# AW AC

#### Ambiguities in the OST that allow private appropriation have kicked off a race to develop space, setting the stage for a debris crisis 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”. Nro 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: Space Debris

#### Space debris is appropriation – permanently occupies and precludes free use. Requires regulation.

De Man 19 [Philip De Man, *Exclusive Use in an Inclusive Environment: The Meaning of the Non-Appropriation Principle for Space Resource Exploitatio*n, Springer (2019)] CT

It is only when a state refuses to remove a space object whose non-functional status is objectively established, that the exercise of the freedom to use outer space by other states is denied on the basis of an act or negligence that originates from a discretionary exercise of positive authority by a single state not grounded in the actual exercise of its own freedom to explore or use outer space. From this perspective, it is rather diffi cult, if not impossible, to distinguish the refusal to remove nonfunctional satellites at the end of their life from an infringement of Article II OST . Every activity in space entails an exclusion of others. 387 Only when this exclusion is enforced in the absence of justification by the enjoyment of the freedom to explore and use outer space does the denial of the correlative freedom of others amount to an unlawful form of appropriation. For, without use, the justifi cation of exclusivity can only be found in the primordial authority as arrogated by the owner to himself, on this same basis. Though they constitute a minority, a number of authors have construed the refusal to remove inactive satellites as a violation of the principles of the UN space treaties as well. As such, Williams has noted that it is to be wondered whether inactive satellites are complying with the requirements of Article I of the 1967 Space Treaty, particularly the « benefi t and interest of all countries» and «freedom of scientifi c investigation». It is submitted that, on these grounds, inactive satellites using up orbital positions, particularly in the GEO, are open to question. 388 While the author primarily analyses the problem from the perspective of Article I OST , Sterns and Tennen rightly contend that the refusal to remove a derelict craft from orbit is the functional equivalent of appropriation of outer space, prohibited by Article II of the Outer Space Treaty. […] Similarly, a nonfunctioning satellite remaining in orbit for an extended period of time could be considered as equivalent to a place-saving object. 389 Combining the fi nality of Articles I and II OST , Fernández-Brital suggests that the placement of non-functional artificial objects in space constitutes a form of appropriation, as it occupies a position that would otherwise be free for the use of others. Though the language is wanting for linguistic accuracy, the author’s observation demonstrates considerable legal perspicacity: [a]s it is a physical truth that two objects [cannot occupy] the same place at the same [time,] when somebody leaves a debris [ sic ] in outer space, [he] is performing the appropriation of the place occupied by the same [, which is] an [action] forbidden by the [Outer Space] Treaty as it is [known]. […] The Treaty allows the «use» of outer space. Placing or leaving rubbish in outer space is not using it in accordance with the Treaty, it is against the rules. 390 Considering the unlawful nature of the act of keeping a non-functional satellite in space to be established, Christol then proposes that due consideration would have to be given to the situation where a non-functional space object was occupying an orbital position of great value for telecommunication or factgathering purposes. The presence of such a space object in orbit does not serve the interests of anyone. Thus, legal and practical means must be devised imposing a legal duty on the launching authority to remove or have removed, if it does not have the capabilities, such an object from orbit. The station-keeping procedures which allow it to remain in a preferred orbital position must be employed to put it into a non-utilitarian [ sic ] and non-interfering orbit. 391 Such a legal obligation already exists, however. As such, a number of authors have argued that, if Article VIII OST should not yield to the powers of other states to remove the disused space object , the failure to remove such an object or to disown it should be construed as a fault or negligent action, or should at least trigger a presumption to this effect. 392 As to the international obligation that has been violated, it has been suggested that the failure to respect the UN space debris guidelines may serve as a point of reference to determine whether a state has exercised due diligence in launching and operating a space object in the sense of Article IX OST . 393 As the statements of the authors cited above have made clear, however, there is no need to rely on indirect indications derived from a set of unenforceable guidelines to suggest a violation of a binding principle of the Outer Space Treaty. For, by virtue of the failure to fulfi l the conditions of the ITU regulations to acquire the protected use of a particular orbital position, the active refusal to remove a disused space object from its occupied position, considering the conditionality of the right not to be interfered upon actual operation, constitutes a violation of the letter and spirit of the legal system established by Article II jo. Article I OST .

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

Chelsea **MuñOz-Patchen, 19** - ("Regulating the Space Commons: Treating Space Debris as Abandoned Property in Violation of the Outer Space Treaty," University of Chicago, 2019, 12-6-2021, https://cjil.uchicago.edu/publication/regulating-space-commons-treating-space-debris-abandoned-property-violation-outer-space)//AW

Debris poses a threat to functioning space objects and astronauts in space, and may cause damage to the earth’s surface upon re-entry.29 Much of the small debris cannot be tracked due to its size and the velocity at which it travels, making it impossible to anticipate and maneuver to avoid collisions.30 To remain in orbit, debris must travel at speeds of up to 17,500 miles per hour.31 At this speed even very small pieces of debris can cause serious damage, threatening a spacecraft and causing expensive damage.32 There are millions of these very small pieces, and thousands of larger ones.33 The small-to-medium pieces of debris “continuously shed fragments like lens caps, booster upper stages, nuts, bolts, paint chips, motor sprays of aluminum particles, glass splinters, waste water, and bits of foil,” and may stay in orbit for decades or even centuries, posing an ongoing risk.34 Debris ten centimeters or larger in diameter creates the likelihood of complete destruction for any functioning satellite with which it collides.35 Large nonfunctional objects remaining in orbit are a collision threat, capable of creating huge amounts of space debris and taking up otherwise useful orbit space.36 This issue is of growing importance as more nations and companies gain the ability to launch satellites and other objects into space.37 From February 2009 through the end of 2010, more than thirty-two collision-avoidance maneuvers were reportedly used to avoid debris by various space agencies and satellite companies, and as of March 2012, the crew of the International Space Station (ISS) had to take shelter three times due to close calls with passing debris.38 These maneuvers require costly fuel usage and place a strain on astronauts.39 Furthermore, the launches of some spacecraft have “been delayed because of the presence of space debris in the planned flight paths.”40 In 2011, Euroconsult, a satellite consultant, projected that there would be “a 51% increase in satellites launched in the next decade over the number launched in the past decade.”41 In addition to satellites, the rise of commercial space tourism will also increase the number of objects launched into space and thus the amount of debris.42 The more objects are sent into space, and the more collisions create cascades of debris, the greater the risk of damage to vital satellites and other devices relied on for “weather forecasting, telecommunications, commerce, and national security.”43 The Space Debris Mitigation Guidelines44 were created by UNCOPUOS with input from the IADC and adopted in 2007.45 The guidelines were developed to address the problem of space debris and were intended to “increase mutual understanding on acceptable activities in space.”46 These guidelines are nonbinding but suggest best practices to implement at the national level when planning for a launch. Many nations have adopted the guidelines to some degree, and some have gone beyond what the guidelines suggest.47 While the guidelines do not address existing debris, they do much to prevent the creation of new debris. The Kessler Syndrome is the biggest concern with space debris. The Kessler Syndrome is a cascade created when debris hits a space object, creating new debris and setting off a chain reaction of collisions that eventually closes off entire orbits.48 The concern is that this cascade will occur when a tipping point is reached at which the natural removal rate cannot keep up with the amount of new debris added.49 At this point a collision could set off a cascade destroying all space objects within the orbit.50 In 2011, The National Research Council predicted that the Kessler Syndrome could happen within ten to twenty years.51 Donald J. Kessler, the astrophysicist and NASA scientist who theorized the Kessler Syndrome in 1978, believes this cascade may be a century away, meaning that there is still time to develop a solution.52

#### Laundry list of impacts.

George **Dvorsky, 15** - ("What Would Happen If All Our Satellites Were Suddenly Destroyed?," 6-4-2015, 12-10-2021https://gizmodo.com/what-would-happen-if-all-our-satellites-were-suddenly-d-1709006681)//AW

Lastly, there’s the Kessler Syndrome to consider. This scenario was portrayed in the 2013 film Gravity. In the movie, a Russian missile strike on a defunct satellite inadvertently causes a cascading chain reaction that formed an ever-growing cloud of orbiting space debris. Anything in the cloud’s wake—including satellites, space stations, and astronauts—gets annihilated. Disturbingly, the Kessler Syndrome is a very real possibility, and the likelihood of it happening is steadily increasing as more stuff gets thrown into space. Given these grim prospects, it’s fair to ask what might happen to our civilization if any of these things happened. At the risk of gross understatement, the complete loss of our satellite fleet would instigate a tremendous disruption to our current mode of technological existence—disruptions that would be experienced in the short, medium, and long term, and across multiple domains. Compromised Communications Almost immediately we’d notice a dramatic reduction in our ability to communicate, share information, and conduct transactions. A visualization from the Opte Project showing the various routes through a portion of the Internet (Opte/cc) “If our communications satellites are lost, then bandwidth is also lost,” Jonathan McDowell tells io9. He’s an astrophysicists and Chandra Observatory scientist who works out of the Harvard-Smithsonian Center for Astrophysics. McDowell says that, with telecommunication satellites wiped out, the burden of telecommunications would fall upon undersea cables and ground-based communication systems. But while many forms of communication would disappear in an instant, others would remain. All international calls and data traffic would have to be re-routed, placing tremendous pressure on terrestrial and undersea lines. Oversaturation would stretch the capacity of these systems to the limit, preventing many calls from going through. Hundreds of millions of Internet connections would vanish, or be severely overloaded. A similar number of cell phones would be rendered useless. In remote areas, people dependent on satellite for television, Internet, and radio would practically lose all service. Submarine cable map (TeleGeography) “Indeed, a lot of television would suddenly disappear,” says McDowell. “A sizable portion of TV comes from cable whose companies relay programming from satellites to their hubs.” It’s important to note that we actually have a precedent for a dramatic—albeit brief —disruption in com-sat capability. Back in 1998, there was a day in which a single satellite failed and all the world’s pagers stopped working. Get Out Your Paper Maps We would also lose the Global Positioning System. In the years since its inception, GPS has become ubiquitous, and a surprising number of systems have become reliant on it. Lockheed-Martin’s GPS-III-AHI satellite “Apart from the fact that everyone has forgotten to navigate without GPS in their cars, many airplanes use GPS as well,” says McDowell. Though backup systems exist, airlines use GPS to chart the most fuel-efficient and expeditious routes. Without GPS and telecomm-sats, aircraft controllers would have tremendous difficulty communicating with and routing airplanes. Airlines would have to fall back to legacy systems and procedures. Given the sheer volume of airline traffic today, accidents would be all but guaranteed. Other affected navigation systems would include those aboard cargo vessels, supply-chain management systems, and transportation hubs driven by GPS. But GPS does more than just provide positioning—it also provides for timing. Ground-based atomic clocks can perform the same function, but GPS is increasingly being used to distribute the universal time standard via satellites. Within hours of a terminated service, any distributing networks requiring tight synchronization would start to suffer from “clock drift,” leading to serious performance issues and outright service outages. Such disruptions could affect everything from the power grid through to the financial sector. A somewhat alarmist video produced by the Marshall Institute, but one that raises some relevant points. In the report, “A Day Without Space: Economic and National Security Ramifications,” Ed Morris, the Executive Director of the Office of Space Commerce at the Department of Commerce, writes: If you think it is hard to get work done when your internet connection goes out at the office, imagine losing that plus your cell phone, TV, radio, ATM access, credit cards, and possibly even your electricity. [...] Wireless services, especially those built to CDMA standard, would fail to hand off calls from one cell to the next, leading to dropped connections. Computer networks would experience slowdowns as data is pushed through finite pipelines at reduced bit rates. The same would be true for major networks for communication and entertainment, since they are all IP-based today and require ultra-precise timing to ensure digital traffic reaches its destination. The lack of effective synch would hit especially hard in banking, where the timing of transactions needs to be recorded. Credit card payments and bank accounts would likely freeze, as billions of dollars could be sucked away from businesses. A financial crash is not out of the question. The Loss of Military Capability The sudden loss of satellite capability would have a profound effect on the military. Useless without GPS: The U.S. Navy’s Harpoon missile (U.S. Navy) The Marshall Institute puts it this way: “Space is a critical enabler to all U.S. warfare domains,” including intelligence, navigation, communications, weather prediction, and warfare. McDowell describes satellite capability as as the “backbone” of the U.S. military. And as 21st century warfare expert Peter W. Singer from New America Foundation tells io9, “He who controls the heavens will control what happens in the battles of Earth.” Singer summarized the military consequences of losing satellites in an email to us: Today there are some 1,100 active satellites which act as the nervous system of not just our economy, but also our military. Everything from communications to GPS to intelligence all depend on it. Potential foes have noticed, which is why Russia and China have recently begun testing a new generation of anti-satellite weapons, which in turn has sparked the U.S. military to recently budget $5 billion for various space warfare systems. What would happen if we lost access to space? Well, the battles would, as one U.S. military officer put it, take us back to the “pre digital age.” Our drones, our missiles, even our ground units wouldn’t be able to operate the way we plan. It would force a rewrite of all our assumptions of 21st century high tech war. We might have a new generation of stealthy battleships...but the loss of space would mean naval battles would in many ways be like the game of Battleship, where the two sides would struggle to even find each other. Moreover, and as McDowell explains to io9, the loss of satellite capability would have a profound effect on arms control capabilities. Space systems can monitor compliance; without them, we’d be running blind. “The overarching consideration is that you wouldn’t really know what’s going on,” says McDowell. “Satellites provide for both global and local views of what’s happening. We would be less connected, less informed—and with considerably degraded situational awareness.” Compromised Weather Prediction and Climate Science One great thing satellites have done for us is improve our ability to forecast weather. Predicting a slight chance of cloudiness is all well and good, but some areas, like India, Pakistan, and Bangladesh, are dependent on such systems to predict potentially hazardous monsoons. And in the U.S., the NOAA has estimated that, during a typical hurricane season, weather satellites save as much as $3 billion in lives and property damage. Hurricane Ivan (NOAA) There’s also the effect on science to consider. Much of what we know about climate change comes from satellites. As McDowell explains, the first couple of weeks without satellites wouldn’t make much of a difference. But over a ten-year span, the lack of satellites would preclude our ability to understand and monitor such things as the ozone layer, carbon dioxide levels, and the distribution of polar ice. Ground-based and balloon-driven systems would help, but much of the data we’re currently tracking would suddenly become much spottier. Without satellites, you can say goodbye to maps like this (NOAA) “We’re quite dependent on satellites for a global view of what’s happening on our planet—and at a time when we really, really need to know what’s happening,” says McDowell. It’s also worth pointing out that, without satellites, we also wouldn’t be able to monitor space weather, such as incoming space storms. Time to Recover With all the satellites gone, both governmental and private interests would work feverishly to restore space-based capabilities. Depending on the nature of the satellite-destroying event, it could take decades or more to get ourselves back to current operational standards. It would take a particularly long time to recover from a Carrington Event, which would zap many ground-based electronic systems as well. The U.S. military is already thinking along these lines, which is why it’s working on the ability to quickly send up emergency assets, such as small satellites parked in Low Earth Orbit (LEO). Cube satellites are increasingly favored, as an easy-to-launch, affordable, and effective solution—albeit a short-term one. The U.S. Operationally Responsive State Office is currently working on the concept of emergency replenishment and the ability to “rapidly deploy capabilities that are good enough to satisfy warfighter needs across the entire spectrum of operations, from peacetime through conflict.” Cubesats in orbit (NASA) As for getting full-sized, geostationary satellites back into orbit, that would prove to be a greater challenge. It can take years to built a new satellite, which typically requires a big, costly rocket to get it into space. Lastly, if a Kessler Syndrome wipes out the satellites, that would present an entirely different recovery scenario. According to McDowell, it would take a minimum of 11 years for LEO to clear itself of the debris cloud; any objects below 500 km (310 miles) would eventually fall back to Earth. Thus, we would only be able to start re-seeding LEO in a little over a decade following a Kessler event. Unfortunately, the area above 600 km (372 miles) would remain out of touch for a practically indefinite period of time; objects orbiting at that height tend to stay there for a long, long time. We’d probably lose this band for good—unless we manually removed the debris field, using clean-up satellites or other techniques. It’s worth noting that a single Kessler event could hit the LEO zone or the GEO zone (geosynchronous orbit) but realistically not both; LEO debris could never reach GEO, and vice versa—though a spent rocket in GTO (geosynchronous transfer orbit) or SSTO (supersynchronous transfer orbit) passes through or near both zones and could potentially affect either of them. The spent rockets in GTO do not stay too close to the GEO arc for long due to orbital perturbations, so a GEO Kessler event is very unlikely to be triggered by one of them. Suffice to say, we should probably take the prospect of a Kessler Syndrome more seriously, and be aware of what could happen if we’re no longer able to use these spaces.

### Advantage 2: Climate

#### Rocket emissions contribute to global warming and investment is an opportunity cost to solving climate change on Earth.

Katharine **Gammon, 21** - ("How the billionaire space race could be one giant leap for pollution," 7-19-2021, 12-14-2021https://www.theguardian.com/science/2021/jul/19/billionaires-space-tourism-environment-emissions)//AW

Last week Virgin Galactic took Richard Branson past the edge of space, roughly 86 km up – part of a new space race with the Amazon billionaire Jeff Bezos, who aims to make a similar journey on Tuesday. Both very wealthy businessmen hope to vastly expand the number of people in space. “We’re here to make space more accessible to all,” said Branson, shortly after his flight. “Welcome to the dawn of a new space age.” Already, people are buying tickets to space. Companies including SpaceX, Virgin Galactic and Space Adventures want to make space tourism more common. The Japanese billionaire Yusaku Maezawa spent an undisclosed sum of money with SpaceX in 2018 for a possible future private trip around the moon and back. And this June, an anonymous space lover paid $28m to fly on Blue Origin’s New Shepard with Bezos – though later backed out due to a “scheduling conflict”. But this launch of a new private space industry that is cultivating tourism and popular use could come with vast environmental costs, says Eloise Marais, an associate professor of physical geography at University College London. Marais studies the impact of fuels and industries on the atmosphere. When rockets launch into space, they require a huge amount of propellants to make it out of the Earth’s atmosphere. For SpaceX’s Falcon 9 rocket, it is kerosene, and for Nasa it is liquid hydrogen in their new Space Launch System. Those fuels emit a variety of substances into the atmosphere, including carbon dioxide, water, chlorine and other chemicals. The carbon emissions from rockets are small compared with the aircraft industry, she says. But they are increasing at nearly 5.6% a year, and Marais has been running a simulation for a decade, to figure out at what point will they compete with traditional sources we are familiar with. “For one long-haul plane flight it’s one to three tons of carbon dioxide [per passenger],” says Marais. For one rocket launch 200-300 tonnes of carbon dioxide are split between 4 or so passengers, according to Marais. “So it doesn’t need to grow that much more to compete with other sources.” Right now, the number of rocket flights is very small: in the whole of 2020, for instance, there were 114 attempted orbital launches in the world, according to Nasa. That compares with the airline industry’s more than 100,000 flights each day on average. But emissions from rockets are emitted right into the upper atmosphere, which means they stay there for a long time: two to three years. Even water injected into the upper atmosphere – where it can form clouds – can have warming impacts, says Marais. “Even something as seemingly innocuous as water can have an impact.” Closer to the ground, all fuels emit huge amounts of heat, which can add ozone to the troposphere, where it acts like a greenhouse gas and retains heat. In addition to carbon dioxide, fuels like kerosene and methane also produce soot. And in the upper atmosphere, the ozone layer can be destroyed by the combination of elements from burning fuels. “While there are a number of environmental impacts resulting from the launch of space vehicles, the depletion of stratospheric ozone is the most studied and most immediately concerning,” wrote Jessica Dallas, a senior policy adviser at the New Zealand Space Agency, in an analysis of research on space launch emissions published last year. Another report from 2019 penned by the Center for Space Policy and Strategy likened the space emissions problem to that of space debris, which the authors say creates an existential risk to the industry. “Today, launch vehicle emissions present a distinctive echo of the space debris problem. Rocket engine exhaust emitted into the stratosphere during ascent to orbit adversely impacts the global atmosphere,” they wrote. “We just don’t know how large the space tourism industry could become,” says Marais. A new market report estimates that the global suborbital transportation and space tourism market is estimated to reach $2.58bn in 2031, growing 17.15% each year of the next decade. “The major driving factor for the market’s robustness will be focused efforts to enable space transportation, emerging startups in suborbital transportation, and increasing developments in low-cost launching sites,” the report says. In the past, most space transportation has been focused on cargo supply missions to the International Space Station and satellite launch services, but currently, this focus has shifted to in-space transportation, planetary explorations, crewed missions, suborbital transportation and space tourism. Several companies, including SpaceX, Blue Origin and Virgin Galactic, have been focusing on developing platforms such as rocket-powered suborbital vehicles that will enable the industry to carry out suborbital transportation and space tourism. People have pointed out that the money these billionaires have poured into space technology could be invested in making life better on our planet, where wildfires, heatwaves and other climate disasters are becoming more frequent as the globe warms up in the climate crisis. “Is anyone else alarmed that billionaires are having their own private space race while record-breaking heatwaves are sparking a ‘fire-breathing dragon of clouds’ and cooking sea creatures to death in their shells?” the former US Labor Secretary Robert Reich tweeted last week. Marais says that there is always an element of excitement to new developments in space – but it’s still possible to be responsible while doing something exciting. She urges caution as the space tourism industry grows, and says there are currently no international rules around the kinds of fuels used and their impact on the environment. “We have no regulations currently around rocket emissions,” she says. “The time to act is now – while the billionaires are still buying their tickets.”

#### Private launches already have massive impacts on warming and air pollution.

John **Letzing, 21** - ("How many space launches does it take to have a climate impact?," World Economic Forum, 7-23-2021, 12-15-2021https://www.weforum.org/agenda/2021/07/what-s-the-climate-impact-of-space-exploration/)//AW

A new satellite launch site is planned for Unst, a windswept UK island that was once part of a ring of radar stations used to detect incoming V-2 rockets – the German “wonder weapons” that spawned a government-led space race more than a half-century ago. According to one assessment, launches at the facility in Unst, designed to cater to commercial clients, would result in 764 tonnes of carbon dioxide equivalent annually. That's a negligible fraction of the country’s total emissions last year. But the site is just one of seven planned for the UK alone, as a largely profit-driven second space race heats up. Space launches haven’t raised much climate concern to date. That may change as the private sector books an increasing number of flights for space tourists, and potentially starts ferrying miners and factory workers beyond Earth’s atmosphere (two successful commercial voyages to space this month both inspired would-be explorers and prompted some pundits to calculate their carbon footprint). Alongside space tourism, the growing use of satellites will also likely ramp up launch activity; a record 1,283 satellites were launched last year, according to the UN, and by April of this year nearly 850 more had been sent into space. In addition to coughing up not-inconsiderable amounts of CO2, rockets can spew exhaust that depletes the ozone layer through chemical reactions. And if the black carbon “soot” particles they leave in the atmosphere reach high enough concentrations, it could impact surface and atmospheric temperatures, according to a NASA assessment. One study estimated that 1,000 space launches per year could create a layer of black carbon particles capable of causing the loss of 5% or more of Antarctic sea ice. As private commercial interest in space increases, a wider variety of governments are also likely to initiate launches. More than a dozen countries now have the ability to send objects into orbit, and related costs have generally declined since 2005. Nations submitting information to the UN on their first satellites in 2019 included Bhutan and Kenya; Indonesia, Lithuania, and Egypt were among the other countries registering functional space objects that year. China now has a space station where it can send additional astronauts and supplies, and the United Arab Emirates plans to follow its successful launch of a Mars orbiter with a satellite-manufacturing complex and a settlement on the Red Planet by 2117. Not long before the private-sector launches this month stirred excitement about new possibilities for spaceflight, an extreme heatwave linked to climate change had blanketed the region from Texas north to Canada – killing hundreds of people, cooking millions of sea creatures, and hinting that an environmental catastrophe may be closer at hand than anticipated. Some argue greater access to space means we could send the most climate-unfriendly aspects of the global economy there. Others say we must find better ways to deal with the problem right here on Earth.

**Air pollution causes widespread health problems.**

Coleman 7/29 - Clayton Coleman [Policy Intern, EESI] and Emma Dietz [Cornel B.S. in Environmental Science and Sustainability, with a minor in Public Policy; Paralegal at Weitz & Luxenberg PC], “Fact Sheet: Fossil Fuel Subsidies: A Closer Look at Tax Breaks and Societal Costs,” *Environmental and Energy Study Institute*. July 29, 2019. Accessed Nov. 13, 2019. <https://www.eesi.org/papers/view/fact-sheet-fossil-fuel-subsidies-a-closer-look-at-tax-breaks-and-societal-costs> AT

Burning fossil fuels creates air pollutants such as particulate matter, carbon monoxide, sulfur dioxide, ozone, and mercury. These pollutants lead to health impacts including asthma, lung disease, bronchitis, and other chronic respiratory diseases that may lead to premature death. Air pollutants from fossil fuels also contribute to the development of lung and other cancers; lung cancer accounts for 30 percent of cancer-related deaths each year. Air pollutants, such as those released from vehicles and power plants that rely on the combustion of fossil fuels, cause 200,000 premature deaths each year.¶ Taking into account the coal power sector alone, it is estimated that fine particulate matter from U.S. coal plants resulted in 13,200 deaths, 9,700 hospitalizations, and 20,000 heart attacks in 2010. Coal-fired power plants are also the largest source of airborne mercury emissions in the United States. Mercury can move through the food chain and accumulate in the flesh of fish, posing the greatest risk to pregnant women.

#### Warming is catastrophic and risks extinction.

**McCoy 14** (Dr. David McCoy et al., MD, Centre for International Health and Development, University College London, “Climate Change and Human Survival,” BRITISH MEDICAL JOURNAL v. 348, 4—2—14, doi: http://dx.doi.org/10.1136/bmj.g2510, CMR)

The Intergovernmental Panel on Climate Change (IPCC) has just published its report on the impacts of global warming. Building on its recent update of the physical science of global warming [1], the IPCC’s new report should leave the world in no doubt about the scale and immediacy of the threat to human survival, health, and well-being. The IPCC has already concluded that it is “virtually certain that human influence has warmed the global climate system” and that it is “extremely likely that more than half of the observed increase in global average surface temperature from 1951 to 2010” is anthropogenic [1]. Its new report outlines the future threats of further global warming: increased scarcity of food and fresh water; extreme weather events; rise in sea level; loss of biodiversity; areas becoming uninhabitable; and mass human migration, conflict and violence. Leaked drafts talk of hundreds of millions displaced in a little over 80 years. This month, the American Association for the Advancement of Science (AAAS) added its voice: “the well being of people of all nations [is] at risk.” [2] Such comments reaffirm the conclusions of the Lancet/UCL Commission: that climate change is “the greatest threat to human health of the 21st century.” [3] The changes seen so far—massive arctic ice loss and extreme weather events, for example—have resulted from an estimated average temperature rise of 0.89°C since 1901. Further changes will depend on how much we continue to heat the planet. The release of just another 275 gigatonnes of carbon dioxide would probably commit us to a temperature rise of at least 2°C—an amount that could be emitted in less than eight years. [4] “Business as usual” will increase carbon dioxide concentrations from the current level of 400 parts per million (ppm), which is a 40% increase from 280 ppm 150 years ago, to 936 ppm by 2100, with a 50:50 chance that this will deliver global mean temperature rises of more than 4°C. It is now widely understood that such a rise is “incompatible with an organised global community.” [5]. The IPCC warns of “tipping points” in the Earth’s system, which, if crossed, could lead to a catastrophic collapse of interlinked human and natural systems. The AAAS concludes that there is now a “real chance of abrupt, unpredictable and potentially irreversible changes with highly damaging impacts on people around the globe.” [2] And this week a report from the World Meteorological Office (WMO) confirmed that extreme weather events are accelerating. WMO secretary general Michel Jarraud said, “There is no standstill in global warming . . . The laws of physics are non-negotiable.” [6]

### Solvency

#### Since, in a just world, outer space would be treated as a global commons, and a global commons model precludes appropriation by private entries, then the appropriation of outer space by private entries 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 by ensuring the sustainable and equitable use of outer space resources.

* prevents circumvention by aligning the interests of state parties
* solves climate through increased cooperation and rigorous rocket standards
* 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).

#### 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.

Saletta Sterling & 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

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.

#### 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.

### Framing

#### Prioritization risk- probability of mitigating current catastrophic risks massively outweighs the benefits of space col.

Marko **Kovic, 21** - ("Risks of space colonization," Elsevier, 2021, 12-26-2021https://reader.elsevier.com/reader/sd/pii/S0016328720301270?token=7F84BB350587571447ACC2DBFDFF224AB4131748D029CEBD668569A2BD91112B6B3D9A6B2C29322C6C9603C44015730D&amp;originRegion=us-east-1&amp;originCreation=20211226200508)//AW

Prioritization risks arise because the moral goal of colonizing space — creating positive expected future value — can be better achieved by addressing existing risks instead of pursuing space colonization. Delaying space colonization in favor of mitigating existing risks can result in a significantly better long-term future. The specific prioritization risks that I discuss in the subsections below are depicted in Fig. 3, The two prioritization risks I focus on, neglecting existing risks and speeding up the creation of new risks, can be both catastrophic as well as existential in nature. 3.1.Neglecting existential risks Space colonization is, as I argue in the introduction, a generalized strategy for the mitigation of existential risks: If we manage to establish permanent and sustainable habitats beyond Earth, there is a chance that existential risks would either become less probable or cease to be existential at all because not all proverbial eggs are in the same basket. Given this premise, it is tempting to extrapolate it into real-life policy: If space colonization is a hedge against existential risks, then achieving space colonization capabilities must be our top priority. The problem with this prioritization strategy is that while it might, on its own, increase the probability of space colonization, it ignores the probabilities of existing existential risks. If we want to create as positive a future for humankind (in the sense of increasing humankind’s future moral expected value), then we need to weigh the benefits of achieving space colonization capabilities sooner rather than later against the benefits of reducing existential risks. When we compare the benefits of these two approaches, as Bostrom (2003, 2013a) argues, it quickly becomes obvious that that the benefits of even marginally reducing existential risks over a given time period are probably much greater

than the damage of delaying space colonization by that same time period. A delay of, say, 100 years in colonizing space has a relatively minor negative impact compared to the immense positive impact of even marginally reducing existential risks in the same time frame. If we, for example, adopt the conservative estimate of 1015 total future human lives if humankind goes on to enjoy a colonized long-term future (Greaves & MacAskill, 2019), then reducing overall existential risks by merely 0.0001 (one percent of one percent) has an expected value of 1011, or 100 billion, lives. Even the tiniest reduction in existential risks has therefore an immense positive benefit that easily offsets the positive benefit of achieving space colonization capabilities sooner rather than later. This is almost certainly true even if we take into account the potential contribution of space colonization to mitigating existential risks. Early colonization efforts are unlikely to mitigate existential risks as much as targeted existential risk mitigation strategies because the early stages of colonization are bound to be small in scale and fragile. Early habitats would in effect do next to nothing to mitigate existential risks, so creating those early habitats as quickly as possible would do very little in terms of existential risk mitigation. The practical question that arises with this prioritization risk is how inherently limited resources should be spent. Existential risk mitigation is currently somewhat of an academic niche topic that receives limited public and policy attention, except maybe for the issues climate change mitigation and nuclear safety. Space exploration, on the other hand, is an established policy branch. In 2018 Fig. 2.Framework for conceptualizing space colonization-related risks. 5 Precise probabilistic estimates of existential risks are difficult to produce (Beard, Rowe, & Fox, 2020). Estimates of an existential risk manifesting by the end of the 21st century typically range in the higher single digit or lower double digit percentage probability range, with anthropogenic risks being much more probable and thus much more relevant than natural risks alone, governments spent over 70 billion US dollars on their respective space exploration agenc

ies (Government Space Programs, 2019). Of course, not all of that money is directly used for space colonization efforts,6 but space exploration-related public spending is orders of magnitude greater than spending on some important existential risk mitigation areas. For example, the area of AI safety which is concerned with the existential risk posed by artificial intelligence and the prospect of uncontrollable superintelligence is funded only to the tune of around ten million dollars a year, even though it is currently one of the greatest existential risks (Halstead, 2019). 3.2.Speeding up the rate of existential risk creation Achieving space colonization capabilities means obtaining sufficiently advanced technology for venturing beyond Earth and permanently sustaining human life there. In order to achieve that goal, maximizing the pace of technological development seems like an instrumentally desirable goal: The faster we technologically innovate and develop, the higher the probability of obtaining space colonization capabilities. However, the problem with such a technological push is that the increased pace of technological develop-ment might also result in an increased pace of existential risk creation. As I argue above in Section 2.1, anthropogenic existential risks correlate with human technological development. All non-natural existential risks are the result of our technological progress, and more technological progress is likely to beget more existential risks. Of course, this should not be misunderstood as a quasi-Luddite argument against all technological progress in general. Scientific and technological progress has made life enormously better and removed tremendous amounts of suffering from the world, to the benefit of current as well as all future generations. However, existential risks are an unprecedented challenge, and the more numerous and probable they are, the more difficult it is to mitigate them in time. In the context of space colonization, this issue is of elevated importance because, as I argue above in Section 3.1, delaying space colonization has an almost imperceptible impact on the long-term future of humankind, whereas existential risks and our attempts at mitigating them (or failing to do so) has an enormous impact. 3.3.Neglecting acute catastrophic risks Humankind is today not only faced with existential, but also with catastrophic risks. The potential damage of catastrophic risks is smaller than that of existential risks, but still not morally negligible. Issues such as (extreme) poverty, the global burden of disease, global animal welfare in farming, and so forth are pressing issues, and they are, in a sense, more acute than existential risks because they are causing enormous moral disvalue right now. The shadow that acute catastrophic risks are casting into the future is not as long as that of existential risks in terms of overall expected disvalue, but in principle, a similar neglect argument as with existential applies in the context of space colonization. Delaying space colonization in favor of mitigating catastrophic risks could in some scenarios yield greater overall moral benefits than achieving space colonization sooner without having mitigated those catastrophic risks.