space activities and provide relevant input concerning the legal status of outer space. The 1967 Outer Space Treaty (OST), in its first article, solemnly declares that the exploration and use of outer space “shall be the province of mankind”. Therefore, a common interest and shared fate await humankind as we advance through the cosmos. Collective action, based on international cooperation and mutual assistance, is of the essence. Nevertheless, a universal definition and delimitation of outer space, as a distinct domain on Planet Earth, remains to be multilaterally accorded (Bittencourt, 2015). Given the evolving nature of space activities and economy, the legal status of outer space has led to intensive debates in various fora. By constituting a resource domain to which all nations have access, but to which none has the right to claim sovereignty, outer space may be understood as an example of global commons – similarly to the high seas, deep seabed, and Antarctica (Buck, 1998, p. 6). Therefore, outer space and its natural resources, including those located at the Moon and other celestial bodies, are not subject to national appropriation by any means. The legal status of outer space as a global commons is of extraordinary importance and relevance for space law and space policy. Indeed, it influences the application and interpretation of the legal framework developed for the governance of outer space activities, vis-à-vis the domain and its resource units. To accurately assess this scenario, a comparative approach is followed. The specific features of global commons and legal ramifications justify further appraisal to comprehend definitions and correlated concepts well.

2. Key problems and conflicts

In space law as in space policy, words matter. By legally classifying outer space as a global commons, relevant political consequences, both national and international, naturally ensue. In order to properly understand the nuances and avoid misconceptions, one should revisit principles of international law. Centuries of customs, often based on Roman law concepts, have led to important regulations and definitions. The proper evaluation of those concepts may illuminate the path forwards.

Global Commons Concept

Legally defining “global commons” has proved to be a challenge, leading to incompatible views. Global commons are socially constructed, as explained by John Vogler, being determined by “shifts in human knowledge, capability and perceptions of scarcity” (Vogler, 2012, p. 61). As a legal concept, its roots may be traced back to Roman law. More specifically, reference should be made to the notions of res nullius and res communis, applicable to domains not subjected to rights of a specific subject. Res nullius is understood as encompassing things belonging to no one or areas free to be acquired by occupatio.1 Terrae nullius, a derivative international law concept, is applicable to unclaimed areas that may be occupied by states (Rose, 2003; Shaw, 2017, p. 372). Not subjected to exclusive sovereignty, global commons may either be unowned resource domains, or deemed as belonging to the international community in totum. Soroos explains that unowned domains can be regarded as commons if generally understood that they cannot be claimed by any individual actor, neither partially nor as a whole. A regulatory scheme may eventually be accorded by users, to reflect shared interests. On the other hand, domains considered as belonging to the international community presume that all states are their partial owners, therefore legitimized to take part in the decision-making processes related to its uses (Soroos, 2001, p. 45).

#### Only the aff can solve space debris and militarization - unregulated private companies won’t cooperate and will abuse the space environment, which means the aff is key to the long-term sustainability of space development.

Yuan 21 [Yuan, Alda. "Filling the Vacuum: Adapting International Space Law to Meet the Pressures Created by Private Space Enterprises." Denv. J. Int'l L. & Pol'y 49 (2021): 27.https://heinonline.org/HOL/LandingPage?handle=hein.journals/denilp49&div=4&id=&page=] CT

C. Non-state Actors Introduce Practical Challenges that Endanger the Future of Space Travel

If companies are permitted to access space without a proper legal framework or sufficient coordination, the practical risks may doom the project of humanity in outer space for the near future. The opening anecdote dramatized the risks, but the fact that a chain of cascading destruction might preclude the use of whole bands of outer space or make launches impossible is not farfetched.99 Indeed, it is already happening.100 Because space missions always create debris and there is a correlation between the number of objects orbiting earth and the chances of collision, which thereby creates more debris, even no further activity in space will eventually result in a belt of debris encircling the earth.101 This cascade effect, called the Kessler Syndrome,102 has the potential to speed up astronomically if activities in outer space expand without contingent regulation and mitigation measures.103 At current rates and in the absence of a catastrophic event, lower earth orbit, in particular, might reach a tipping point within the next ten to fifty years.104 If the space debris problem is permitted to reach this tipping point, access to space may well be cut off for the near future because it will be impossible to launch satellites. 105 Given that we do not have the technology to clean up debris yet, space travel faces an existential threat.

In light of this, most space-faring states cooperate, working together to develop guidelines and pool resources to track the debris already orbiting the earth to minimize the chances of a collision.106 Given the high speeds the debris travels at, approximately 10 km/second,107 and the amount of damage even tiny pieces can do,108 the existing tracking systems are not an absolute fix. At these speeds, a piece of debris weighing a mere two grams can produce an impact force equivalent to a kilogram of TNT.109 More than three hundred thousand pieces of debris greater than one cm in diameter,110 and therefore capable of causing enormous damage, orbit the earth while the US Space Surveillance Network (SSN) system can only track objects over five cm in diameter.111 There are millions of fragments smaller than one cm, which are impossible to track and yet can still cause significant damage. 112 Still, the tracking system is important. In the last twenty years, the International Space Station has carried out several avoidance maneuvers to avoid potential collision with pieces of space debris being tracked by the SSN system.113 Between April of 2011 and April of 2012, the ISS performed four evasive maneuvers.114 On two additional occasions, the crew fell back to the Soyuz since there was no time to set up an evasive maneuver.115 This sort of cooperation works given the limited number of actors involved and the aligned interests of the nation-state parties. Commercial space companies do not have the same incentives to cooperate to share data and new technologies. This is why many have called for the creation of a new convention on managing orbital debris.116

However, escalation of the Kessler Syndrome is not the only problem that might arise by failing to accommodate for the rise of the commercial corporations, so such a convention would not eliminate the threat. For instance, many satellites use nuclear power sources (NPS), which can break up upon reentry.117 As early as 1978, the Cosmos-954 incident scattered radioactive debris over Canada.118 Other accidents of this type could raise fallout concerns, especially if they occur over more densely populated regions. In an attempt to alleviate this risk and decrease the chances of collisions, various nations have cooperated to design and standardize methods of decommissioning satellites.119 One strategy is to supply spacecraft with additional fuel and nudge it out of orbit so it will burn up in the atmosphere over the ocean.120 Another is to push the ailing satellite into a graveyard orbit.121 These methods require additional research and design and incur additional costs.122 Private companies may not spontaneously take the steps necessary to comport with the common practices of space-faring nations.

Thus, the rise of private corporations, while opening up new possibilities, may also threaten space travel itself and the international legal order in which coordination currently occurs. The coordination necessary to prevent and manage the unique problems that arise in space requires a more pragmatic framework.

Directly binding private non-state actors benefits the international community because it prevents abusive practices and permits the coordination of efforts that make space safer. However, it will also benefit the private sector by providing companies with a background legal structure, neutral dispute resolution, and common guidelines to even the playing field. More importantly, if companies not subject to regulation and oversight are permitted to operate in outer space, disasters cannot be effectively prevented. In that case, space exploration and the benefits stemming from it might be closed off for all.

III. SPACE IS A GLOBAL COMMONS UNDER CUSTOMARY INTERNATIONAL LAW

The central principle articulated by the Outer Space Treaty is that space is a global commons, the “province of [hu]mankind.”123 In the decades since the ratification of the Outer Space Treaty, the principle that space should be preserved as the ‘province of all humankind’ has attained the status of customary international law.

A. Customary International Law Emerges Based on the Settled Practice of States and Opinio Juris

Customary international law is one of the traditional ‘sources’ of international law and is defined as a general practice accepted as law.124 These customs do evolve over time, and new principles of customary international law emerge when it becomes both the “settled practice” of states as well as opinio juris.125 “Settled practice” simply refers to a nation state’s observable actions, or what it actually does.126 Opinio juris means “recognition as law,” and refers to a state’s “belief that this practice is rendered obligatory by the existence of a rule of law requiring it.”127 Thus, emergence of customary international laws require both an objective factor as well as subjective or psychological element. Customary international law forms when states adhere to a certain practice and do so because of their belief that they are required to by law.128

Customary international law is somewhat unique in the context of international law because its rules apply universally to all states without reciprocity requirements. 129 International law is thought to recognize that states are sovereign and, as legal personalities, are only bound by the rules that they consent to.130 The universal application of customary international law, even to states that have not explicitly consented or formally agreed to adhere to it, is not wholly incompatible with this. Early conceptions of customary law make clear that what makes it legitimate is the fact that it arises from the actions of those who it binds.131 In the case of customary international law, states are the relevant community, and so participation in the international community of states is contingent upon adhering to customs. 132 In that sense, customary international law makes international law available in the first place by establishing a basic foundation upon which agreement is possible, for instance, by requiring that treaties must be obeyed.133

The only way a nation may reject a principle of customary international law is by being a persistent objector while a new principle is emerging.134 Even this rule is rarely applied, and there is some debate about its validity.135 The upshot of all this is that after a customary international law principle is established, new states must abide by them when they enter the community of states.136

B. Preservation of Space as the Province of All Humankind has Become Customary International Law

There is a wide diversity of opinions about how much of the Outer Space Treaty has emerged as customary international law, with some arguing that the entire document has attained that status.137 Rather than engage in this debate, this paper only seeks to establish that the Outer Space Treaty’s admonishment that space be preserved as the ‘province of all humankind’ ‘free for the exploration and use by all states’ has emerged as a principle of customary international law. In particular, the interpretation that has become customary international law includes nonappropriation of property and ensures free access to space such that space is a global commons.

i. Space is a Global Commons

Some scholars argue that the principle that space shall be preserved as the ‘province of humankind’ is synonymous with the assertion that space is the common heritage of humankind,138 a principle adopted by the 1979 Moon Treaty.139 This interpretation would prohibit any ownership of property in outer space and require all benefits derived from space exploration, economic or otherwise, be shared amongst the signatories.140 This would mean that when a nation develops a technology that improves the efficiency of rockets, it might be legally obligated to share it.141 It would also mean that if a corporation established a base on the moon and began to extract Helium-3, a potential source of energy,142 it might not be able to sell. Despite some evidence for this interpretation, The Moon Treaty, which contains the common heritage of humankind language, was roundly rejected by the international community.143 To date, it has only been signed by a handful of countries, which include almost none of the major space-faring nations,144save France.

On the other end of the spectrum, some scholars believe the ‘province of all humankind’ language applies only to states.145 These scholars would permit private corporations to claim property with virtually no oversight or legal framework and allow permanent grants of expansive property rights.146 This theory has no basis in state practice or opinio juris and has not been met with acceptance by specialists. 147 In addition, expansive property rights without proper legal authority and government oversight would shut out new parties in an enterprise with already high barriers of entry. Thus, this extreme interpretation of the province of humankind would lead to conflicts and erode the important strides made toward coordination and cooperation in space.

Instead, the interpretation of the ‘province of all humankind’ principle that has emerged as customary international law provides for 1) non-appropriation of property, but permits use of and profit from extracted resources and 2) free access to space but no obligation to share technological advances and resources. 148 This would mean that outer space is a global commons, much like the high seas or Antarctica.149 So while space is collectively owned by all nations, or perhaps more accurately, by all people, companies, and nations are not required to share their technology.150 Nor would it assert that entities may not obtain legal property rights over resources they extract.151 However, it would continue to take seriously the mandate to preserve space and keep it both safe and accessible for future generations. This means upholding the principle of non-appropriation for both states and private corporations while permitting activities like mining and temporary grants of property rights to enable the efficient completion of those activities. It would also mean recognizing the necessity of coordination among all parties acting in space, whether state or non-state, to prevent disasters like an escalated Kessler Syndrome scenario. This interpretation strikes the right balance between encouraging the fair use of space and preserving it as a domain of activity for those who come after. And it is this interpretation that has become customary international law. That is to say, states have not only adhered to it but demonstrably done so out of a sense of legal obligation.

ii. State Practice

States have consistently acted in line with the non-appropriation and free access principles. No state has ever sought to assert a property claim over any object in outer space.152 When the astronauts of Apollo 11 reached the moon, they did not seek to claim it for America. The raising of a flag on its surface signified the success of the astronauts mission–– not an attempt to assert sovereignty.153 Neither has any other nation attempted to claim territory on the moon, despite the vast amounts of exploitable resources there.154 Nor has any nation laid claim to an asteroid or other celestial body.

An attempt by several equatorial states to claim the band of space above their own territory has been rejected by the international community as contrary to space law.155 This band of space is valuable because a satellite can only remain in a geostationary orbit (at a fixed point relative to the ground, which is important for certain communication and tracking functions) above the equator.156 This makes it a convenient location for communications satellites so that instruments on the ground will not have to continuously move in search for it in the sky. In 1976, eight countries signed the Bogota Declaration at the First Meeting of Equatorial Countries, claiming sovereignty over these orbits as a natural resource.157 This incident proves the rule, for it stands out as the only instance where nations attempted to contravene the principle of national non-appropriation in space. In point of fact, even the eight countries that signed the Bogota Declaration did not argue that the Outer Space Treaty did not apply. Rather, they made a legal argument that the Outer Space Treaty’s prohibition on the appropriation of property in outer space simply did not apply to geostationary orbit.158 No other nations and critically, none of the space-faring nations recognized this attempt to extend sovereignty. 159

Additionally, states have acted in accordance with the principle of free access. Not only have the major space-faring nations refrained from preventing the free access of others to space, they have gone above and beyond to provide resources to those parties that do not have the capability to access space on their own. Particularly in recent years, space-faring nations have increasingly cooperated to ensure space remains safe and accessible for all. These range from multilateral treaties banning weapons of mass destruction in space to the U.S. database registering all space objects.160 Every year since 1983, The U.N. General Assembly has passed a resolution affirming the “Prevention of an Arms Race in Outer Space.”161 These measures contribute both to the national security of each individual state as well as to the viability of free access for other nations.

Another example of state practice supporting the principle of free access is the way the International Telecommunication Union (ITU) helps states assign global radio spectrums and orbital satellites.162 ITU is a U.N. agency that assigns frequency slots to both states and private corporations who wish to launch a telecommunications satellite.163 It serves as a central repository, licensor, and coordinator to ensure there is no crossover of frequencies.164 This is important because there are a limited number of frequency bands, and without proper organization, there would be competition, jockeying for spots, and quite possibly collisions between satellites.165 Instead, the current system balances the interests of entities with the technological capacity to immediately use the resources of space as well as those who lack the capability.166 To that end, the ITU has established a two-tiered allocation system.167 While some frequencies are reserved for developing countries, even though they cannot immediately take advantage of them, the rest are allocated on a first-come, first-served basis which benefits developed nations as well as private corporations, largely based in the developed world.168

The various states have, through collaborative schemes and scientific cooperation, extended the principle of free access. Rather than simply avoiding behaviors that prevent others from accessing space, some nations and entities have been active in assisting others without the technological capacity or funding to do so unilaterally. The various space-faring states have an established norm of welcoming and bringing scientists of other nations into space, such as when Brazilian scientists were permitted to work in the International Space Station.169 NASA has procedures by which entities can apply to access and take advantage of the research capabilities of the International Space Station.170 Members of the scientific community apply to do research in the national labs on the American portion of the International Space Station.171

iii. Opinio Juris

General practice is not enough to establish the ascension of the preservation of space principle to customary international law. States must have been practicing and adhering to the principle out of a sense of legal obligation. There is ample evidence to support the assertion that states have observed the principle of preserving space as the ‘province of all humankind’ precisely because they believe they are required to do so by law. First, individual states, as well as the international collective of nations, have always used legal arguments to justify their actions or to reject the illegal claims of others in regard to property claims. Second, subsequent developments and treaties adopted to flesh out the articles of the Outer Space Treaty make it clear that the major space-faring nations understand that they have legal obligations. Third, nations have taken steps in their domestic legal systems that demonstrate how seriously they take the legal obligations outlined in international legal treaties. Fourth, the conscious move toward non-binding guidelines is evidence that states recognize the binding nature of previous legal agreements.

When disputes arise in space, states have always relied upon the rule of law and legal arguments. When Orbital Development, a private US corporation, attempted to assert its property rights over the asteroid NASA landed on, the agency responded with a legal argument.172 NASA’s chief legal counsel sent a letter to Orbital Development arguing there was no basis in international law for their property claim or demands for a ‘parking fee.’173 When Orbital Development sued in federal court, NASA submitted itself to the authority of the court. When a USSR satellite scattered nuclear waste over Canada, the two nations reached a legal settlement. The settlement stated Canada was pursuing the claim under the Liability Convention.174 For other disputes that arise under the Liability Convention, the agreement itself provides for Claims Commission organized much like an arbitration committee.175 The Permanent Court of Arbitration even has separate rules for arbitration of disputes relating to outer space activities.176 To date, these specialized legal procedures have not been often used. Nevertheless, their existence supports the proposition that space-faring states intend to use legal procedures and legal means of settling conflicts. Finally, as mentioned previously, when the eight equatorial nations attempted to extend their sovereignty over geostationary orbit, they did so not by rejecting the Outer Space Treaty, but rather by arguing “there is no valid or satisfactory definition of outer space which may be advanced that supports . . . that the geostationary orbit is included in outer space.”177

Each of the four treaties subsequent to the Outer Space Treaty expanded upon the precepts of that foundational treaty. The Rescue Agreement, the Liability Convention and the Convention on Registration of Objects Launched in Outer Space all take on specific articles of the Outer Space Treaty, fleshing out the legal obligations and duties of the signatories.178 There is internal consistency between all these documents, and the drafters clearly understood they were part of a single legal system. The Outer Space Treaty and the subsequent agreements are respectively analogous to a Constitution and legislative acts that give color and greater detail to the initial document. The states who signed the treaties certainly recognized the constitutions and legislative acts as legally binding. This is apparent in the subsequent agreements propagated between smaller groups of nations cooperating on projects. The most salient example is the 1998 International Space Station Intergovernmental Agreement (IGA) which very consciously recalls each of the four major treaties and establishes that nothing in the agreement would modify the right and obligations the partner states had under those treaties.179 While recognizing their legal obligations and the binding nature of those obligations under international law, the partner states chose to contract around the default liability assignments set out in the Outer Space Treaty and the Liability Convention in service of fuller cooperation in space.180 The IGA includes a provision establishing mutual exemption of liability onboard the ISS.181 This provision applies to claims brought by a partner state for damage against another state, an entity of a state, or an employee of an entity.182 The partner state’s choice to contract around the default rules shows the gravity with which states regard their legal obligations. If they did not believe they had binding legal obligations, there would be no need to add this extra layer of agreements to reduce liability.

Some states have taken steps to align their domestic legal systems with their international law obligations. The U.S., for instance, has passed a series of laws183 that recognize its obligations and liability under the Outer Space Treaty and Liability Convention. Under these treaties, the U.S. would ordinarily be liable for damage done by its agencies, by companies incorporated in America, and U.S. citizens. 184 To protect itself while also fostering private innovation, the U.S. requires companies to buy $500 million of third party insurance.185 In 2015, the U.S. passed the Commercial Space Launch Competitiveness Act.186 In keeping with the interpretation of the principle that space shall be preserved as the ‘province of all humankind’ that has emerged as customary international law, the Commercial Space Launch Competitiveness Act allows private parties to “engage in commercial exploration for and commercial recovery of space resources free from harmful interference.” 187 In fact, it explicitly declaims sovereignty, which is forbidden by the Outer Space Treaty, by saying that the U.S. does not “assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body.”188 Other nations have different schema but nonetheless act to extend the regime of existing international law. Finland altered its penal code to extend jurisdiction to its citizens who enter space.189 Sweden, like the U.S., requires a citizen to acquire a license to take part in space activities, whether or not the activity originates from Swedish territory.190 These domestic policies and laws are meant to protect these nations against liability and are evidence of the gravity with which these countries approach their legal obligations. There would be no need to develop liability schemes and pass domestic laws that protect themselves in the event of damage that triggers international law if states did not believe they had legal obligations. This is particularly true of countries like Finland and Sweden, which have limited space programs.191

Finally, since the end of the Cold War and the fall of the Soviet Union, there have been no additional binding space treaties.192 Instead, as the number of parties, both state and non-state, have increased, non-binding guidelines have been released instead.193 The U.N. COPOUS has also adopted non-binding procedures and announcements rather than pass binding resolutions, or propose guidelines for the General Assembly to pass. At least part of this difference is due to the types of agreements being forged.194 Whereas the Outer Space Treaty is foundational and necessarily vague in some places, many of the recent guidelines deal with a single aspect of the space regime, such as the recommendations on the categorization, tracking, and mitigation of space debris.195 These are technical guidelines and will necessarily change over time in response to both technological advances and the development of better practices.196 Surely, there is something to this. But it is also the case that U.N. COPOUS and other such bodies are not making the new comprehensive agreements necessary to lay proper ground rules to smooth the path to space for private parties. That is to say, there is a need for new guidelines and rules, many of which are not technical in nature. Yet, there has been little activity on this front. At least some of the reason for this is the proliferation of actors and the difficulty of reaching a consensus that takes into account the interests of private parties, developing as well as developed nations. The unwillingness to develop and sign on to new treaties is yet another indication that nations are not following the precepts of the Outer Space Treaty out of mere convenience but instead because of the belief they have real legal obligations to act in certain ways.

These examples show the states acting in accordance with the interpretation of the principle of preserving space as the province of all humankind are indeed doing so out of a sense of legal obligation. Thus, this principle, which involves non-appropriation and free access, has passed into customary international law.

IV. PRIVATE ACTORS ARE ANALOGOUS TO NEW STATES AND SUBJECT TO CUSTOMARY INTERNATIONAL LAW

Application of customary international legal duties directly to non-state actors is particularly apt in space because private parties enter a vacuum of sovereignty. In that respect, they are analogous to new states. Though these private nonstate actors are not henceforth welcomed into the community of states, they achieve an independence from external control that is like new states becoming sovereign.

Analogizing private non-state actors to new states means the main principle derived from the Outer Space Treaty attaches as a customary international law obligation. This analogy offers a path by which the legal duty to preserve space as the province of humankind may be extended. The analogy to new states is particularly useful because while international law generally relies upon consent, new states are subject to customary international law whether or not they offer explicit consent. This means that, for instance, the International Court of Justice could rely upon a principle of customary international law in a case involving a state that never signed a treaty consenting to the principle.197 When a new state is created and joins the international community, recognition of nationhood transmits certain obligations including adherence to customary international law.198 Newly formed states are expected to abide by the principles and practices of the international community they enter, regardless of whether they offer explicit consent.199 States have no right to reject customary international law even though they never had an opportunity to be a persistent objector.200 Instead, to be recognized as members of the international community, new states must accept the limitations and be obliged to respect the norms of the legal system they are entering. So it should be with private, non-state actors entering space.

Just as the behavior of new states affects the interpretation of customary international law, private companies will necessarily help shape and determine general practice in outer space. As private non-state actors begin to outnumber and outweigh state actors, their actions will alter common practice and, thus, what is considered legal in space. Though they do not address international space law specifically, international law scholars, such as Wolfgang Friedmann, have been arguing since the 1960s that corporations participate in the evolution of international law.201 The argument is stronger fifty years later given the size and power of multinational corporations, especially in space. If corporations will be creating or at least affecting customary space practice, they should also be subject to it.

Thus, this is, above all, a pragmatic approach aimed at preserving the long-term accessibility of space and the legitimacy of space law. Nation-states are simply a centrally controlled unit that possesses a monopoly over the legitimate use of force in a given area. That is to say, states are a useful organizing unit, but there is nothing divinely ordained about nation-states.

Surely when we say there is a jus cogens standard against the use of torture, we do not mean an action is wrong when a state engages in it but not when a different entity does the same. Rather, we mean this standard should be common to all governments and peoples. Indeed, the doctrine on International Humanitarian Law offers a good example of how this is so. Recently, the ICRC has interpreted Common Article I202 of the Geneva Convention as saying states have a responsibility to make sure non-state actors are working with and supplying, respect the customary international law standards articulated and proliferated by the Geneva Convention. 203 In this case, it makes sense to try to affect the behavior of non-state actors by binding states because a direct relationship exists that is reminiscent of agency. Additionally, when the activities are bounded by territory, in the sense that they happen in a location covered by a well-defined jurisdiction, it makes sense to use states as a proxy and medium to ensure that the central precepts of international law are followed by all parties and not only sovereign states. In space law, exclusive use of states as the unit of control may endanger international law. Without beginning to think about the way international law should best operate in a world where private parties take on activities previously limited to states, the international community of states risks irrelevancy. Thus far, states have proved a workable avenue by which to develop global legal standards and duties. States will doubtlessly remain important, but in some arenas, the centrality of nation- states is already beginning to erode. This is very apparent in international space law because states are, by their very nature, bounded to a certain territory. Yet, private commercial space enterprises act primarily, perhaps soon exclusively, in space, which is beyond the territorial control of any nation. Applying practices developed for entities bounded to land fails to recognize the changing circumstances and underlying assumptions with respect to territorial control. It is also a waste of an opportunity to ensure that customary international law and other legal structures that reflect the will of the international community are strengthened rather than weakened by changing technologies and new geopolitical realities. Customary international law should not be permitted to collapse and become outdated. Instead, it should be extended over the actors that have taken up the activities those principles were developed to affect. The expansion of international law to include private actors is necessary in many fields of international law but is especially pressing in the law of outer space where attachment to state-mediated regulation in the face of proliferating non-state actors risks an existential threat to the accessibility of space. The expansion has been developed in human rights law,204 and it should likewise be developed in space law.

V. CUSTOMARY INTERNATIONAL LAW SHOULD APPLY DIRECTLY TO PRIVATE ACTORS

A. Extending Legal Duties to Private, Non-state Actors

Ever since the first spacecraft owned by a private corporation soared into space, legal scholars have been conscious of the need to adapt the international space law scheme.205 Yet, most of their proposals still focus on the states alone or else do not engage deeply with the problem of how authority should be extended over private actors to coordinate and regulate their behavior in an area beyond the jurisdiction of any individual nation. The method outlined in this paper, of analogizing states to new states and applying direct legal duties under customary international law responds to the unique coordination problems in space and the outsize position of non-state actors.

Born in the wake of the digital revolution, these companies may have the capability to place people on new planets and to exploit resources that can change the way humankind uses energy.206 A single unified and internally consistent body of law is crucial particularly in space where entities will be forced to plan decades in advance and rely on technologies still in development. The potential benefits of space travel will not be realized unless parties accessing space have clear cut legal principles. So, while regulations may sometimes limit the activity of particular entities in the short term, a stable legal order can only lead to a more robust industry in the long run which may be more mindful of sustainable practices and more likely to cooperate for collective benefit.

The preceding sections have discussed how applying customary international law obligations to private, non-state actors in space is based on the existential threat to a global commons and the fact that the private actors will be entering a vacuum of sovereignty in a manner that is analogous to the creation of new states. Because of all the practical coordination problems and legal barriers already discussed, space cannot be preserved as a global commons or the ‘province of all humankind,’ without centralized coordination and the application of direct legal duties to permit it. Other proposals to regulate these entities are not sufficiently attentive to the unique problems of space law, nor do they lay the groundwork for the evolution of human interaction in space.

#### Treating space as a commons solves orbital debris. States already agree to a limited regime of this type.

Silverstein & Panda ‘3/9 - Benjamin Silverstein [research analyst for the Space Project at the Carnegie Endowment for International Peace. MA, International Relations, Syracuse University Maxwell School of Citizenship and Public Affairs BA, International Affairs, George Washington University] and Ankit Panda [Stanton Senior Fellow in the Nuclear Policy Program at the Carnegie Endowment for International Peace. AB, Princeton University], “Space Is a Great Commons. It’s Time to Treat It as Such.” *Carnegie Endowment for International Peace* (Web). March 9, 2021. Accessed Dec. 13, 2021. <<https://carnegieendowment.org/2021/03/09/space-is-great-commons.-it-s-time-to-treat-it-as-such-pub-84018>> AT

The failure to manage Earth orbits as a commons undermines safety and predictability, exposing space operators to growing risks such as collisions with other satellites and debris. The long-standing debris problem has been building for decades and demands an international solution.¶ Competing states need to coalesce behind a commons-based understanding of Earth orbits to set the table for a governance system to organize space traffic and address rampant debris. New leadership in the United States can spur progress on space governance by affirming that Earth orbits are a great commons. So far, President Joe Biden and his administration have focused on major space projects, but a relatively simple policy declaration that frames Earth orbits as a great commons can support efforts to negotiate space governance models for issues like debris mitigation and remediation. The Biden administration can set the stage to pursue broad space policy goals by establishing a consensus among states, particularly those with the most invested in Earth orbits, that space is a great commons.¶ THE PRESSING NEED FOR SPACE GOVERNANCE¶ The Earth orbits that provide the majority of benefits to states and commercial ventures represent only a tiny fraction of outer space as a whole. Competition for the limited volume of these Earth orbits is especially fierce since two satellites cannot be in the same place at the same time and not all orbits are equally useful for all missions. The number of objects residing in Earth orbits is now at an all-time high, with most new objects introduced into orbits at altitudes of between 400 and 700 kilometers above sea level. Millions of pieces of debris in Earth orbits pose a threat to continuing space operations. For instance, the final U.S. space shuttle missions faced 1-in-300 odds of losing a space vehicle or crew member to orbital debris or micrometeoroid impacts.¶ Collisions with fragments of orbital litter as small as a few millimeters across can ruin satellites and end missions. Current technologies cannot track all of these tiny pieces of debris, leaving space assets at the mercy of undetectable, untraceable, and unpredictable pieces of space junk. Some researchers have determined that the debris population in low Earth orbit is already self-sustaining, meaning that collisions between space objects will produce debris more rapidly than natural forces, like atmospheric drag, can remove it from orbit.¶ States—namely the United States, Russia, China, and India—have exacerbated this debris accumulation trend by testing kinetic anti-satellite capabilities or otherwise purposefully fragmenting their satellites in orbit. These states, along with the rest of the multilateral disarmament community, are currently at an impasse on establishing future space governance mechanisms that can address the debris issue. A portion of this impasse may be attributable to disparate views of the nature of outer space in the international context. Establishing a clear view among negotiating parties that Earth orbits should be treated as a great commons would establish a basis for future agreements that reduce debris-related risks.¶ Beyond debris-generating, kinetic anti-satellite weapons tests, revolutionary operating concepts challenge existing space traffic management practices. For instance, commercial ventures are planning networks of thousands of satellites to provide low-latency connectivity on Earth and deploying them by the dozens. States are following this trend. Some are considering transitioning away from using single (or few) exquisite assets in higher orbits and toward using many satellites in low Earth orbits. These new operational concepts could lead to an increase in collision risks.¶ Without new governance agreements, problems related to debris, heavy orbital traffic, and harmful interference will only intensify. Debris in higher orbits can persist for a century or more. The costs of adapting to increasingly polluted orbits would be immense, and the opportunity costs would be even higher. For instance, all else being equal, hardening satellites against collisions increases their mass and volume, in turn raising launch costs per satellite. These costs, rooted in a failure to govern space as a commons, will be borne by all space actors, including emerging states and commercial entities.¶ EXISTING FORMS OF SPACE GOVERNANCE¶ A well-designed governance system, founded on a widespread understanding of Earth orbits as a great commons, could temper these risks. Currently, space is not wholly unregulated, but existing regulations are limited both in scope and implementation. Many operators pledge to follow national regulations and international guidelines, but decentralized accountability mechanisms limit enforcement. These guidelines also do not cover the full range of potentially risky behaviors in space. For example, while some space operators can maneuver satellites to avoid collisions, there are no compulsory rules or standards on who has the right of way.¶ At the interstate level, seminal multilateral agreements provide some more narrow guidance on what is and is not acceptable in space. Most famously, the Outer Space Treaty affirms that outer space “shall be free for exploration and use by all states without discrimination of any kind” and that “there shall be free access to all areas of celestial bodies.” Similar concepts of Earth orbits being a great commons arise in subsequent international texts. Agreements like the Liability Convention impose fault-based liability for debris-related collisions in space, but it is difficult to prove fault in this regime in part because satellite owners and operators have yet to codify a standard of care in space, and thus the regime does not clearly disincentivize debris creation in orbit. Other rules of behavior in Earth orbits have been more successful in reducing harmful interference between satellite operations, but even these efforts are limited in scope.¶ States have acceded to supranational regulations of the most limited (and thus most valuable) Earth orbits. The International Telecommunication Union (ITU) coordinates, but does not authorize, satellite deployments and operations in geosynchronous orbits and manages radiofrequency spectrum assignments in other regions of space to reduce interference between satellites. These coordination activities are underpinned by the ITU’s constitution, which reminds states “that radio frequencies and any associate orbits . . . are limited natural resources,” indicating a commons-based approach to governing the radiofrequency spectrum. However, the union’s processes are still adapting to new operational realities in low Earth orbit, and these rules were never designed to address issues like debris.

#### Development of space resources is still possible with a commons model. Property rights are not necessary. Existing models governing commons encourage responsible development, numerous examples prove.

Sterling Saletta & Orrman-Rossiter 18 [Sterling Saletta, Morgan; Orrman-Rossiter, Kevin (2018). Can space mining benefit all of humanity?: The resource fund and citizen's dividend model of Alaska, the ‘last frontier’. Space Policy, (), S0265964616300704–. doi:10.1016/j.spacepol.2018.02.002] CT

The Outer Space Treaty (OST) came into force in 1967 and, having been ratified by all the major space faring governments as well as some 100 other nations, the Outer Space Treaty serves as the basis for international space law, the current corpus juris spatialis. The treaty declares the exploration and use of outer space shall be for, “the benefit and in the interests of all countries [27]” and that outer space, as mentioned previously, “shall be the province of all mankind [27]”.

With the increased commercialization of space, and the entrance of new actors, both national and private, the OST has come under increased scrutiny, with calls to expand, modify, and even to abrogate it [35,36]. Issues surrounding the mining of celestial bodies have received particular attention and debate [37]. Of particular concern is the matter of exploitation licences and property rights [38]. The OST expressly forbids the “national appropriation by claims of sovereignty, by means of use or occupation, or by other means” [27] of outer space and celestial bodies. This is frequently interpreted to mean that the OST denies private property claims in outer space, some authors and individuals [39–41] have argued that appropriation by non-nationalentities is allowed.

The Outer Space Treaty, and its terrestrial analogues, UN Convention on the Law of the Seas (UNCLOS) and the Antarctica Treaty System (ATS) are ‘global commons regimes', though the terminology governing these commons differs and juridical concepts such as “common heritage of humanity” found in UNCLOS (and the Moon Treaty of 1979) and the “common province of mankind” found in the Outer Space Treaty have been interpreted in various manners. Due in part to these varying wordings, interpretations and attendant uncertainties, the need for a more comprehensive framework governing the environmental, ethical, and commercial aspects of space exploration, exploitation and colonization has been highlighted by many authors [30,33,34].

Some advocates for the commercial exploitation of space claim that the absence of property rights is a barrier to such ventures, and in particular to the mining of celestial bodies such as the Moon or near earth asteroids [35]. Some have gone so far as to suggest an abrogation of the OST in favor of a treaty that allows something like fee-simple ownership and what might best be called a California gold rush approach to outer space resource exploitation [36–38]. Advocates of this approach would give something like fee-simple ownership of outer space resources on a ‘first in time, first in right’ basis with no clear licensing regime for such activities [39]. In recent US law, Title IV of H.R. 2262- the U.S. Commercial Space Launch Competitiveness Act, grants ownership of asteroid resources to entities obtaining them but attempts to walk a fine line between this approach and international treaty obligations. It does not grant ownership of asteroid themselves, and explicitly states that resource exploitation must be in accordance with federal laws and existing treaty obligations, i.e. the OST [40]. How such eventual exploitation occurs, and under what precise national and international regulatory and licensing regimes, is thus still a matter for the future to decide.

On the other hand, it has also been suggested that modifications and additions to the OST based on terrestrial models will provide sufficient guarantee of the right to make profits from the exploitation of outer space resources. Henry Hertzfeld and Frans von der Dunk argue the current regime does not pose a problem for exploitation rights and that terrestrial models would allow private ventures the right to reasonable returns on investment from resource exploitation in space [41]. Furthermore, in addition to important, and possibly irreconcilable, differences between a California gold rush style approach and the OST [42], arguments suggesting fee-simple or similar ownership is necessary for profitable private outer space resource exploitation simply do not stand in the face of contrary evidence from numerous terrestrial examples. These include offshore oil drilling, mining, timber and grazing operations in the United States and internationally which are regularly and profitably undertaken without ownership [43]. Thus P. M. Sterns and L. I. Tennen argue that the current international regime does provide an adequate framework for commercial development in space, that fee-simple ownership is unnecessary and:

“those who advocate the renunciation and abandonment of the nonappropriation principle are either seeking to increase their own bottom line by disingenuous and deceptive constructs, or lack an appropriate appreciation and respect for international processes [[44], p. 2439]”.

Thus, claims that a lack of private property rights in outer space will be a deterrent to commercial resource exploitation ventures in space do not reflect an adequate reflection and analysis of the manner in which current terrestrial practices might be extended into outer space without abrogating the current treaty regime. Nor would a system based on fee simple ownership be likely to tangibly benefit more than a small proportion of the world's population. Instead, the eventual wealth from exploiting celestial bodies would be concentrated in the hands of a few, exacerbating rather than alleviating existing problems for humanity and global sustainable development.

The Outer Space Treaty has provided an effective legal framework for the exploration of outer space for over 50 years. Based on the history of treaty regimes governing other international spaces, UNCLOS and the ATS, it seems likely that, in future, additional protocols and agreements will be layered onto the OST and that calls to abrogate and to negotiate a wholly new treaty system are unlikely to succeed. While low participation in the Moon Agreement, also known as the Moon Treaty of 1979, which has not been ratified by either the United States, Russia, or China, has raised questions of legitimacy, it has recently been argued that the Moon Treaty may receive renewed interest in the international community. René Lefeber argues that, far from stifling commercial ventures, the Moon Agreement “provides the best available option for mankind, states and industry to develop space mineral resources in a harmonious way [[5], p. 47]”, and that, as resource exploitation in outer space now seems likely, the need to elaborate an international regime to prevent conflict over resources may bring other parties to ratify, accede to, or sign the treaty.

Ultimately, some form of international governance of outer space as a global commons [45] building on the OST and the current corpus juris spatialis seems both more likely and more desirable than an abrogation of the OST and its replacement with an entirely new treaty regime. Thus, an international regime built upon this existing regime will need to be constructed which takes a balanced approach to space exploration, development and exploitation and which encourages entrepreneurial development but also moves beyond vague utopian platitudes to real and concrete benefits for all of humanity.