# 100 Seconds 1AC NO SPREAD

## [11:58:20]

#### [Mecklin 1] It is 100 seconds to midnight.

Mecklin 22

John Mecklin, editor, Science and Security Board, Bulletin of the Atomic Scientists. “At doom’s doorstep: it is 100 seconds to midnight.” <https://thebulletin.org/doomsday-clock/current-time/> -CAT

Last year’s leadership change in the United States provided hope that what seemed like a global race toward catastrophe might be halted and—with renewed US engagement—even reversed. Indeed, in 2021 the new American administration changed US policies in some ways that made the world safer: agreeing to an extension of the New START arms control agreement and beginning strategic stability talks with Russia; announcing that the United States would seek to return to the Iran nuclear deal; and rejoining the Paris climate accord. Perhaps even more heartening was the return of science and evidence to US policy making in general, especially regarding the COVID-19 pandemic. A more moderate and predictable approach to leadership and the control of one of the two largest nuclear arsenals of the world marked a welcome change from the previous four years. Still, the change in US leadership alone was not enough to reverse negative international security trends that had been long in developing and continued across the threat horizon in 2021. US relations with Russia and China remain tense, with all three countries engaged in an array of nuclear modernization and expansion efforts—including China’s apparent large-scale program to increase its deployment of silo-based long-range nuclear missiles; the push by Russia, China, and the United States to develop hypersonic missiles; and the continued testing of anti-satellite weapons by many nations. If not restrained, these efforts could mark the start of a dangerous new nuclear arms race. Other nuclear concerns, including North Korea’s unconstrained nuclear and missile expansion and the (as yet) unsuccessful attempts to revive the Iran nuclear deal contribute to growing dangers. Ukraine remains a potential flashpoint, and Russian troop deployments to the Ukrainian border heighten day-to-day tensions. For many countries, a huge gap still exists between long-term greenhouse gas-reduction pledges and the near- and medium-term [emission-reduction actions](https://www.foreignaffairs.com/articles/2021-09-30/net-zero-trap) needed to achieve those goals. Although the new US administration’s quick return to the Paris Agreement speaks the right words, it has yet to be matched with actionable policies. Developed countries improved their responses to the continuing COVID-19 pandemic in 2021, but the worldwide response remained entirely insufficient. Plans for quick global distribution of vaccines essentially collapsed, leaving poorer countries largely unvaccinated and allowing new variants of the SARS-CoV-2 virus to gain an unwelcome foothold. Beyond the pandemic, worrying biosafety and biosecurity lapses made it clear that the international community needs to focus serious attention on management of the global biological research enterprise. Further, the establishment and pursuit of biological weapons programs marked the beginning of a new biological arms race. And while the new US administration made progress in reestablishing the role of science and evidence in public policy, corruption of the information ecosystem continued apace in 2021. One particularly concerning variety of internet-based disinformation infected America last year: Waves of internet-enabled lies persuaded a significant portion of the US public to believe the utterly false narrative contending that Joe Biden did not win the US presidential election in 2020. Continued efforts to foster this narrative threaten to undermine future US elections, American democracy in general, and, therefore, the United States’ ability to lead global efforts to manage existential risk. In view of this mixed threat environment—with some positive developments counteracted by worrisome and accelerating negative trends—the members of the Science and Security Board find the world to be no safer than it was last year at this time and therefore decide to set the Doomsday Clock once again at 100 seconds to midnight. This decision does not, by any means, suggest that the international security situation has stabilized. On the contrary, the Clock remains **the closest it has ever been to civilization-ending apocalypse because the world remains stuck in an extremely dangerous moment.** In 2019 we called it the new abnormal, and it has unfortunately persisted. Last year, despite laudable efforts by some leaders and the public, negative trends in nuclear and biological weapons, climate change, and a variety of disruptive technologies—all exacerbated by a corrupted information ecosphere that undermines rational decision making—kept the world within a stone’s throw of apocalypse. Global leaders and the public are not moving with anywhere near the speed or unity needed to prevent disaster. Leaders around the world must immediately commit themselves to renewed cooperation in the many ways and venues available for reducing existential risk. Citizens of the world can and should organize to demand that their leaders do so—and quickly. The doorstep of doom is no place to loiter. The nuclear tightrope During 2021, some nuclear risks declined while others rose. Upcoming decisions on nuclear policies could generate either salutary or dangerous modifications of an already uncertain and worrisome security situation. The February 2021 agreement between the United States and Russia to renew New START for five years is a decidedly positive development. This extension creates a window of opportunity to negotiate a future arms control agreement between the two countries that possess 90 percent of the nuclear weapons on the planet. The United States and Russia also agreed to start two sets of dialogues about how to best maintain “nuclear stability” in the future: the Working Group on Principles and Objectives for Future Arms Control and the Working Group on Capabilities and Actions with Strategic Effects. These groups have met and in early 2022 are expected to report on initial results of the consultations, aimed at shaping future arms control agreements. Another bright spot was the Biden administration's announcements that it would seek to return to the Joint Comprehensive Plan of Action (JCPOA) with Iran and offer to enter strategic stability talks with China. Although no talks between North Korea and the United States took place in 2021, the North Koreans have not resumed testing of nuclear weapons or long-range intercontinental ballistic missiles (ICBMs). (Tests of shorter-range missiles have continued.) Finally, when the Biden administration began its Nuclear Posture Review (NPR) process, it announced that one specific goal would be to “reduce the role of nuclear weapons” in US national security policy. Other developments, however, appeared on the negative side of the ledger: Iran continues to build an enriched uranium stockpile, insisting that all sanctions be removed before returning to talks with the United States on the JCPOA. The window of opportunity seems to be closing. Over time, Iran's neighbors, particularly Saudi Arabia, may feel compelled to acquire similar capabilities, foreshadowing the frightening possibility of a Middle East with multiple countries with the expertise and material to build nuclear weapons. The Chinese have started to build new ICBM silos on a large scale, leading to concerns that China may be considering a change in its nuclear doctrine. China and Russia have both tested anti-satellite weapons recently, increasing concerns about rapid escalation in any conventional conflict with the United States. Efforts by all three countries to field hypersonic missiles are beginning to yield results, intensifying competition. While experts disagree on both the causes and the consequences of these programs, they clearly mark the start of a new arms competition. The North Koreans continue to test nuclear-capable short- and medium-range missiles, including cruise, ballistic, and glide vehicles, and there is evidence of their restarting plutonium production. Meanwhile, there have been no high-level negotiations between the United States and North Korea. India and Pakistan continue to advance their nuclear, missile, and other military capabilities with no diminution of possible flash points that could lead to nuclear conflict. As the January 6, 2021 insurrection at the US Capitol demonstrated, no country is immune from threats to its democracy, and in a state with nuclear-weapons-usable material and nuclear weapons, both can be targets for terrorists and fanatics. Notably, the insurrectionists came close to capturing Vice President Mike Pence and the “nuclear football” that accompanies the vice president as the backup system for nuclear launch commands. More than 10 percent of those charged with crimes during the January 6th insurrection were veterans or active service members. The Pentagon has conducted a major review of extremism in the military and has adopted new definitions of extremist activities in an attempt to reduce this danger in the future. The seriousness of the problem is clear. Finally, the United States is preparing a Nuclear Posture Review to guide US strategy, policy, and deployments of nuclear weapons, but its overall message appears not yet decided. We hope the document will assert that the United States will reduce the role of nuclear weapons in its deterrence and defense policies, which in turn may positively affect the nuclear weapons postures of other countries, leading, we believe, to a safer world. Where we set the Clock next year will be influenced by what the Nuclear Posture Review ultimately contains. Reports of congressional interference in the process, resulting in the firing of personnel conducting the review, suggests unwelcome politicization that could well affect the outcome and make more rational nuclear weapons policies hard to effect. Climate change: Lots of words, relatively little action This past year’s climate negotiations in Glasgow marked an important milestone in climate multilateralism: a critical first round of the treaty’s cycle of upgrading national efforts. Countries were under pressure to strengthen their emission-reduction pledges significantly relative to their pledges six years ago in Paris. The results, unfortunately, were insufficient. China and India affirmed that they would move away from use of coal, but only gradually; they affirmed for the first time the objective of achieving “net zero,” but only in 2060 and 2070, respectively. There was only partial progress toward defined accounting rules to allow international markets for greenhouse gas emissions and removals to develop. Developed countries again failed to follow through on treaty commitments to provide necessary financial and technological support. Overall, countries’ projections and plans for fossil fuel production are far from adequate to achieve the global Paris goals to limit the warming of the surface of the planet to “well below two degrees Celsius” (3.6 degrees Fahrenheit) relative to the temperature around 1800, at the beginning of the industrial revolution. Encouragingly, several countries (as well as financial institutions and corporations) have announced a commitment to achieve net-zero carbon dioxide emissions for the long term—meaning by 2050 or thereabouts. These announcements are significant, in that reaching zero aggregate carbon dioxide emissions globally would halt the buildup of greenhouse gas pollution in the atmosphere, which is absolutely critical to halting yet more warming. Earnest efforts to reach these seemingly distant targets require concerted actions in the immediate term, including a redirection of investment away from the production and use of fossil fuel and toward renewables and energy efficiency, massive upgrading of existing infrastructure, and a shift in land use and agriculture practices. The real test of the significance of these net-zero pledges will be whether they are matched by near- and medium-term emission-reduction actions. Global energy-related carbon dioxide emissions, 1990-2021. Despite declining in 2020, global energy-related carbon dioxide emissions remained at 31.5 gigatonnes, which contributed to carbon dioxide reaching its highest ever average annual concentration in the atmosphere of 412.5 parts per million in 2020—around 50 percent higher than when the Industrial Revolution began. In 2021, emissions increased to nearly match their 2019 peak. (Chart courtesy of IEA Global Energy Review 2021) Last year, we noted optimistically the election of a US president who “acknowledges climate change as a profound threat and supports international cooperation and science-based policy,” and we’ve seen a dramatic change in tone from the previous presidential administration. Recognizing that “[t]he effects we are seeing of climate change are the crisis of our generation,” Biden has indeed attempted to move forward quickly, reentering the United States in the Paris Agreement and announcing the United States’ updated Paris emission pledge of a 50 percent reduction by 2030. He has also signaled an attentiveness to the connection between climate action and environmental justice, in both the domestic and international contexts. He has committed to making climate investments in disadvantaged communities within the United States, and at the UN General Assembly meeting he pledged to double climate financing to developing countries. However, progress achievable through the US political process is highly constrained and fragile, as any subsequent president may try to swing the pendulum backward. The major infrastructure package passed in 2021 is less of a “climate bill” than the Biden administration initially proposed, and the fate of the climate goals of the “Build Back Better” bill hangs in the balance of a starkly divided Congress. It thus is not yet clear how much progress the United States will make in the coming year toward its announced emissions reduction pledge and finance promise. For over four decades the threat of climate change to “future generations” has been ruefully noted. As warming has continued to drive up temperatures—from an unprecedented extreme high temperature of 100 degrees Fahrenheit in the Siberian Arctic to the record-breaking 2021 “heat dome” over western Canada and the United States—today’s young people are increasingly seeing themselves as the future victims. They are witnessing human and ecosystem tragedies caused, for example, by droughts in eastern Africa and the United States, floods in China and Europe, and wildfires raging around the world, harbingers of yet more dire consequences as climate change accelerates in their lifetimes. The experience of a deepening crisis has animated protests and other civil society expressions of alarm this year. These have occurred at major political events (such as the G7 Summit), by youth climate movements (such as the student-led Fridays for Future protests around the world), at September’s Climate Week in New York, at COP26 in Glasgow, and at individual sites of proposed new fossil fuel infrastructure (such as Line 3 in the United States, the Trans Mountain Pipeline in Canada, and the EACOP pipeline in Uganda and Tanzania). These actions focus public attention on climate change and raise its political salience, but whether they will transform policies, investments, and behaviors remains among the most important questions facing global society. The burgeoning biological threat to civilization For years, the United States and many other countries underinvested in defense against natural, accidental, and intentional biological threats. They also underestimated the impacts that a biological threat could have on the entire world. COVID-19 revealed vulnerabilities in every country and the world’s collective ability to prepare for, respond to, and recover from infectious disease outbreaks. The COVID-19 pandemic rightly has absorbed the world’s attention, given its demonstrated ability to sicken and kill millions, weaken national economies and global supply chains, and destabilize governments and societies. And yet, what the world has experienced during this pandemic is nowhere close to a worst-case scenario. To deal with the crisis at hand, the world is focusing almost all its efforts on COVID-19, to the exclusion of other biological threats. The scope of potential biological threats is expansive. Preventing and mitigating future biological events will require a wider lens for viewing biological threats. For example, slow vaccination rates have allowed virus mutations, perpetuating the threat from COVID-19. Similarly, failing to address antibiotic resistance could trigger a worldwide pandemic involving antimicrobial-resistant organisms within a decade. Research into novel diseases has proliferated high-containment laboratories around the world. Some of those labs inadvertently release pathogens into the environment. Some regimes to monitor and regulate these laboratories are perceived by their researchers to be excessively burdensome and restrictive. At the same time, the Biological Weapons and Toxin Convention still struggles to find effective ways to enforce its prohibitions on the development and production of biological agents and weapons. This year, the US Department of State declared that Russia and North Korea possess active biological weapons programs and expressed concern about dual-use biological research programs in China and Iran. Terrorist organizations such as Al Qaeda and ISIS and some criminal organizations continue to profess their determination to build, acquire, and use biological weapons to achieve their goals. The globally inadequate response to COVID-19 only serves to underscore that an attack using a weapon containing biological agents designed to resist existing medical countermeasures could provide attackers with some of the tactical, operational, strategic, and economic advantages they seek. The US Department of Defense is now concerned enough about that prospect to undertake a biological posture review. The world now lives in an age of biological innovation. Many countries and corporations are making enormous investments in biological science, biotechnology, and combinational science and technology (in which biology combines with other fields), recognizing that they have immense opportunities to establish and grow bio-economies. Innovative biological research and development efforts simultaneously increase and decrease biological risk. The field is moving quickly. CRISPR-Cas9, the revolutionary genetic engineering tool that scientists in the United States and Sweden discovered in 2012, is cheap and ubiquitous today, spurring investments in genetic testing and adult stem cell technologies. Countries and non-state actors are exploring ways to create super-soldiers, personalize medicine, increase human performance, improve human gene therapy, and synthesize biology. Innovations such as synthetic biology have created new areas of discovery, outpacing current public health, safety, and security measures. The world is failing to recognize the multifaceted nature of the biological threat. Advances in biological science and technology can harm us as well as help us. Leaders must recognize that COVID-19 is not the last biological threat we will have to face in our lifetimes—or, perhaps, even this year. Disruptive technology in the age of disinformation The new US administration has done much to reestablish the role of scientists in informing public policy, and even more to minimize deliberate confusion and chaos emanating from the White House. Thoughtful deliberation—merely a promise in January 2021—appears to be realized more often today. On the other hand, disinformation fomented outside the executive branch—including from some members of Congress and many state leaders—appears to have taken root in alarming and dangerous ways. Large fractions of Congress and the public continue to deny that Joe Biden legitimately won the presidential election, and their views on these matters appear to be hardening rather than moderating. Similar trends regarding COVID-related disinformation are apparent around the world, crippling the ability of public health authorities and medical science to achieve higher vaccination rates. Mask-wearing and social distancing are similarly discouraged by disinformation. While we know more now about the role of social media campaigns in taking advantage of vulnerabilities in human psychology and cognition to spread disinformation and societal disunity, the behavior of social media companies has changed hardly at all. Political attacks on institutions that provide societal continuity and store hard-won knowledge about how best to deal with problems continue apace. In cyber conflict, cyberattackers have grown more audacious. The SolarWinds hack, an attack on Microsoft Exchange that affected millions around the world, and a ransomware attack on Colonial Pipeline (resolved only with the payment of $4.4 million to get the system up and running again) all demonstrate the far-reaching ramifications of cyber-vulnerabilities. The good news in cyber includes a Biden executive order and other federal government initiatives on cybersecurity that seem to have significant force and momentum behind them and have gone farther than previous orders and initiatives. The expert cybersecurity team the new administration has assembled has the ear of the president. In addition, against all odds, both the UN Open-Ended Working Group and the Group of Government Experts have reached some rough consensus on cyber norms of behavior. (The first group involves representatives from most of the world’s nations; the latter includes the biggest players in cyber.) It remains to be seen whether these norms actually affect the behavior of national actors in cyberspace, but it is better to have these norms in place (or in the process of being formed and agreed to) than not to have them at all. It also appears that Chinese use of surveillance technology has reached new heights in Xinjiang in the last year. Artificial intelligence and facial recognition systems intended to reveal states of emotion have been tested on Uyghurs in Xinjiang. In the last year, it has also come to light that China is seeking to develop standards for using facial recognition that can be optimized for distinguishing individuals by ethnic group. The potential widespread deployment of these technologies presents a distinct threat to human rights around the world and, therefore, civilization as we know and practice it.Finally, tensions over military space activity have increased in the past few years. For example, Russia conducted an anti-satellite missile test in November, destroying one of its own satellites and creating a debris cloud that orbited dangerously close to the International Space Station. Russia has also “injected an object into orbit” that subsequently approached another Russian satellite already in orbit in a manner consistent with its use as [an anti-satellite weapon](https://www.space.com/russia-tests-anti-satellite-weapon-in-space.html). A similar activity has been used to follow a [US government satellite](https://www.space.com/russian-spacecraft-stalking-us-spy-satellite-space-force.html). Press reports have suggested that US Space Command is on the verge of disclosing [a new anti-satellite weapon](https://breakingdefense.com/2021/08/what-satellite-attack-weapon-might-the-us-reveal-soon/). On the other hand, US officials from the State and Defense departments were reported to be drafting language for [a binding UN resolution](https://www.armscontrol.org/act/2021-04/news/us-advocates-binding-rules-behavior-space) regarding responsible behavior in space.​ If approved, such language could reduce the likelihood of space incidents taking place.

[A screenshot of a galaxy

Description automatically generated with low confidence](https://thebulletin.org/wp-content/uploads/2022/01/esa-space-debris-report-2021-still-e1642616194277.png)

The European Space Agency [estimates](https://www.esa.int/Safety_Security/Space_Debris/Space_debris_by_the_numbers) that the Earth is currently orbited by more than 300 million objects of space debris sized 1 millimeter to 1 centimer. Long-term simulations project the number of small objects to increase exponentially at the current rate of new vehicle launches and collisions. (Video still from ESA [2021 Space Debris Report](https://www.esa.int/Safety_Security/Space_Debris/ESA_s_Space_Environment_Report_2021)) Practical steps to move the world away from catastrophe and toward a safer world Last year, we looked forward to the end of the COVID-19 pandemic—but that end is not yet in sight. Leaders in the wealthiest and most advanced countries have not acted with the speed and focus necessary to manage dire threats to humanity’s future. Our decision to keep the Doomsday Clock at 100 seconds to midnight is a clear warning to the world: We need to back away from the doorstep of doom. Immediate, practical steps to protect humanity from the major global threats that we have outlined are needed:

* The Russian and US presidents should identify more ambitious and comprehensive limits on nuclear weapons and delivery systems by the end of 2022. They should both agree to reduce reliance on nuclear weapons by limiting their roles, missions, and platforms, and decrease budgets accordingly.
* The United States and other countries should accelerate their decarbonization, matching policies to commitments. China should set an example by pursuing sustainable development pathways—not fossil fuel-intensive projects—in the Belt and Road Initiative.
* US and other leaders should work through the World Health Organization and other international institutions to reduce biological risks of all kinds through better monitoring of animal-human interactions, improvements in international disease surveillance and reporting, increased production and distribution of medical supplies, and expanded hospital capacity.
* The United States should persuade allies and rivals that no-first-use of nuclear weapons is a step toward security and stability and then declare such a policy in concert with Russia (and China).
* President Biden should eliminate the US president’s sole authority to launch nuclear weapons and work to persuade other countries with nuclear weapons to put in place similar barriers.
* Russia should rejoin the NATO-Russia Council and collaborate on risk-reduction and escalation-avoidance measures.
* North Korea should codify its moratorium on nuclear tests and long-range missile tests and help other countries verify a moratorium on enriched uranium and plutonium production.
* Iran and the United States should jointly return to full compliance with the Joint Comprehensive Plan of Action and initiate new, broader talks on Middle East security and missile constraints.
* Private and public investors should redirect funds away from fossil fuel projects to climate-friendly investments.
* The world’s wealthier countries should provide more financial support and technology cooperation to developing countries to undertake strong climate action. COVID-recovery investments should favor climate mitigation and adaptation objectives across all economic sectors and address the full range of potential greenhouse gas emission reductions, including capital investments in urban development, agriculture, transport, heavy industry, buildings and appliances, and electric power.
* National leaders and international organizations should devise more effective regimes for monitoring biological research and development efforts.
* Governments, technology firms, academic experts, and media organizations should cooperate to identify and implement practical and ethical ways to combat internet-enabled misinformation and disinformation.
* At every reasonable opportunity, citizens of all countries should hold their local, regional, and national political officials and business and religious leaders accountable by asking “What are you doing to address climate change?”

Without swift and focused action, truly catastrophic events—events that could end civilization as we know it—are more likely. When the Clock stands at 100 seconds to midnight, we are all threatened. The moment is both perilous and unsustainable, and the time to act is now.

## Framework

#### The value mandated by the resolution is justice. The criterion is the parliamentary model; Nick Bostrom explains:

Bostrom 09

Bostrom, Nick (Founding director of the Future of Humanity Institute at Oxford University; Ph.D. in philosophy from the London School of Economics; enjoys hiking, reading, and not going extinct). “Moral uncertainty – toward a solution?” 1 January 2009. JDN. http://www.overcomingbias.com/2009/01/moral-uncertainty-towards-a-solution.html

It seems people are overconfident about their moral beliefs. But how should one reason and act if one acknowledges that one is uncertain about morality – not just applied ethics but fundamental moral issues? if you don't know which moral theory is correct? It doesn't seem you can simply plug your uncertainty into expected utility decision theory and crank the wheel; because many moral theories state that you should not always maximize expected utility. Even if we limit consideration to consequentialist theories, it still is hard to see how to combine them in the standard decision theoretic framework. For example, suppose you give X% probability to total utilitarianism and (100-X)% to average utilitarianism. Now an action might add 5 utils to total happiness and decrease average happiness by 2 utils. (This could happen, e.g. if you create a new happy person that is less happy than the people who already existed.) Now what do you do, for different values of X? The problem gets even more complicated if we consider not only consequentialist theories but also deontological theories, contractarian theories, virtue ethics, etc. We might even throw various meta-ethical theories into the stew: error theory, relativism, etc. I'm working on a paper on this together with my colleague Toby Ord. We have some arguments against a few possible "solutions" that we think don't work. On the positive side we have some tricks that work for a few special cases. But beyond that, the best we have managed so far is a kind of metaphor, which we don't think is literally and exactly correct, and it is a bit under-determined, but it seems to get things roughly right and it might point in the right direction: The Parliamentary Model. Suppose that you have a set of mutually exclusive moral theories, and that you assign each of these some probability. Now imagine that each of these theories gets to send some number of delegates to The Parliament. The number of delegates each theory gets to send is proportional to the probability of the theory. Then the delegates bargain with one another for support on various issues; and the Parliament reaches a decision by the delegates voting. What you should do is act according to the decisions of this imaginary Parliament. (Actually, we use an extra trick here: we imagine that the delegates act as if the Parliament's decision were a stochastic variable such that the probability of the Parliament taking action A is proportional to the fraction of votes for A. This has the effect of eliminating the artificial 50% threshold that otherwise gives a majority bloc absolute power. Yet – unbeknownst to the delegates – the Parliament always takes whatever action got the most votes: this way we avoid paying the cost of the randomization!) The idea here is that moral theories get more influence the more probable they are; yet even a relatively weak theory can still get its way on some issues that the theory think are extremely important by sacrificing its influence on other issues that other theories deem more important. For example, suppose you assign 10% probability to total utilitarianism and 90% to moral egoism (just to illustrate the principle). Then the Parliament would mostly take actions that maximize egoistic satisfaction; however it would make some concessions to utilitarianism on issues that utilitarianism thinks is especially important. In this example, the person might donate some portion of their income to existential risks research and otherwise live completely selfishly. I think there might be wisdom in this model.  It avoids the dangerous and unstable extremism that would result from letting one’s current favorite moral theory completely dictate action, while still allowing the aggressive pursuit of some non-commonsensical high-leverage strategies so long as they don’t infringe too much on what other major moral theories deem centrally important.

#### That means any risk that consequences matter obligates us to mitigate existential risks.

## Contention 1 is that the private appropriation of space risks human extinction

#### [Boley and Byers 1] The status quo encourages companies to flood the sky with tens of thousands of satellites.

Boley and Byers 21

Boley, A.C., Byers, M. Satellite mega-constellations create risks in Low Earth Orbit, the atmosphere and on Earth. Sci Rep 11, 10642 (2021). <https://doi.org/10.1038/s41598-021-89909-7> <https://www.nature.com/articles/s41598-021-89909-7#citeas> Department of Physics and Astronomy, The University of British Columbia, Vancouver, Canada Aaron C. Boley Department of Political Science, The University of British Columbia, Vancouver, Canada Michael Byers //avery =recut CAT

* International Telecommunications Union = ITU

National regulators such as the FCC are assigning orbital shells to mega-constellations on a first come, first served basis, without assessing the effects on other countries. These could include making any addition of further satellites to those shells too dangerous to contemplate. This de facto occupation of orbital shells likely violates Article I of the 1967 Outer Space Treaty, which designates the exploration and use of space as “the province of all mankind” and open to all countries “without discrimination of any kind.” There is also Article II: “Outer space … is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.” Although regulators are not claiming sovereignty over orbital shells, allowing national companies to saturate them with satellites could constitute appropriation by “other means.” Lastly, Article IX requires that space activities be conducted “with due regard to the corresponding interests of other States”. Mega-constellation operators and their regulators could respond that they are exercising the right to explore and use space without discrimination, the use of an orbital shell is time-limited as a result of the license, and the satellites will be actively de-orbited32. They could also reference that countries have been using slots in geostationary orbit for decades, resulting in the de facto exclusion of others from any given slot without this being considered appropriation. However, the use of slots in geostationary orbit is mediated by the International Telecommunications Union (ITU), which does not play the same role in LEO. Another ‘land rush’ is occurring over radio spectrum. The ITU is involved in the allocation of frequencies to communications satellites. Under its binding instruments, countries must treat frequencies as limited resources to which others have equitable access, and therefore limit their own use. But companies are not party to those instruments and do not deal directly with the ITU. They apply for and obtain licenses from their national regulator, which early in the planning process files a general description of the mega-constellation with the ITU, including the frequencies it will use33. A company is required to coordinate with any satellite system that might be affected by its planned mega-constellation, provided the other system was filed before its filing, but there is no requirement to coordinate with those whose filings are made after its own. The ITU recently adopted a tiered management approach, whereby listing a mega-constellation in its ‘Master Register’ depends on certain milestones being met. This deters companies from filing and effectively claiming orbital shells years before they are ready to launch, but thereby disadvantages smaller companies and exacerbates long-term equity concerns for those developing countries that are not yet active in space. No binding international rules exist on other aspects of mega-constellations. In 2007, the Inter-Agency Space Debris Coordination Committee (IADC), currently representing 13 space agencies, indicated that direct re-entry at the end of a satellite’s operational life was preferred but nevertheless only recommended that deorbiting conclude within 25 years. This widely accepted guideline is poorly suited for mega-constellations made up of thousands of satellites with short operational lives. It also overlooks placement, with satellites at higher altitudes producing relatively high collision probabilities when de-orbiting timescales are long34. The IADC also recommended collision avoidance and end-of-life deorbiting technologies. These add costs, and in 2017 the IADC reported that adherence to its guidelines was “insufficient and no apparent trend towards a better implementation is observed”35. More recent analyses indicate that compliance with the end-of-life guidelines is now improving by some metrics36. However, these improvements appear to be driven, at least in part, by SpaceX’s own practices, which may not be followed by other mega-constellation operators. Guidelines allow for ‘free riding’, whereby individual actors can save costs through non-compliance while benefitting from the compliance of others. In the context of any shared resource, free riding can lead to a ‘tragedy of the commons,’ which is exactly what needs to be avoided in LEO. Finally, we would be remiss not to mention the threats posed by mega-constellations to astronomy, although for a detailed discussion we refer to other recent work37,38,39,40,41. Briefly, astronomers pushed for reductions in the number and brightness of Starlink satellites after an image from a telescope in Chile was ruined. SpaceX responded by adding visors to the satellites, which has reduced their naked-eye visibility while still leaving them bright to telescopes39. Next generation sky surveys and observations close to the horizon, especially near sunrise and sunset, are especially vulnerable—and critical for near-Earth object observations for planetary defence. Occultations are another issue: even a satellite that is unilluminated (i.e. passing through the shadow of the Earth) can interfere with rapid time domain astronomy when it passes in front of a star. Radio astronomy is also threatened39, since mega-constellations will require frequencies additional to those traditionally used by land stations. These could encroach on protected spectrum through out-of-band overtone emission. The large number of fast-moving transmitting stations (i.e. satellites) will cause further interference. New analysis methods could mitigate some of these effects, but data loss is inevitable, increasing the time needed for each study and limiting the overall amount of science done. There are reasons for hope. SpaceX is showing some leadership with rapid end-of-life deorbiting, automatic collision avoidance, and visors to reduce light pollution, even if these are not yet sufficient. Spacefaring countries, moreover, recognize that debris threatens all satellites, including military satellites. Some are strengthening their national regulations, including by incorporating non-binding international guidelines into binding national laws. However, there is little recognition that Earth’s orbit is a finite resource, the space and Earth environments are connected, and the actions of one actor can affect everyone. Until that changes, we risk multiple tragedies of the commons in space.

#### [Boley and Byers 2] That “first-come, first-served” mentality exacerbates collision risks.

Boley and Byers 2

Boley, A.C., Byers, M. Satellite mega-constellations create risks in Low Earth Orbit, the atmosphere and on Earth. Sci Rep 11, 10642 (2021). <https://doi.org/10.1038/s41598-021-89909-7> <https://www.nature.com/articles/s41598-021-89909-7#citeas> Department of Physics and Astronomy, The University of British Columbia, Vancouver, Canada Aaron C. Boley Department of Political Science, The University of British Columbia, Vancouver, Canada Michael Byers //avery

Mega-constellations are composed of mass-produced satellites with few backup systems. This consumer electronic model allows for short upgrade cycles and rapid expansions of capabilities, but also considerable discarded equipment. SpaceX will actively de-orbit its satellites at the end of their 5–6-year operational lives. However, this process takes 6 months, so roughly 10% will be de-orbiting at any time. If other companies do likewise, thousands of de-orbiting satellites will be slowly passing through the same congested space, posing collision risks. Failures will increase these numbers, although the long-term failure rate is difficult to project. Figure 3 is similar to the righthand portion of Fig. 2 but includes the Starlink and OneWeb mega-constellations as filed (and amended) with the FCC (see “Methods”). The large density spikes show that some shells will have satellite number densities in excess of n=10−6 km−3. Figure 3 Chart, histogram

Description automatically generated Satellite density distribution in LEO with the Starlink and OneWeb mega-constellations as filed (and amended) with the FCC. Provided that the orbits are nearly circular, the number densities in those shells will exceed 10–6 km−3. Because the collisional cross-section in those shells is also high, they represent regions that have a high collision risk whenever debris is too small to be tracked or collision avoidance manoeuvres are impossible for other reasons. Deorbiting satellites will be tracked and operational satellites can manoeuvre to avoid close conjunctions. However, this depends on ongoing communication and cooperation between operators, which at present is ad hoc and voluntary. A recent letter12 to the FCC from SpaceX suggests that some companies might be less-than-fully transparent about events13 in LEO. Despite the congestion and traffic management challenges, FCC filings by SpaceX suggest that collision avoidance manoeuvres can in fact maintain collision-free operations in orbital shells and that the probability of a collision between a non-responsive satellite and tracked debris is negligible. However, the filings do not account for untracked debris6, including untracked debris decaying through the shells used by Starlink. Using simple estimates (see “Methods”), the probability that a single piece of untracked debris will hit any satellite in the Starlink 550 km shell is about 0.003 after one year. Thus, if at any time there are 230 pieces of untracked debris decaying through the 550 km orbital shell, there is a 50% chance that there will be one or more collisions between satellites in the shell and the debris. As discussed further in “Methods”, such a situation is plausible. Depending on the balance between the de-orbit and the collision rates, if subsequent fragmentation events lead to similar amounts of debris within that orbital shell, a runaway cascade of collisions could occur. Fragmentation events are not confined to their local orbits, either. The India 2019 ASAT test was conducted at an altitude below 300 km in an effort to minimize long-lived debris. Nevertheless, debris was placed on orbits with apogees in excess of 1000 km. As of 30 March 2021, three tracked debris pieces remain in orbit14. Such long-lived debris has high eccentricities, and thus can cross multiple orbital shells twice per orbit. A major fragmentation event from a single satellite could affect all operators in LEO. Even if debris collisions were avoidable, meteoroids are always a threat. The cumulative meteoroid flux15 for masses m > 10–2 g is about 1.2 × 10–4 meteoroids m−2 year−1 (see “Methods”). Such masses could cause non-negligible damage to satellites16. Assuming a Starlink constellation of 12,000 satellites (i.e. the initial phase), there is about a 50% chance of 15 or more meteoroid impacts per year at m > 10–2 g. Satellites will have shielding, but events that might be rare to a single satellite could become common across the constellation. One partial response to these congestion and collision concerns is for operators to construct mega-constellations out of a smaller number of satellites. But this does not, individually or collectively, eliminate the need for an all-of-LEO approach to evaluating the effects of the construction and maintenance of any one constellation.

#### [Mecklin 3] Commercial uses of space can be easily militarized – and space debris serves as a critical flashpoint.

Mecklin 3

John Mecklin Why the final frontier should not become the final battleground Bulletin of the Atomic Scientists Volume 78, 2022 - Issue 1: Special issue: Conflict in space Pages 1-2 | Published online: 17 Jan 2022 Download citation <https://doi.org/10.1080/00963402.2021.2020988> <https://www.tandfonline.com/doi/full/10.1080/00963402.2021.2020988> -CAT

Since the launch of Sputnik and the so-called missile gap of the late 1950s, the United States and the Soviet Union (and later, Russia) have vied for space supremacy. Through much of the competition, prestige and propaganda value have played at least as large a role as space-faring hardware. Laika, the first dog in space, and Yuri Gagarin, the first man, were potent symbols of a wide-ranging Soviet challenge to American leadership. The United States fought back by orbiting Ham, the space chimp, and winning the race to the moon. Russian and American space efforts have long been paralleled by less public efforts to use space for military purposes. The fearsome and obvious downsides of space-based warfare led to some early and fairly effective international agreements regulating military activities in space. Nuclear weapons and other weapons of mass destruction, for example, are not (as far as I know) stationed in orbit, thanks to the 1967 Outer Space Treaty. Now, more than five decades later, more countries (and private companies) are using space for more purposes, the possibility of space conflict seems to be growing, and the regulations of an earlier era seem increasingly insufficient to the space reality of the 21st century. In November, Russia used a ground-launched missile to destroy one of its own satellites, creating thousands of pieces of debris that could have endangered the International Space Station. The action drew international condemnation. But the Russian anti-satellite missile test was hardly the first, and it is only one of many efforts, by many countries (including, notably, China) that suggest competition in space is increasing as space technologies and capabilities advance. To lead off this issue on this 21st century space race, I spoke to Robert Latiff, a retired US Air Force major general and Bulletin Science and Security Board member, about the worsening international security situation as countries jockey for both advantage in space. Latiff, who has served on the staffs of US Air Force Headquarters and the Secretary of the Air Force, summed that situation up in this way: “I guess the point is that there’s a lot of aggressive, sort of threatening language that’s out there. So it’s a lot more, seems to be anyway, a lot more dangerous.” In their article, “Cis-lunar space and the security dilemma,” University of British Columbia space law experts Michael Byers and Aaron Boley explain how and why the United States is planning to expand its military space activities from Earth orbit into the vast region between Earth’s geosynchronous orbit and the moon. If that move into the area known as “cis-lunar space” does occur, they argue, the militaries of other countries will surely follow – unless an agreement to demilitarize the area is reached. The dangers of conflict in space are vividly displayed in “A China-US war in space: The after-action report,” an analysis of a complex space war game involving China, the United States, and their allies or client states conducted by the Nonproliferation Policy Education Center. Written by NPEC executive director Henry Sokolski, this piece explains why, in the near and medium term, space war could occur – but probably won’t be waged between entirely dedicated military systems. More likely, it will involve ground-and space-based threats – including laser satellite trackers, commercial space surveillance systems, space debris-removing satellites, and refueling spacecraft – that have legitimate civilian uses but can be flipped to conduct military missions. Indeed, the rise of the private sector in space has complicated the security situation for space-faring nations. As Victoria Samson of the Secure World Foundation notes in “The complicating role of the private sector in space,” there are some 4,800 active satellites in orbit around Earth, and 1,850 of them belong to Elon Musk’s SpaceX’s Starlink internet service. And this is only the first wave; there are, Samson writes, plans for mega-constellations that could wind up putting more than 100,000 new satellites in low Earth orbit. Even a small fraction of that number will force a fundamental shift: Musk and other wealthy private sector space cowboys will become major players in space, and some countries – including, particularly, Russia – may feel threatened by the change. “It is important to work to develop new governance of space to meet the emerging needs of this ecosystem. Otherwise,” Samson writes in understated prose, “we run the risk of inadvertent escalation and even conflict in space that can extend down to Earth.” As an old television series1 and the exploits of the early human, chimp, and canine astronauts remind us, space can be an inspiring frontier. It has already provided new and almost magical capabilities in communications, navigation, and the monitoring of natural resources and the climate that could expand vastly, for the good of all, if space is managed as a cooperative commons rather than a potential field of battle. “There ought to be some understanding that those things are there for the good of [hu]mankind,” Latiff told me. “We’re not talking just about war-fighting and national security here.”

#### [Breen 18] Overloading Low Earth Orbit triggers an irreversible slide to war

Breen 18

CAN THE OUTER SPACE TREATY PREVENT CONFLICTS IN ORBIT IN THE 21ST CENTURY? Nicole M. Breen Lieutenant, United States Navy BS, U.S. Naval Academy, 2013 Submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE IN SPACE SYSTEMS OPERATIONS from the NAVAL POSTGRADUATE SCHOOL June 2018 <https://apps.dtic.mil/dtic/tr/fulltext/u2/1059769.pdf> //avery -recut CAT

One of the more dangerous concerns is the idea that the world will reach “a point of no return in space” 431 meaning there will be so much space junk that the ability to operate ceases to exist.432 In Marshall Kaplan’s view, “space-faring nations have already passed the point of no return, with the accumulation of debris objects in LEO steadily building over the past 50 years.” 433 As discussed earlier, NASA’s Kessler, established a similar concept called the Kessler Syndrome, which stated “when debris reaches a critical density in particular orbit, it can set off a chain reaction of collisions that create more debris, eventually making the orbit unusable.” 434 The importance of this statement is with the word “eventually,” because Kessler understood that this process could take decades.435 But, he wanted the world, especially the U.S., “to understand that if we don’t actively start removing five to ten objects per year for the next 100 years, we’ll have an unstable environment.” 436 Unstable environments have the potential to lead to political and military crisis. For example, imagine a hypothetical future scenario where LEO has been banned for satellite usage due to the immense amount of traffic, which no longer allows satellites to orbit safely without being hit by debris. Also, the satellites left in LEO are colliding with one another, creating even more debris and, additionally, making it difficult to launch satellites into higher orbits. This becomes a global conflict; militaries lose capabilities, and civilians lose basic luxuries that commercial space offers such as Internet connectivity, satellite television broadcasts, and other communications. The scenario presented above could result in an international crisis, creating the potential for more dangerous political and military disputes and disagreements. If space were unusable, the world might then become unstable, since we now depend on a variety of data from space for society, national militaries, and the international economy to function. The loss of satellites, specifically military assets, to space debris could incite armed conflict between space-faring nations.437 Armed conflict or even war in space would be the most dangerous possibility resulting from space debris collisions. Vitaly Adushkin,from the Russian Academy of Sciences, says that there can only be two likelihoods when a military defense satellite suddenly fails: “an unregistered collision with space debris or an aggressive action by an adversary.” 438 Both of those possibilities deal with a sensitivity that has the potential to become a politically or militarily dangerous conflict.439

#### [Johson-Freese 17] That goes nuclear – best models

Johnson-Freese 17

Joan Johnson-Freese is a Professor and former Chair of National Security Affairs at the US Naval War College, Newport, Rhode Island, and author of several books. Pg 18-19 SPACE WARFARE IN THE 21ST CENTURY https://www.routledge.com/Space-Warfare-in-the-21st-Century-Arming-the-Heavens/Johnson-Freese/p/book/9781138693883 //avery,

Space warfare runs two untenable risks: the creation of destructive debris and escalation to terrestrial, even nuclear, warfare. Kinetic warfare in space creates debris traveling at a speed of more than 17,000 miles per hour, which then in itself becomes a destructive weapon if it hits another object—even potentially triggering the so-called Kessler Syndrome,86 exaggerated for dramatic effect in the movie Gravity. Ironically, both China and the United States learned the negative lessons of debris creation the hard way. In 1985, the United States tested a miniature homing vehicle (MHV) ASAT launched from an F-15 aircraft. The MHV intercepted and destroyed a defunct US satellite at an altitude of approximately 250 miles. It took almost 17 years for the debris resulting from that test to be fully eliminated by conflagration re-entering the Earth’s atmosphere or being consumed by frictional forces, though no fragment had any adverse consequences to another satellite—in particular, no collisions. China irresponsibly tested a direct-ascent ASAT in 2007, destroying one if its defunct satellites. That test was at an altitude almost twice that of the 1985 US test. The debris created by the impact added 25 percent to the debris total in low Earth orbit87 and will dissipate through the low Earth orbit, heavily populated with satellites, for decades, perhaps centuries, to come. Perhaps most ironically, because of superior US debris-tracking capabilities, the United States—even though not required to do so—has on more than one occasion warned China that it needed to maneuver one of its satellites to avoid a collision with debris China itself had likely created.88 In 2013, a piece of Chinese space junk from the 2007 ASAT test collided with a Russian laser ranging nanosatellite called BLITS, creating still more debris.89 The broader point is that all nations have a compelling common interest in avoiding the massive increase in space debris that would be created by a substantial ASAT conflict. Gen. Hyten has said that not creating debris is “the one limiting factor” to space war. “Whatever you do,” he warns, “don’t create debris.”90 While that might appear an obvious “limiting factor,” preparing to fight its way through a debris cloud had been a Pentagon consideration in the past. Now, however, sustaining the space environment has been incorporated into Pentagon space goals. Beyond debris creation, MacDonald points out that as China becomes more militarily capable in space and there is more symmetry between the countries, other risks are created – specifically, escalation. That is, the United States could threaten to attack not just Chinese space assets, but also ground-based assets, including ASAT command-and-control centers and other military capabilities. But such actions, which would involve attacking Chinese soil and likely causing substantial direct casualties, would politically weigh much heavier than the U.S. loss of space hardware, and Protecting space assets 19 thus might climb the escalatory ladder to a more damaging war that both sides would probably want to avoid.91 MacDonald isn’t alone in concerns about escalation. Secure World Foundation analyst Victoria Samson has also voiced apprehension regarding US rhetoric that does not distinguish between actions against unclassified and classified US satellites, stating that “things can escalate pretty quickly should we come into a time of hostility.”92 Theresa Hitchens explained the most frightening, but not implausible, risk of space war escalation in a 2012 Time magazine interview. Say you have a crisis between two nuclear-armed, space-faring countries, Nation A and Nation B, which have a long-standing border dispute. Nation A, with its satellite capability, sees that Nation B is mobilizing troops and opening up military depots in a region where things are very tense already, on the tipping point. Nation A thinks: “That’s it, they’re going to attack.” So it might decide to pre-emptively strike the communications satellite used by Nation B to slow down its ability to move toward the border and give itself time to fortify. Say this happens and Nation B has no use of satellites for 12 hours, the time it takes it to get another satellite into position. What does Nation B do? It’s blind, it’s deaf, it’s thinking all this time that it’s about to be overwhelmed by an invasion or even nuked. This is possibly a real crisis escalation situation; something similar has been played out in U.S. Air Force war games, a scenario-planning exercise practiced by the U.S. military. The first game involving anti-satellite weapons stopped in five minutes because it went nuclear – bam. Nation B nuked Nation A. This is not a far-out, “The sky’s falling in!” concern, it is something that has been played out over and over again in the gaming of these things, and I have real fears about it.93 While escalation to a nuclear exchange may seem unthinkable, in war games conducted by the military, nuclear weapons are treated as just another warfighting weapon. Morgan also voiced concerns about escalation generally and nuclear escalation specifically in the 2010 RAND report, stating: The adversary would also likely be deterred from damaging U.S. satellite early-warning system (SEWS) assets to avoid risking inadvertent escalation to the nuclear threshold, but that firebreak would almost certainly collapse with the conclusion that such escalation is inevitable and that it is in the adversary’s interest to launch a preemptive nuclear strike.

#### [Starr 17] And nuke war causes extinction.

Starr 17

(Steven Starr; director of the University of Missouri’s Clinical Laboratory Science Program, senior scientist at the Physicians for Social Responsibility, Associate member of the Nuclear Age Peace Foundation, expert in the environmental consequences of nuclear war; 1/9/17; “Turning a Blind Eye Towards Armageddon — U.S. Leaders Reject Nuclear Winter Studies”; <https://fas.org/2017/01/turning-a-blind-eye-towards-armageddon-u-s-leaders-reject-nuclear-winter-studies/>; Federation of American Scientists; accessed 11/24/18; TV) [AV] -recut CAT

The detonation of an atomic bomb with this explosive power will instantly ignite fires over a surface area of three to five square miles. In the recent studies, the scientists calculated that the blast, fire, and radiation from a war fought with 100 atomic bombs could produce direct fatalities comparable to all of those worldwide in World War II, or to those once estimated for a “counterforce” nuclear war between the superpowers. However, the long-term environmental effects of the war could significantly disrupt the global weather for at least a decade, which would likely result in a vast global famine. The scientists predicted that nuclear firestorms in the burning cities would cause at least five million tons of black carbon smoke to quickly rise above cloud level into the stratosphere, where it could not be rained out. The smoke would circle the Earth in less than two weeks and would form a global stratospheric smoke layer that would remain for more than a decade. The smoke would absorb warming sunlight, which would heat the smoke to temperatures near the boiling point of water, producing ozone losses of 20 to 50 percent over populated areas. This would almost double the amount of UV-B reaching the most populated regions of the mid-latitudes, and it would create UV-B indices unprecedented in human history. In North America and Central Europe, the time required to get a painful sunburn at mid-day in June could decrease to as little as six minutes for fair-skinned individuals. As the smoke layer blocked warming sunlight from reaching the Earth’s surface, it would produce the coldest average surface temperatures in the last 1,000 years. The scientists calculated that global food production would decrease by 20 to 40 percent during a five-year period following such a war. Medical experts have predicted that the shortening of growing seasons and corresponding decreases in agricultural production could cause up to two billion people to perish from famine. The climatologists also investigated the effects of a nuclear war fought with the vastly more powerful modern thermonuclear weapons possessed by the United States, Russia, China, France, and England. Some of the thermonuclear weapons constructed during the 1950s and 1960s were 1,000 times more powerful than an atomic bomb. During the last 30 years, the average size of thermonuclear or “strategic” nuclear weapons has decreased. Yet today, each of the approximately 3,540 strategic weapons deployed by the United States and Russia is seven to 80 times more powerful than the atomic bombs modeled in the India-Pakistan study. The smallest strategic nuclear weapon has an explosive power of 100,000 tons of TNT, compared to an atomic bomb with an average explosive power of 15,000 tons of TNT. Strategic nuclear weapons produce much larger nuclear firestorms than do atomic bombs. For example, a standard Russian 800-kiloton warhead, on an average day, will ignite fires covering a surface area of 90 to 152 square miles. A war fought with hundreds or thousands of U.S. and Russian strategic nuclear weapons would ignite immense nuclear firestorms covering land surface areas of many thousands or tens of thousands of square miles. The scientists calculated that these fires would produce up to 180 million tons of black carbon soot and smoke, which would form a dense, global stratospheric smoke layer. The smoke would remain in the stratosphere for 10 to 20 years, and it would block as much as 70 percent of sunlight from reaching the surface of the Northern Hemisphere and 35 percent from the Southern Hemisphere. So much sunlight would be blocked by the smoke that the noonday sun would resemble a full moon at midnight. Under such conditions, it would only require a matter of days or weeks for daily minimum temperatures to fall below freezing in the largest agricultural areas of the Northern Hemisphere, where freezing temperatures would occur every day for a period of between one to more than two years. Average surface temperatures would become colder than those experienced 18,000 years ago at the height of the last Ice Age, and the prolonged cold would cause average rainfall to decrease by up to 90%. Growing seasons would be completely eliminated for more than a decade; it would be too cold and dark to grow food crops, which would doom the **majority of the** human population. NUCLEAR WINTER IN BRIEF The profound cold and darkness following nuclear war became known as nuclear winter and was first predicted in 1983 by a group of NASA scientists led by Carl Sagan. During the mid-1980s, a large body of research was done by such groups as the Scientific Committee on Problems of the Environment (SCOPE), the World Meteorological Organization, and the U.S. National Research Council of the U.S. National Academy of Sciences; their work essentially supported the initial findings of the 1983 studies. The idea of nuclear winter, published and supported by prominent scientists, generated extensive public alarm and put political pressure on the United States and Soviet Union to reverse a runaway nuclear arms race, which, by 1986, had created a global nuclear arsenal of more than 65,000 nuclear weapons. Unfortunately, this created a backlash among many powerful military and industrial interests, who undertook an extensive media campaign to brand nuclear winter as “bad science” and the scientists who discovered it as “irresponsible.” Critics used various uncertainties in the studies and the first climate models (which are primitive by today’s standards) as a basis to criticize and reject the concept of nuclear winter. In 1986, the Council on Foreign Relations published an article by scientists from the National Center for Atmospheric Research, who predicted drops in global cooling about half as large as those first predicted by the 1983 studies and described this as a “nuclear autumn.”

## Contention 2 is Solvency

#### I affirm the resolution.

#### My advocacy is that the UN ought to be entrusted with the sole authority to lease orbital slots for mega-constellations of satellites.

#### Starlink is appropriation.

Johnson 20

The Legal Status of MegaLEO Constellations and Concerns About Appropriation of Large Swaths of Earth Orbit Christopher D. Johnson J. Pelton (ed.), Handbook of Small Satellites, https://doi.org/10.1007/978-3-030-20707-6\_95-1https://swfound.org/media/206951/johnson2020\_referenceworkentry\_thelegalstatusofmegaleoconstel.pdf -CAT

Yes, This Is Impermissible Appropriation Article II of the Outer Space Treaty, discussed above, is clear on the point that the appropriation of outer space, including the appropriation of either void space or of celestial bodies, is an impermissible and prohibited action under international law. No means or methods of possession of outer space will legitimize the appropriation or ownership of outer space, or subsections thereof. Excludes Others The constellations above, because they seem to so overwhelmingly possess particular orbits through the use of multiple satellites to occupy orbital planes, and in a manner that precludes other actors from using those exact planes, constitute an appropriation of those orbits. While the access to outer space is nonrivalrous – in the sense that anyone with the technological capacity to launch space objects can therefore explore space – it is also true that orbits closer to Earth are unique, and when any actor utilizes that orbit to such an extent to these proposed constellations will, it means that other actors simply cannot go there. The Legal Status of MegaLEO Constellations and Concerns About Appropriation... 15 To allow SpaceX, for example, to so overwhelmingly occupy a number of altitudes with so many of their spacecraft, essentially means that SpaceX will henceforth be the sole owner and user of that orbit (at least until their satellites are removed). No other actors can realistically expect to operate there until that time. No other operator would dare run the risk of possible collision with so many other spacecraft in that orbit. Consequently, the sole occupant will be SpaceX, and if “possession is 9/10th of the law,” then SpaceX appears to be the owner of that orbit. Done Without Coordination Additionally, SpaceX and other operators of megaconstellations are doing so without any real international conversation or agreement, which is especially egregious and transgressive of the norms of outer space. Compared to the regime for GSO, as administered by the ITU and national frequency administrators, Low Earth Orbit is essentially ungoverned, and SpaceX and others are attempting to seize this lack of authority to claim entire portions of LEO for itself; and before any international agreement, consensus, or even discussion is had. They are operating on a purely “first come, first served” basis that smacks of unilateralism, if not colonialism. Governments Are Ultimately Implicated As we know, under international space law, what a nongovernmental entity does, a State is responsible for. Article VI of the Outer Space Treaty requires that at least one State authorize and supervise its nongovernmental entities and assure their continuing compliance with international law. As such, the prohibition on nonappropriation imposed upon States under Article II of the Outer Space Treaty applies equally to nongovernmental private entities such as SpaceX. Nevertheless, through the launching and bringing into use of the Starlink constellation, SpaceX will be the sole occupant, and thereby, possessor, both fact and in law, of 550 km, 1100 km, 1130 km, 1275 km, and 1325 km above our planet (or whatever orbits they finally come to occupy). The same is true for the other operators of these large constellations which will be solely occupying entire orbits. Long-Term Occupation Constitutes Appropriation These altitudes are additionally significant, as nonfunctional spacecraft in orbits lower than around 500 km will re-enter the Earth’s atmosphere in months or a few years, but the altitudes selected for the Starlink constellation, while technologically desirable for their purposes, also mean that any spacecraft which are not de-orbited from these regions may be there for decades, or possibly even hundreds of years. By comparison, the granting of rights for orbital slots at GSO is in 15-year increments, a length of time much less than what the altitudes of the megaconstellations threaten. Such long spans of time at these altitudes by these megaconstellations further bolster the contention that this occupation rises to the level of appropriation of these orbits. Prevents Others from Using Space Article I of the Outer Space Treaty establishes that the exploration and use of outer space is “the province of all mankind.” It further requires that this exploration and 16 C. D. Johnson use shall be by all States “without discrimination of any kind, on a basis of equality and in accordance with international law...” However, when one private corporation so overwhelmingly possesses entire portions of outer space, their use is discriminatory to other potential users and interferes with their freedom to access, explore, and use outer space. So long as these actors are so dominantly possessing and occupying those orbits, their actions exclude others from using them. What other operator would dare use orbits where there are already hundreds of satellites operating as part of a constellation? It would be an extremely unwise and risky decision to try to share these orbits with a mega constellation, so they will likely choose other altitudes and orbits. This massive occupation of particular orbits effectively defeats others from enjoying the use of outer space. While a State can issue permits for one of its corporations allowing them to launch and operate satellites to this extent, that does not automatically mean that their activities in outer space, an area beyond national sovereignty, are therefore in perfect accordance with the strictures of international law. Indeed, national permissions offer no such guarantee. No Due Regard for Others That these megaconstellations violate the prohibition on appropriation in Article II is additionally supported by Article IX of the Outer Space Treaty. Article IX requires that in the exploration and use of outer space, States “shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space... with due regard to the corresponding interests of other States...” There is hardly any way to view this deployment of megaconstellations as showing any type of due regard to the corresponding interests of others. This lack of regard further supports the notion of their unilateral transgressive violations of the purposes of space law norms. Harmful Contamination The impacts of the spacecraft on the pressing issue of space debris need not be gone into detail here. Suffice it to say, megaconstellations threaten mega-debris. The failure rate of these comparatively cheap satellites should give pause, because if 5% of a constellation of 100 satellites fails, this is 5 guaranteed new pieces of debris intentionally introduced to the fragile space domain. Article IX of the Outer Space Treaty warns of harmful contamination of the space environment and requires States to take appropriate measures to prevent this harmful contamination. A responsible government could not, in all seriousness, permit the intentional release of such amounts of space debris, especially in the already fraught orbits that many megaconstellations are headed towards. While the threat of space debris is not directly relevant to the accusation of appropriation of outer space, it goes towards the argument that these actors are conducting activities in a manner lacking in regard to others, and in fact, amounts to excluding others from using the space domain. By excluding others, this has the effect of taking orbits for themselves, which IS occupation. The Legal Status of MegaLEO Constellations and Concerns About Appropriation... 17 If This Isn’t Appropriation, Then What Is? Arguing in the alternative, if these megaconstellations — in their dominant occupation of entire orbits in orbital planes with numerous satellites — could be considered (merely for the sake of argument) to not be appropriation, we must therefore ask: what would be appropriation? What use of void space, including orbits of the Earth, would constitute actual appropriation? What further, additional fact of these uses of space, if added to the scenario, would cause that constellation to cross over the line into clearly prohibited appropriation? Perhaps the exact same scenario, but supplemented with an actual, formal claim of sovereignty, issued by a government, is the only element which could be added to megaconstellations which would then cross the threshold into appropriation. However, a formal claim of sovereignty would be merely an act occurring on Earth and would not change any actual facts in the space domain. Consequently, the lack of a formal claim of sovereignty should not be the deciding criteria in arriving at the conclusion that megaconstellations constitute appropriation of orbits. Conclusion In conclusion, these megaconstellations effectively occupy entire orbital regions with their vast fleet of spacecraft and in so doing effectively preclude other actors from sharing those domains. They have done so, or are attempting to do so, without any international consensus or discussion, which is most egregious for a domain outside of State sovereignty and which no State can own. Governments will ultimately be responsible for this appropriation, and both are prohibited from appropriating space. In distinction to GSO, their permission to go there means that they could occupy these regions for incredibly long periods — which again shows their appropriation. These constellations significantly prevent others from using those regions, which therefore interferes with others’ right to explore and use space. And ultimately, this reckless ambition shows absolutely no due regard (as per Article IX) for the corresponding rights of others. As such, these megaconstellations constitute an impermissible appropriation of particular regions of outer space, regardless of any formal, official claim of such by a responsible, authorizing government.

#### [Eymork 12] Multilateral treaties over satellites are key to prevent conflict and ensure equitable use of limited resources.

Eymork 12

Tania Patricia Eymork. “International Negotiations of Natural Resources on the Moon and Other Celestial Bodies: Future Cooperation or Conflict?” Norwegian University of Life Sciences, Department of International Environment and Development Studies, Noragric. May 2012. <https://nmbu.brage.unit.no/nmbu-xmlui/bitstream/handle/11250/187862/eymork_master2012.pdf?sequence=3>. -CAT

The reason for highlighting the issue of REE’s is that this issue may also be a good reason to mine on the Moon. Those most dependent on the space industry would be the most threatened, the most dependent are the major space nations i.e. USA, Russia, China, India, Japan This argument, Lutes, 2008, suggests cooperation among these: Cooperation in a globalized society encourages peace and stability, and the space industry is highly globalized. Cooperation leads to technological developments and advancements, political stability and socio-economic strength especially in Less Developed Countries (Lutes, 2008). 6. International Treaties with Analogues. In attempting to establish a (new) legal regime for mining on the Moon and other celestial bodies, it is useful to look to analogous situations in international law to consider the issues discussed and how they were resolved. Whilst the Moon may be the most exciting area within the international mining debate, international mining treaties have been concluded regarding the deep oceans including the Arctic, and the continent Antarctica. These areas have much in common with the Moon and other celestial bodies. Geographically both areas are situated in harsh environments, are difficult to reach to extract natural resources, and difficult to live in. Further, they are also designated international areas in which no nation has a sovereign claim. After World War II in 1945, the establishment of permanent settlement on Antarctica seems to follow the same pattern as the colonization of the New World as mentioned above. Conflicting territorial claims by countries such as Argentina, Australia, Great Britain, Chile, France, New Zealand and Norway were leading towards conflict. The Antarctic Treaty from 1959 postponed territorial claims and established a legal regime that came into force in 1961 banning any military activity and exploitation as the OST. Until 1991 the continent was peacefully studied until technological advancements within oil and minerals extraction developed. Governments and corporations wanted to open up for exploitation purposes of oil and gas. However, today it is a protected area with successful conflict prevention. Since the second half of the twentieth century, technological advancements of especially floating oil and gas platforms able to reach the sea bottom for the exploitation of natural resources were commercialized. However, the question in terms of governance was by whom and under whose control. The United Nations became the main body to address these issues and to prevent conflicts where upon the 1982 Convention on the Law of the Sea (UNCLOS) was established. Rules and guidelines were agreed upon that expanded national control over coastal regions including the oversight of any commercial activity on the ocean floor, which would be excluded from possible national territorial appropriation. The USA refused to sign due to its opposition to the extension of exclusionary territorial waters and the United Nations treatment of the seabed as the Common Heritage of Mankind. Hence, the UNCLOS established the International Seabed Authority (ISA), which carries requirements to any prospecting for natural resources on the seabed to have international approval and license to ensure compliance with the UNCLOS clause regarding the Common Heritage of Mankind38. The USA remains outside the UNCLOS regime today as it does with the Moon Treaty of 1979. As per today, China, France, India, Japan, Russia and South Korea have registered with the ISA39, thereby retaining exploratory, but not yet exploitive rights, to certain identified regions of the seabed. However, no commercial mining has yet been carried out and as per today The Mining Code40 has yet to be completed. No nation owns the North Pole or the region of the Arctic oceans surrounding it. Russia, Norway, the USA, Canada, and Denmark (Via Greenland) are Arctic states bordering the Arctic Ocean and are limited to a 370 km41 economic zone around their coasts. The Arctic is warming. Surface air temperatures in the Arctic since 2005 have been higher than for any five-year period since measurements began around 1880. The increase in annual average temperature since 1980 has been twice as high over the Arctic as it has been over the rest over the world. Nearly all glaciers and ice caps have shrunk and the Arctic sea-ice decline has been faster during the past ten years than in the previous 20 years (Arctic Monitoring and Assessment Program, 201142). According to the Stockholm International Peace and Research Institute (SIPRI), ice-melting increasing may become one of the geopolitical debates in our time as a result to gain access to the region’s most important natural resources and transport routes. Countries have announced new military strategies in this region such as Canada43 and the USA, Russia44 and China. Tensions may emerge over who will determine the future of this region. Will it be the five littoral Arctic states45, or will it be the eight Arctic Council states46, or will a wide variety of countries be able to develop the region? Accordingly, there are challenges emerging in respect in the Arctic and in the management through cooperation based on international law and multilateral agreements. The Arctic Council strives to promote consensus and cooperation, however as an international organization without a firm legal charter, the Council is constrained in what it can do and several of the Council’s member states oppose broadening its mandate to deal with legal issue (SIPRI, 2011). 7. FINDINGS Space law derive from the desire of countries to derive benefits from what is called a common resource – outer space that has been likened to the high seas or the continent of Antarctica – a resource that no nations owns, however have a strong economic, political and even military interest for countries. As access to outer space is now more accessible and more and more space faring nations are entering the space market, space treaties and conventions assist in the coordination on how countries view space and to a certain degree regulate its usage. **Due to the growth of the space industry, this may be a complicated task**. This can be **exemplified by** one major segment such as **the coordination of** the use of **satellites** for communication, remote sensing, navigation, meteorology, etc. Without coordination of how the various frequencies are used there would be interference and chaos. **Further, if satellites deployed are not coordinated there would be difficulties of interference and** possibly **collision.** To retain international cooperation and to avoid conflict, a specialized agency of the United Nations (UN) the International Telecommunication Union (ITU). The ITU’s role is provide registration of radio frequencies used in outer space, to assign the usage of the various orbits, to set standards for the provision of various types of space services (Pelton et al. 2008:291-293). 8. CONCLUSION The need for a safe, clean, and non-radioactive energy resource to serve all and especially people in extreme poverty. Even though the development of a helium-3 based fusion reactor is still under development, we still need to await an eventual establishment of an international treaty and sets the rules for all nations who wish to explore and exploit the universe for the benefit of human kind….in an orderly manner to enable a cooperative state of mind to all.

#### [Pershing 19] That permits private companies to lease orbits in an orderly way, but never appropriate or own them.

Pershing 19

Abigail D. Pershing, J.D., Yale, “Interpreting the Outer Space Treaty’s Non-Appropriation Principle: Customary International Law from 1967 to Today,” 2019, *The Yale Journal of International Law*, Vol. 44, https://openyls.law.yale.edu/bitstream/handle/20.500.13051/6733/Pershing.pdf -CAT

B. A New Property Rights Proposal: Leasing Space One promising proposal that does not appear to have received much attention in the literature is the concept of leasing space to nations, private individuals, or companies rather than allocating it as permanently-owned property. It appears that the only authors who have even tangentially considered the possibility of leasing property rights in space beyond rights to mineral extraction are Marcel Williams and G.S. Sachdeva. Williams’ writing is limited to a thought experiment in which he imagines renting out up to one percent of the moon’s surface. This property would be directly leased to national governments, which in turn would be vested with the power to sublease sections of this territory to private companies or individuals.134 This proposal is not elaborated any further and is left as a broad-strokes outline. The second mention of leasing or renting space comes from G.S. Sachdeva, who argues that a U.N. Space Superintendence Authority could grant leases to those able to pay.135 Yet this theory is limited to a discussion of renting property rights in particular orbits to allow for hovering geostationary space hotels and does not delve into questions of renting land on celestial bodies. The concept of leasing outer space deserves greater consideration by space law scholars. This Section sketches a brief outline of how such a system might operate via an internationally-run space property rental system modeled on UNCLOS. Although UNCLOS itself is deeply problematic in its potentially devastating environmental consequences and negative impacts on indigenous peoples as it regulates deep-sea mining,136 the UNCLOS model may nonetheless be the best option for preserving non-space-faring nations’ rights with regard to outer space, given its success in providing developing nations with a voice in the regulation of the high seas and the seabed beyond national jurisdiction.137 It is worth noting that although very few scholars appear to have considered the possibility of renting space, several have examined the similarities between UNCLOS and space law.138 The approach advanced here differs from the conventional approach to this comparison in that it suggests that the international community move beyond merely authorizing nations or individuals to extract a certain quantity of minerals and instead consider the possibility of leasing out actual tracts of space land. Opened for signature on December 10, 1982, UNCLOS establishes the international rules that govern the use of the world’s oceans and their resources. An examination of UNCLOS is especially apt because it deals with resources— the high seas—that, like space, are not subject to national appropriation. In language strikingly similar to Article II of the Outer Space Treaty, Article 137 of UNCLOS reads: No State shall claim or exercise sovereignty or sovereign rights over any part of the Area [resources of the seabed and ocean floor beyond the limits of national jurisdiction] or its resources, nor shall any State or natural or juridical person appropriate any part thereof.139 Although there are clear similarities between the two treaties, there are substantial differences as well, many of which would be useful in informing an update to the Outer Space Treaty. In addition to extending the prohibition on sovereignty to individuals as well as to nations, UNCLOS goes far beyond the Outer Space Treaty in detailing the limits of the non-appropriation principle. All of Part XI of UNCLOS, totaling fifty-eight Articles, gives a detailed description of how States can negotiate within the bounds of the non-appropriation principle to exploit ocean resources. Of particular relevance for purposes of crafting a parallel space law proposal is UNCLOS Part XI, Section 4, which lays out the rules governing the International Seabed Authority—the main mechanism through which States and private companies can legally exploit ocean resources, including mining of the deep seabed.140 Using UNCLOS as a model, a similar system may prove promising for the evolution of space law. However, the new space system should allow for rental of space land instead of merely allowing for the extraction of space resources. As with UNCLOS, any such space leasing system should be run through the United Nations. Situating such a system in this forum would help the international community stay true to the intentions of the Outer Space Treaty, which provides, in the words of one author, a “philosophical roadmap for the future development of the outer space legal regime.”141 Although a new committee within the United Nations could be formed for this purpose, the existing Committee on the Peaceful Uses of Outer Space (UNCOPUOS) would be an ideal environment for the creation and operation of such a system. UNCOPUOS is composed of eighty-seven geographically and economically diverse member States (including all the major space-faring States). Additionally, intergovernmental organizations and non-governmental organizations have observer status.142 Given its central mission to maintain space as a peaceful arena of international cooperation, as well as its representative composition,143 it would be an ideal body to bring a space leasing system to fruition. UNCOPUOS, in turn, should operationalize the leasing system by establishing a new International Outer Space Authority. This Outer Space Authority should parallel the International Seabed Authority described above.144 There should be similar provisions for the International Outer Space Authority relating to the makeup and functioning of the Authority (with each country getting one vote and decisions made by a two-thirds majority);145 the power of the Outer Space Authority to exercise control over space generally;146 the ability to decide how much rent to charge nations or individual corporations;147 and how to use these funds,148 among other provisions. For this proposed Outer Space Authority to be useful as well as operational, it is critical that it have jurisdiction over property rights in space beyond mining rights. Having rights to property in addition to rights to extracted minerals would add an extra layer of legal security for companies considering venturing into space for mining purposes. And, although businesses currently seem most interested in the possibilities of mining space resources, in the long term, questions of space tourism and the potential development of space colonies may arise. Having a flexible system in place that can adequately handle these concerns is therefore desirable. Instead of just focusing on mining, an Outer Space Authority with broader jurisdiction will have longer staying power and will require less reworking in the near future. Part of the appeal of this rental model is that it works so seamlessly with the current Outer Space Treaty. Turning again to the language of the Treaty and beginning with the non-appropriation principle, Article II lays out that “[o]uter space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”149 Because no State or individual would ever own land in space under a leasing system, this proposed leasing regime would not be in contravention to Article II. And yet, despite this, a leasing regime would establish enough legal security that exploitation of space resources would not be impeded—the main rationale for those who argue that the Treaty (or at least Article II) should be rescinded. Moreover, the principle established in Article I of the Outer Space Treaty, that “[t]he exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind,” is also upheld under this leasing regime.150 Leasing not only allows nations and private companies to exploit space resources and reap the benefits of their labor, but also directly benefits developing countries not yet able to tap into the resources of space by redistributing some of the space-going nations’ profits via a leasing fee and a tax on extracted resources. A potential argument against this rental system, as well as any other international legal system that would seek to regulate property rights in space, is that the United States never signed on to UNCLOS and there is nothing different about this situation that would cause the United States to join an international treaty regulating property in space either. However, space law has a fairly different history than the law of the sea. These differences make it more likely (though unfortunately not certain) that a proposal for an International Outer Space Authority would be adopted by the United States despite the fact that the facially similar UNCLOS proposal failed to garner a two-thirds majority vote in the Senate. The major difference between UNCLOS and this proposed International Outer Space Authority is that the United States has self-interested reasons for supporting an International Outer Space Authority, whereas it did not have similar reasons to join UNCLOS. The United States has maintained that under customary international law, deep seabed mining is already permissible.151 Since the United States does not recognize limitations of deep seabed mining established in UNCLOS, it may legally undertake deep sea mining under customary international law—a right that is codified in domestic U.S. law in the Deep Seabed Hard Mineral Resources Act: [I]t is the legal opinion of the United States that exploration for and commercial recovery of hard mineral resources of the deep seabed are freedoms of the high seas subject to a duty of reasonable regard to the interests of other states in their exercise of those and other freedoms recognized by general principles of international law . . . .152 The United States therefore already has access to what it wants without having to join UNCLOS. As an additional point, there is also not much pressure from American companies to ratify UNCLOS, in part because the American Exclusive Economic Zone (recognized by the United States under customary international law)153 and the continental shelf is hugely rich in the resources companies might otherwise have hoped to gain by joining the Treaty and gaining access to minerals from deep sea mining in other areas. Finally, not only does the United States stand to gain very little by ratifying the Treaty, there is an argument that ratification would disadvantage the United States. Under UNCLOS, “coastal States are required to make payments to the International Seabed Authority based on a percentage of revenues derived from the exploitation of the resources found within the continental margin beyond two hundred miles from the coast.”154 Notably, customary international law creates no such obligation.155 In stark contrast to UNCLOS, the new rental system proposed would directly benefit the United States. Unlike with deep sea mining, the United States and its citizens currently are bound by a treaty that prohibits appropriation of space: the Outer Space Treaty. Unlike the UNCLOS analogy, the United States has already relinquished rights in this arena. Agreeing to a leasing amendment would expand the scope of its rights, not infringe upon them. Additionally, the United States does not have access to an outer space “exclusive economic zone” in the same way that it does for the sea. Without some sort of agreement, the United States simply may not legally appropriate any in situ property in outer space. One final consideration increases the likelihood that the United States would in fact become a signatory to an amendment to the Outer Space Treaty. Such an amendment would likely have the support of businesses, environmental groups, and the military, an unlikely combination of key constituencies that would help push an amended treaty forward. Businesses would advocate for the change because it would provide a clearer mechanism for establishing property rights.156 Environmental groups might push for the amendment’s ratification because of the environmental protections that could be included in such an agreement.157 Finally, the military would also likely be a proponent of the system because having access to property in space gives strategic advantages158 and because it is likely that certain Cold War-era concerns that prompted spacefaring nations to sign the original Outer Space Treaty remain relevant—most notably, concerns over the weaponization of space.159 CONCLUSION The brief history of outer space law since the adoption of the Outer Space Treaty in 1967 highlights the ease with which customary international law shifts in this arena. Despite an original broad interpretation of the non-appropriation principle during the Treaty’s drafting, customary international law has since carved out an exception to this principle for extracted space resources. A second shift could be similarly underway. Driven by economic incentives, States may reinterpret the non-appropriation principle to allow for private appropriation of space property. Currently, States have an incentive to cooperate to establish a new international agreement concerning the use of outer space because international law, as it is presently understood, prohibits private property rights in space. A new amendment could broaden these rights, providing an enticing carrot to encourage State cooperation. But this enticement may soon disappear. Given the flexibility of the current outer space legal regime, customary international law could easily shift to interpret the non-appropriation principle as allowing private appropriation of property in space. Whatever the international community decides is the optimal solution regarding outer space property rights, it is vital that action be taken now to preserve the principles advanced by the Outer Space Treaty, such as equitable access and peaceful use of outer space. As the original drafters of the Outer Space Treaty recognized, these principles are best protected through a formal agreement and not merely through customary international law, which is often driven by the most powerful States. Regardless of whether a rental system similar to the one described above is established or some other method is used, the international community will have to act quickly if it wants to maintain shared international control over space. Pursuing an amendment to the Treaty as described also provides certainty and timeliness, two elements that would likely appeal to constituencies that might otherwise be supposed to be content with waiting for customary international law to shift.

#### [Van Fossen 99] Only common ownership solves – private ownership allows corporations to rely on microstates to circumvent alternatives.

Van Fossen 99

Anthony Van Fossen, Griffith University, Nathan, Australia. “Globalization, Stateless Capitalism, and the International Political Economy of Tonga’s Satellite Venture,” Pacific Studies, Vol. 22, No. 2, June 1999 -CAT

Satellites, by their very nature, operate beyond a country’s territory and serve as instruments to bypass the effective sovereignty and jurisdiction of most of the states of the world. They are increasingly owned or controlled by private capitalists rather than governments. The recent trend toward mobile cellular networks and small satellites has offered much greater opportunities for participation and even control by the private sector. It has made governmental regulators and national post and telecommunications monopolies Political Economy of Tonga’s Satellite Venture 21 and oligopolies ever more apprehensive. This defensiveness has been expressed particularly by INTELSAT, which is financed by a consortium of national telephone companies and acts to limit competition with and between them. INTELSAT supports a system where satellites have genuine nationality. Tongasat points the way toward a “nationality of convenience,” where a jurisdiction may register satellites and enact laws for them that favor the interests of capital. States such as Tonga have little actual supervisory power. The tax havens of Mauritius and Singapore followed Tonga’s lead by filing for a disproportionate number of satellite slots—apparently intending to offer them to foreign companies for a fee (Business Times [Singapore], 22 September 1994). Located in the tax haven of Luxembourg, Société Européene des Satellites (the platform of choice for Rupert Murdoch, Canal Plus, Leo Kirch, and other major media organizations) has become the third largest satellite operator in the world (Australian Financial Review, 30 March 1995; Financial Times, 10 May 1998). In a move seen as having “echoes of Tongasat,” GE Americom (the company that has controlled the largest number of orbital slots over the United States and that has the largest satellite capacity in the world) abandoned the U.S. regulatory process administered by the FCC and turned to the government in the tax haven of Gibraltar for assistance in obtaining rights to twelve international satellite slots (Satellite Week, 15 January 1996; Via Satellite, 1 July 1997). Orion Asia Pacific also decided to avoid American regulations, including foreign ownership limits, by operating from the Pacific Islands tax haven of the Marshall Islands, whose government arranged access to a slot at 139.0 degrees East so Orion can provide services from India to Hawai‘i (Bernama, 2 October 1997; Cable and Satellite Asia, March 1997). Tax haven promoters in Pacific Islands microstates would appear to be likely beneficiaries of the ITU’s increasing reluctance to grant valuable slots to countries that already have a large number of satellites in orbit (Newsbytes News Network, 28 March 1996). If American hegemony continues to weaken, it appears likely that current or aspiring offshore financial centers may become increasingly involved in passing satellite legislation that allows owners and lessors to avoid a welter of competing laws, regulations, and taxes that mainland states attempt to enforce. According to international law, positions in geostationary orbit cannot be maintained for longer than thirty years; hence an allocation amounts to usufruct and not permanent appropriation. Thus, over time, users of slots given to traditional powers may gravitate toward new space-age flag-of-convenience jurisdictions in a manner similar to the major post–World War II movement of ships to maritime open registers in tax havens. Since it is difficult, if not impossible, for a state to appropriate or own 22 Pacific Studies, Vol. 22, No. 2—June 1999 outer space (which is like the open seas), jurisdiction and regulation become largely a matter of regulation of the vessel, represented by its flag (Weaver 1992). Although a maritime flag of convenience does not give a ship exclusive access to any section of the global waters, a satellite flag of convenience currently is supposed to confer use of an orbital slot from which other satellites are excluded. But there is increasing recognition (even within the ITU) that space may be even more like the open seas than once thought and that the value of exclusion has been overly emphasized. At 94.5 degrees East four satellites operate harmoniously in the same slot because there are no conflicts between their frequencies and antennas (Aviation Week and Space Technology, 8 August 1994). Flags of convenience in outer space are likely to increase as the number of satellites grows. Some writers claim technical advances will allow four thousand satellites to operate in geostationary orbit without interference (Riddick 1994). A Possible Future As the world’s global satellite regime continues to evolve, spacefaring companies ultimately owned in core countries may find it increasingly necessary to pay fees to microstates such as Tonga to gain access to orbital slots. Core countries (and particularly the United States) no longer have virtually unlimited use of the orbital spectrum. This evolving space satellite regime increasingly favors the claims of less-developed sovereign states. Even the United States will probably have to learn to cooperate with small, less-developed countries such as Tonga (Ezor 1993). Pacific Islands states would appear to be primary candidates for the further development of flags of convenience in space. Like the shipping business over the past twenty-five years, the satellite business has been risky and unpredictable. High rates of failure have meant that not a single American satellite carrier from the early 1980s was still operating ten years later (Australian Financial Review, 16 November 1993). Tongasat’s situation has also been extremely volatile. In May 1997 Tongasat had four satellites in different orbital slots, with a fifth just launched into the 170.75-degrees-East slot (Islands Business, May 1997). Less than a year later only two of its slots were still filled by satellites paying fees to Tonga—at 134.0 and 138.0 degrees East, which connect Asia and North America (Via Satellite, February 1998). Continuing deregulation of telecommunications would only further accentuate the satellite industry’s instability, unpredictability, and riskiness (Giget 1994:478). The cycles of the world satellite industry increasingly resemble the boom and bust of the oil-tanker business, a great user of maritime flags of convenience. In both the shipping and satellite industries Political Economy of Tonga’s Satellite Venture 23 there is a long delay between the ordering and the launching of vessels (Economist, 3 May 1997), with consequent cycles of great scarcity and oversupply. If both the maritime and satellite businesses continue to become more entrepreneurial, more globalized, and less tied to subsidies and protection from states, the appeal of flags of convenience will grow. Flags of convenience are means of minimizing state regulation, taxation, national rules of procurement and service, and so forth.15 The increasing deregulation of outer space reflects conditions on earth, where property is increasingly allowed to be relocated to jurisdictions that make the fewest claims on it. This is often justified by the doctrine of the equality of sovereign states. Tonga’s satellite venture has departed radically from the social democratic conception of outer space as the common heritage of humanity. It has accelerated the globalization of stateless capitalism into ethereal realms. One day the advent of Tongasat may even be regarded as marking a significant new phase in world historical change.