## Off

### OSCS CP

#### CP Text: Governments and private entities ought to establish a Universal Outer Space Criminal Statute (OSCS) as per White 21.

#### OSCS stops resource exploitation, arms race, nuclear great power conflict

White, 21

(Reid White is an assistant district attorney at the DeKalb County District Attorney’s Office and a Managing Editor on the Emory International Law Review, 2021, <https://scholarlycommons.law.emory.edu/cgi/viewcontent.cgi?article=1258&context=eilr> // HW KA)

With human expansion comes human problems, including crime. As evidenced by Ms. McCain, space is no exception. In fact, “it is expected that there will be a high rate of criminal and deviant conflicts in any long-term human presence in outer space. . . .” This prediction is strengthened by disheartening results of experiments on Earth designed to test human responses to isolation in space. During a particularly disconcerting trial conducted by Russia over a period of 100 days, the commander of the mock space mission committed battery, assault, and attempted murder and tried to rape a female crewmember while drunk. Though classified, rumors exist regarding criminal acts in real outer space missions. This recalcitrant behavior by cosmonauts and astronauts is especially troubling: with the exception of seven paid space tourists, the approximately 550 people that have traveled to space thus far are arguably some of the most mentally stable people Earth has to offer. Because sending people to space is such an investment, “[a]stronauts are subject to a very rigorous recruitment process where they are evaluated from medical and psychological standpoints.” Not only do they have to initially pass medical and psychological evaluations, they are reassessed annually. The psychological evaluations focus on both their mental ability to handle the stresses of spaceflight and their ability to perform in group settings while locked in close proximity to others for extended periods of time. Factors considered are their proclivity to commit crimes and their morals. “This careful and competitive process only selects highly qualified individuals for human space programs.” Despite the filtering process, space crime occurs. Conceivably, such space-travel criteria will degrade or be disregarded entirely when the floodgates of commercial space travel open. Many more people will be entering the cosmos soon, and their space-worthiness will not be determined by the quality of their characters, but by the size of their wallets. And if history has shown us anything, with people comes crime. Since even stringent standards are not enough to prevent criminal activity in space, logic dictates that crime frequency will increase when such standards are discarded. Therefore, future space endeavors will require legal authority to address criminal acts committed in space. Given the inevitability of outer space crime, especially with looming commercial space flight and space tourism, one would think there would be a regime in place to address such wrongdoings. However, one would be mistaken. Not only are there questions of criminal jurisdiction and law with ambiguous answers, the current “criminal law” of outer space has gaps where there is simply no guidance. In fact, the entire “current legal regime in space is increasingly fragmented and inadequate to meet the challenges of the intensifying use of space.” Simply put, there are a variety of behavior problems that are expected to occur as we get into outer space, and our current laws “. . . [do] not address or propose specific solutions to prevent the occurrence of criminal behavior in outer space.” These weaknesses are products of the current “muddling through” scheme of outer space legal development that was adopted at the advent of space travel. The international community operates under differing interpretations of vaguely stated, albeit shared, general principles. “Rule creation . . . is ad hoc, incremental, and piecemeal.” The framework reflects state-sponsored exploration of space but does not reflect the evolving interests of permanent inhabitation and use of space. Despite the fact this framework is designed to ensure “. . . no single power dominates and possibly jeopardizes access to space by others[,]” it is simply insufficient to guarantee a stable international community with increasing travel to space. This instability is extremely problematic, as Earth’s international community has diverse and varied interests. There is no rationale for thinking this diversity will, absent international agreement, terminate above the Kármán Line (considered by most to be the boundary where Earth’s atmosphere ends and outer space begins). These varied interests are unlikely to be balanced by current laws regarding space; imbalance threatens a collapse of the current outer space legal regime. Such a collapse may facilitate countries to establish a national dominance philosophy, where states selfishly exploit space for their own national self-interest. We have already seen proof that at least one nation is preparing to militarize space. On August 26, 2019, out of fears that “[s]pace will be a part of future conflicts on Earth,” U.S. President Donald Trump authorized creation of the United States Space Command (SPACECOMM). SPACECOMM quickly evolved into the sixth branch of the U.S. military, the United States Space Force, on December 20, 2019. The U.S. military’s entry into space could make international treaties and negotiations irrelevant, or sweep them away entirely. Militarization could also inspire other countries to pursue their own outer space militarization. This runaway system of national dominance of space would be disastrous for humanity and the current international cooperation of space exploration: “[a] contest over national superiority in space could extinguish the explicit equal right to use space that all nations enjoy, creating instead a de facto regime of control over access and use by the first nation to successfully deploy weapons based in space. . . .” Not only would this arms race transform the cooperative culture in space into one of conflict, but also tarnish earthly international relations. The best case scenario in such a conflict may be non-spacefaring countries develop anti-satellite weapons to even the playing field, collaterally depriving us of convenience of necessities such as cell phones and Global Positioning Systems (GPS). The worst case could be another World War, but this time with a rain of nuclear, “kinetic-kill,” and laser weapons from outer space. We need to forestall such a result, as discussed infra Part III, and an OSCS would solve criminal jurisdictional problems in space and be part of a comprehensive framework of international outer space regulation.

### Space Col CP

#### Text: States ought to adopt a binding international agreement that bans the appropriation of outer space outside of low earth orbit by private entities by establishing outer space outside of low earth orbit as a global commons subject to regulatory delimiting and global liability.

#### That competes –

#### The resolution/plan is entirety of outer space, but CP is only a small portion of space between the Earth and moon, but it’s the most developed and written about portion of the resolution – skirting conversation about the LEO area erases decades of literature.

#### Commercialization of LEO allows government agencies to focus on deep space exploration and makes research for space colonization more efficient

Julie 12/9/21 (Alyssa, International News Producer & Journalist, Global News, "How the Private Space Race is Allowing NASA to Explore New Frontiers," https://globalnews.ca/news/8408558/how-the-private-space-race-is-allowing-nasa-to-explore-new-frontiers/)

In February, NASA will launch the first un-crewed test flight of its Orion spacecraft and SLS rocket as it prepares to send astronauts back to the moon. Artemis I is the first in a series of increasingly complex missions to take place over the next few years. It will be followed by a second crewed test flight and a third flight that will land astronauts on the moon’s south-pole. NASA expects that will be in 2025, at the earliest. The agency says partnerships with private companies like SpaceX will build the lunar lander to ferry astronauts to the moon’s surface, making the Artemis program possible. The private space race has allowed NASA, and agencies like it, to turn their attention from Earth’s lower orbit and start planning for future missions, like Artemis. And as the agency plans to send astronauts to new frontiers, it is encouraging private industry to establish a greater presence in lower-Earth orbit — by collaborating with the private sector on a new space station. The International Space Station is now more than 20 years old, approved for use until 2024, with a likely extension only until the end of 2028 or 2030. NASA’s office of audits released a report at the start of December detailing the “costly repairs” to the orbiting laboratory that have been needed over time. It said maintenance and system upgrades to the ISS increased to approximately $169 billion in 2020. On Dec. 3, NASA announced three U.S. Companies that would receive over $400 million in government funding to develop commercial space stations — Jeff Bezos’ Blue Origin, Nanoracks and Northrop Grumman. Misty Snopkowski, Program Executive for the commercial LEO development program at NASA, says commercial stations, like the one’s these three companies are developing, will help the agency travel deeper into space. “We’re trying to go deeper into space and we can give this very well understood environment in LEO to commercial entities — for them to start establishing that LEO economy,” she says, adding that instead of owner and operator of a new space station, NASA would be one of many customers using the orbiting laboratory. With less of its funding tied up in the International Space Station, the agency will be free to throw more cash at deep space exploration, Snopkowski says. But there is still research that needs to be done in order to make these frontier missions possible. She says the agency has approximately 200 long-term experiments, most of which study the impact of space travel on the human body. The agency needs that work to continue after the International Space Station is decommissioned. “Those types of research, human research, [have] long lead times,” she explains. Such research not only helps further NASA’s ambitions in space, it is also helps us tackle big challenges on Earth, says York University astrophysicist Jesse Rogerson. “Going to the moon and going to Mars is going to push our understanding of how to do agriculture,” he says, as an example of how research in space can help us improve conditions on Earth. “Because we can’t do a permanent settlement on the moon or Mars without ‘living off the land.’ So pushing that science to the very edge so that we can grow something on Mars would inevitably help us do better on Earth.” Canadian astronaut Jeremy Hansen, who acts as CAPCOM at the Canadian Space Agency while he awaits his first flight assignment, says his agency is also involved in discussions about a future commercial space station. In addition to freeing-up funding for future deep space travel, he says such a partnership could reveal new ways to save money on research. “The space agency, we expect, will always be doing research in orbit. But the model on how we do that could change, could create more opportunities and could allow us to do more for less money,” he says. Hansen adds that collaborating with private industry will create more opportunities for astronauts to explore space, a boon for the Canadian Space Agency, whose astronauts have had to wait years to go to space as they wait for a seat to open on a mission. One upcoming mission Canada is taking part in will be Artemis II, the crewed test of the Orion spacecraft that will eventually transport astronauts to the moon. The private space race will also create more opportunities for scientists and astronomers hoping to conduct research in space, Rogerson adds.

#### Space colonization is key to ensure human survival – pursuing it as soon as possible is crucial

Kovic 18 (Marko Kovic, co-founder and president of the thinktank [ZIPAR](https://kovic.ch/zipar/), the Zurich Institute of Public Affairs Research. He is also co-founder and CEO of the consulting firm [ars cognitionis](https://kovic.ch/consulting-ars-cognitionis/),. He has a PhD in political communication, University of Zurich.)(“Why space colonization is so important”, Nov 10, 2018, https://medium.com/@marko\_kovic/space-colonization-why-nothing-else-matters-a877723f77d4)//ASMITH

Should humankind exist in the future? Should the future existence of humankind be as good as possible in as many ways as possible? If your answer to these two questions is Yes, then there is a topic that you should care about a lot: Space colonization. Why, you might wonder, does space colonization matter, possibly more than anything else, as the title of this article claims? Because the future of humankind directly and completely dependent on whether and how we manage to colonize space. Space colonization is a double-edged sword. On one hand, the creation of permanent and self-sustainable human habitats beyond Earth is unavoidable if humankind is to exist in the long-term future. On the other hand, however, space colonization could bring about a catastrophically bad future if we colonize space in a bad way. That future that might be worse than one in which humankind does not exist. Space or bust: Why we must reach for the stars Why should we pursue space colonization in the first place? Don’t we have more pressing problems today, on Earth? Yes, we do have many problems on Earth today, and we should try to solve them. But space colonization is just that: A strategy for dealing with certain problems. An the problems that space colonization would be dealing with are, arguably, among the greatest problems of them all: Existential risks; risks that might lead to the extinction of humankind [1]. Currently, all of our proverbial existential eggs are in the same basket. If a natural existential risk strikes (for example, a large asteroid colliding with Earth) or if a man-made existential risk results in a catastrophic outcome (for example, runaway global warming [2, 3]), all of humankind is at risk because humankind is currently limited to planet Earth. If, however, there are self-sustainable human habitats beyond Earth, then the probability of an irreversibly catastrophic outcome for all of humankind is drastically reduced. Investing in space colonization today could therefore have immense future benefits. Using resources today in order to make space colonization possible in the medium-term future is not a waste, but a very profitable investment. If humankind stays limited to Earth and if we go extinct as a consequence of doing so, then we will all the billions of life years and billions of humans who might have come to exist — and who would have experienced happiness and contributed to humankind’s continued epistemic and moral progress. Taking space colonization more seriously today does not, of course, mean that we should only pursue space colonization and ignore everything else that is bad in the world. We should continue dealing with current global problems and, at the same time, invest greater resources into space colonization. At this point in our history and our technological development, even modest amounts of resources directed at space colonization would go a long way, such as public funding of basic research. Additionally, it is very likely that technological advances in the domain of space colonization would improve our lives in other ways as well thanks to technology transfer [4] — investing in space colonization today would probably be a win-win situation. So the situation seems clear: We must pursue space colonization and try to spread beyond Earth as fast as possible. Unfortunately, there is a catch: Yes, we must colonize space if humankind is to survive, but space colonization itself is very risky. So much so that bad outcomes of space colonization might be even worse for humankind than “merely” going extinct.

### Militarization DA

#### The US government is perfectly positioned to focus on space governance and let private entities develop tech – this avoids bilateral or unilateral missions that increase the chance for conflict and space weaponization while creating effective multilateral agreements that spill over

Rosenberg and Marber 21 (Mark Y. - CEO of Geoquant and an adjunct professor at Columbia University’s School of International and Public Affairs, Peter - teaches at Harvard University and is a senior portfolio manager at Aperture Investors, 2/22, “America Needs a Supercharged Space Program,” [accessed 9/25/21], <https://foreignpolicy.com/2021/02/22/biden-space-force-race-policy-rockets-china/>)

In 2015, the U.S. government granted U.S. citizens the right to own any materials they extract in space, blowing open the door for civilian space business. In 2018, China launched a reconnaissance rover on the moon’s far side that’s been gathering data for more than 18 months now. In late 2019, then-President Donald Trump launched the formation of the U.S. Space Force as part of the military, while early 2020 saw the National Aeronautics and Space Administration (NASA) sign a contract with Axiom Space to build the first commercial space station. And in October 2020, the United States led the signing of the Artemis Accords, a set of bilateral agreements on space with Australia, Canada, Italy, Japan, Luxembourg, Italy, the United Kingdom, and the United Arab Emirates, which deliberately skirted the United Nations and did not include space rivals such as China and Russia. (Ukraine and Brazil were later added to the accords.) Although this pact claims to affirm the Outer Space Treaty, it actually increases the potential for conflict by expanding the interpretation of commercial space law while drawing hard geopolitical borders. Without Russia and especially China on board, much of the world will see the Artemis Accords as the informal rulebook of a cliquish club rather than a true multilateral agreement. Meanwhile, a new space race is gathering stream: In addition to this year’s unmanned missions to Mars, both the United States and China are planning moon landings later this decade. The Biden administration must prioritize a more multilateral approach to space governance than what was taken under Trump. Just like on Earth, a lack of international standards in space will likely lead to chaotic, wasteful competition. A 2011 U.S. law blocking NASA from cooperating with Chinese agencies has already shut China out of the U.S.-Russian International Space Station, prompting the Chinese to start building their own while partnering with Russia on a lunar research station. Revising this law would be a good place for the Biden administration to start. Cooperating with China in space might be a sensible hedge against growing conflict on Earth. Unregulated space activity could create a myriad of problems from accidentally or intentionally blocked data transmission to orbital pollution from too many space objects. Indeed, U.S. companies are currently the worst offenders, highlighting the need for more targeted regulation. Just a few uncontrolled collisions could generate enough debris to render near-Earth space unusable. And of course, no one wants to see space weaponized with extremely expensive, escalating arms races. Given private U.S. companies’ increasingly aggressive push to expand space exploration, the U.S. government is in a position to structure a more effective extraterrestrial regulatory regime. Renewed U.S. leadership founded on rebuilt space capabilities will be key to any hope for multilateral space cooperation. A more dedicated focus on space governance and a more aggressive approach to exploration can be the underpinnings of a future “New Space Deal.” A supercharged space program can help build entire new industries, create new jobs, green the economy, turbocharge next-generation communications, and expand the frontiers of science and technology. By uniting Americans behind a common purpose, it could even help mend the country’s frayed democracy. It would also reestablish Washington’s leadership in the fight against climate change and for a stronger multilateral system. Who else but the United States could even contemplate such a bold plan?

#### Non-state actors in space are conflict dampeners – they avoid geopolitical tension and have financial incentives to keep conflict low

Frankowski 17 (Pawel, Assistant Professor at the Faculty of National Security. His current research interests include space policy, labour standards in free trade agreements, and theories of international relations, Jagiellonian University in Kakow, “OUTER SPACE AND PRIVATE COMPANIES CONSEQUENCES FOR GLOBAL SECURITY”, <https://doi.org/10.12797/Politeja.14.2017.50.06>)

In the terms of privatization and space security, space remains relatively untapped, but commercial and military benefits from space exploration/exploitation could even lead to ‘privatization of space’. Such privatization will result from growing pressure on spacefaring countries to defect from cooperation, since is less viable with good number of multiple actors who entered the space.36 However, space policy and space research are characterized by very high costs, which are rather impossible to bear by private companies, limited by economic calculation. As pointed out earlier, under-investment in technological development by private companies it is related to the fact that these actors are not focused on profits of a social nature, such as improving the quality of life of the recipient of the product.37 This makes some technology, potentially beneficial to society, not developed or introduced into use, because the profit margin is too small to make this viable for commercial players. To conclude, privatization of space security can develop in unexpected ways, but in today’s space environment private actors would rather play the role of security regulators than security providers. When investment in space technologies is less profitable than other areas of economy, private actors would focus on soft law and conflict prevention in space, and new private initiatives will appear. For example, apart from important space companies, as SpaceX or Blue Origin active in outer space, other private actors as Secure World Foundation (SWF), who focus on space sustainability, will play more important role in crafting international guidelines for space activities.38 This path the way for future solutions and projects, as cleaning the space debris, extracting resources from asteroids and planetoids, refuelling satellites, providing payload capabilities for governmental entities on market-based logic, will be based on activity non-state actors, providing soft law and regulatory solutions, where space faring states are unable to find any compromise. Therefore private companies will be in fact global (or space) regulators, as part of UNCOPUS, being involved in space activities.39 The last argument for private involvement in space security comes from an approach based on common good and resilience of space assets, emphasized by the Project Ploughshares, as an important part of space security. As of 2017 there are more than 700,000 man-made objects on the Earth’s orbit bigger than 1 cm, while 17,000 of them are bigger than 10 cm.40 Some of them are traced by SSA systems, both American and European, but these systems are public-military owned, and private operators are not granted any access to this data. Any collision of space object with space debris, even with small particles, might result in a chain reaction, called Kessler’s syndrome, and not only private but public, and military assets will be destroyed or impaired. In such conditions, a reluctant cooperation between the public and private sector, and unwillingness to share vulnerable data by public actors seem to confirm that private space activity is more than necessary. This is an apparent case when logic of mistrust between state powers must be overcome by private actors, perhaps by suggesting common preferences for debris mitigation, and space situational awareness. In the case of space debris, Space Data Association, an initiative supported by private sector, with its main aim to enhance data sharing between commercial satellite operators, could be an example of nascent public good provided by private actors for the sake of global security.

#### Space weaponization and arms racing ensure space war goes nuclear – only strong private competition can check conflict

Hitchens ’17 (Theresa Hitchens, Theresa Hitchens is Senior Research Scholar at the Center for International and Security Studies at Maryland, Prior to joining CISSM, Hitchens was the director of the United Nations Institute for Disarmament Research (UNIDIR) in Geneva from 2009 through 2014. Among her activities and accomplishments at UNIDIR, Hitchens served as a consultant to the U.N. Group of Governmental Experts on Transparency and Confidence Building Measures in Outer Space Activities, provided expert advice to the Conference on Disarmament regarding the prevention of an arms race in outer space (PAROS), and launched UNIDIR's annual conference on cyber security, From 2001 to 2008, Hitchens worked at the Center for Defense Information, where she served as Director, and headed the center’s Space Security Project, setting the strategic direction of the center and conducting research on space policy and other international security issues, “Space weapon technology and policy”, School of Public Policy University of Maryland, <https://aip.scitation.org/doi/pdf/10.1063/1.5009221?class=pdf>, November 2017)

Abstract. The military use of space, including in support of nuclear weapons infrastructure, has greatly increased over the past 30 years. In the current era, **rising geopolitical tensions between** the United States and Russia and China **have led to assumptions** in all three major space powers **that warfighting in space now is inevitable, and possible because of rapid technological advancements**. New capabilities for disrupting and destroying satellites include radio-frequency jamming, the use of lasers, maneuverable space objects and more capable direct-ascent anti-satellite weapons. **This situation, however, threatens international security and stability among nuclear powers. There is a continuing and necessary role for diplomacy, especially the establishment of normative rules of behavior, to reduce risks of misperceptions and crisis escalation, including** up to the **use of nuclear weapons**. U**.S. policy and strategy should seek a balance between traditional military approaches to protecting its space assets and diplomatic tools to create a more secure space environment.** I. INTRODUCTION Outer space is recognized by all nations as “the province of mankind” not subject to national boundaries or appropriation via both treaty – especially the 1967 Outer Space Treaty1 – and by the practice of nation states. Since the dawn of the space age, the use of satellites has become integral to the global economy, including providing communications, weather services, mapping, precision timing and navigation services for shipping, secure crossborder banking, and Internet connectivity. Every state has both an interest in making use of space, and reason to deal with its use by other states, because **the activities in space by one actor have the potential to impact all others**, for good or for bad. In addressing international and national security, and nuclear security in particular, the space environment has played a role of great importance from almost the beginning of the nuclear age. The first satellites launched by the Soviet Union and the United States were oriented toward seeking information on what was transpiring in areas controlled by the other, and to verify bilateral arms control agreements. While in short order space systems also were integrated to the offensive uses of long-range delivery systems by providing photographic information about potential targets, strategic space systems were during the Cold War widely viewed as stabilizing the Superpower nuclear competition. The use of space for military purposes has continued into the present era, with increasing capabilities to take advantage of large segments of the electromagnetic spectrum for acquiring intelligence, communicating globally, and generally supporting ways of using nuclear weapons both for deterrence, and, should deterrence fail, use of those weapons against an adversary. Most of the nuclear weapon possessing states operate satellites for these purposes. Perhaps as importantly, space systems over the last two decades have become integral to the tactical warfighting ability of many modern states – a situation that has complicated the status of space systems as strategically stabilizing. Indeed, the growing use of space by many countries to achieve victory on the battlefield has increased both the vulnerability of militaries to attacks on their space systems and has, at the same time, increased their value as potential targets in a war. Over the past 50 years, the Soviet Union, the United States, and China have carried out experiments in or aimed at the outer space environment – mostly the area close to the atmosphere in Low Earth Orbit (LEO) – that show the capability to destroy a satellite, or to disrupt its functions. The specter of space warfare for many years has, among other negative consequences, raised concerns that a state’s nuclear retaliatory capability could be compromised. This concern also applies more generally, of course, to an ability to disrupt communications functions for other military, or civilian, purposes. In the 1980s, there was a period when the United States, and perhaps others, explored whether systems based in space could be used to destroy an adversary’s intercontinental ballistic missiles, or their payloads. The so-called Star Wars program under the Reagan Administration envisioned the deployment of a system of satellites that would seek to destroy the missiles/warheads launched at the United States. One technology explored envisioned detonating a nuclear explosive to generate a beam of x-rays that would put out of commission the adversary’s warhead. Thus far, such technologies have not succeeded in playing a role in the nuclear-weapon situation globally. However, the U.S. descendant of the Star Wars program – currently limited to conventionally equipped, ground- and sea-based missile defense interceptors with limited capability against a full-blown nuclear attack – continues to stress nuclear deterrence and stability between the United States and Russia, as well as China, which maintains a much smaller nuclear arsenal than the Cold War adversaries. However, recent missile experiments by China have demonstrated the vulnerability of the geosynchronous equatorial orbit (GEO), where many hundreds of satellites are “parked” carrying out communications and other functions, including nuclear weapons support systems and spy satellites. II. INCREASED THREATS INVOLVING OUTER SPACE Since the first satellites were launched in the 1950s by the Soviet Union and then the United States, the Russian Federation, the United States, China, India, Japan, and other states have, without much coordination, launched so many satellites into space into various orbits and at various altitudes that there is currently a strong risk of both congestion and competition. There is no global regime for regulating outer space activities. The Outer Space Treaty of 1967, to which all the launching states, and most others, are party2 mandates that outer space be used solely for peaceful purposes, and prohibits the stationing of nuclear or other weapons of mass destruction in that environment. (The Treaty does not prohibit the transit of nuclear weapons, e.g. as a payload on a submarine-launched ballistic missile, through outer space; furthermore under common law practice, defensive military activities are tolerated as compliant with “peaceful purposes.”) The Outer Space Treaty, however, makes it clear that states are responsible for their own space activities, and compliance with international law. And while there are a number of other spacerelated treaties, UN principles and voluntary agreements managed by various UN and multilateral bodies, a nation’s activities in space are largely regulated by that nation alone. There is no international legal requirement for any one state to coordinate its satellite launches or maneuvers with others. Environmental Threats: Crowding and Debris Some 1,500 operational satellites are now in orbit, owned by more than 80 states or other entities. These states and entities have varying levels both of proficiency and of knowledge of the established laws and rules affecting space. In the radio frequency band of the electromagnetic spectrum, interference is rising, especially in the GEO regime. Some of this interference is deliberate, undertaken for political purposes, despite the fact that deliberate interference is one of the few legally binding restraints in the international space arena3 . The evolution in satellite technology has led to the wider use of smaller satellites, including so-called “Cubesats,” that can be deployed in constellations, especially in LEO. The number of operational satellites is expected to rise to many thousands within the decade. LEO, in particular, is becoming incredibly crowded with satellites, making tracking of on-orbit objects extremely difficult. Furthermore, many small satellites have no ability to maneuver to avoid collisions with other satellites and space debris. The half-century of using space has resulted, from the breakup of satellites and other activities, in a considerable amount of on-orbit debris – including satellites no longer in use, parts of satellites that have broken up, launcher stages, nuts and bolts, and debris from the deliberate destruction of satellites. The United States and others track some 23,000 orbiting pieces with a diameter of greater than 10 cm. This debris is especially dangerous if a satellite or transiting vehicle collides with a piece, since the closing velocity of such a collision on-orbit is very high – some 7.5 kilometers per second (faster than a bullet) in LEO. Worse yet, even very small debris, most of which cannot be detected much less tracked, can destroy an operational satellite; it is estimated that some 500,000 to one million pieces of debris smaller than 10 centimeters exist on orbit. **It is widely agreed that new international measures to better coordinate space activities are required to ensure that the space environment is sustained**. In 2007, the United Nations Committee for the Peaceful Uses of Outer Space (COPUOS) in Vienna, Austria, agreed on a set of guidelines for the mitigation of space debris, which are slowly being implemented by many space-faring states. It may be that such measures will eventually require removal of debris from orbit, as the decay of debris from space into the atmosphere where it burns up (or falls on Earth) is a very long-term prospect, taking as much as 25 years in LEO. Sadly, the lifetime of debris in GEO, like diamonds, is practically forever. COPUOS currently is working on a set of recommended best practices to ensure the “long-term sustainability of space.” COPUOS has a 2018 deadline to finish this work; however, there is already discussion of follow-on effort that may include international guidelines for debris removal. Increasing Military Tensions in Space In the geopolitical sphere, compared with the period following the breakup of the Soviet Union, the current decade is witnessing increased tensions between the United States and Russia, and between the United States and China. The geopolitical situation in space has been further eroded by the proliferation of experimentation with and/or deployment of dual-use technologies with “counterspace,” i.e. satellite attack, capabilities. As noted above, China, Russia and the United States all have tested (or in some cases deployed) such technologies in both LEO and GEO. The United States continues to have an advantage in military space capabilities, but its edge is eroding as China and Russia dedicate more resources. Most technologies involved in sustaining systems in orbit are dual-use, but certain specific activities are raising suspicions about potential intended weapons use. The capability to maneuver satellites is particularly relevant. Russia placed a satellite called Luch/Olymp in GEO that maneuvered or drifted over a considerable range, and at several points in 2015 came extremely close to commercial satellites owned by Intelsat.4 Intelsat called the move “irresponsible,” but their request for information from Russia went unanswered. The maneuvers further prompted concern at the U.S. Defense Department about the satellite’s mission, which has not been revealed by Moscow. The United States also has carried out programs in GEO that could have potential weapons capabilities. For example, the PAN, an acronym for Palladium at Night, is a classified program apparently dealing with communications platforms, and perhaps providing other capabilities.5 The Geosynchronous Space Situational Awareness Program (GSSAP) is a U.S. military satellite constellation that also maneuvers in orbit, designed, according to the Pentagon, with the objective of inspecting other satellites orbiting in GEO. Such activities are known as Rendezvous and Proximity Operations (RPO), and have a number of benign applications such as satellite refueling, inspection and repair. Russia is carrying out other such experiments in LEO, as are China, the United States, Japan and Sweden. The commercial applications of maneuvering satellites are also increasing. Among the number of more directly identifiable counterspace technologies now available, the most widespread are ground-based radio-frequency jammers, which can be used to disrupt satellite communications and operations. In addition, there are efforts to develop lasers for disrupting or degrading systems based in space. Russia, China and the United States have also carried out projects involving terrestrially based missiles carrying anti-satellite payloads. The United States as early as the 1980s launched missiles from an F-15 fighter jet with this objective. A 2007 Chinese test, involving the destruction of a non-functional Chinese weather satellite in LEO, released a considerable quantity of debris. The United States subsequently launched a missile from an Aegis cruiser that was advertised to have the objective of destroying a satellite in a decaying orbit, but this did not prevent speculation that the mission also had the objective of demonstrating a similar capability to that of China. Over decades, the U.S. missile defense program has also heavily relied on the space environment, for early warning, for communications, and as a place for engaging and destroying hostile systems. Noted above is the Reagan Administration’s “Star Wars” program, pursued with the idea of creating a “shield” against intercontinental ballistic missiles. **The harder-line rhetoric that has been employed in recent years also has had an inevitable impact of raising tensions**. The United States has pivoted from an approach of “strategic restraint” to one emphasizing “warfighting.”6 In particular, the budgets for providing resiliency in space systems and counterspace capabilities have been increasing. At the same time, Russian accusations that U.S. activities have a hostile objective, and its responses to U.S. representations, have become shriller. Russia has called the anti-ballistic missile system SM-3 2A an anti-satellite weapon, while touting its own objectives for acquiring anti-satellite capabilities. In 2013, China tested a missile, the Dong Ning-2, which appears capable of reaching satellites in GEO. Chinese military space activities lack transparency, but it seems clear that such activities include the objective of being able to exercise counterspace actions. Most troubling, there has been a lack of serious dialogue among these Big Three states. Multilateral Efforts to Reduce Risks For many years, a direct approach to concerns about the potential for weaponizing space (space has been militarized since the dawn of the space age, but so far cannot be said to have been weaponized) has been debated within the United Nations, as well as at the Conference on Disarmament in Geneva. The Russian-Chinese cosponsored initiative, on the Prevention of an Arms Race in Outer Space, has been on the agenda of the Conference on Disarmament since 1985, and under that agenda item Moscow and Beijing have proposed a treaty to ban weapons in space.7 However, the Conference has been all but immobilized by wider disagreements since that time; and the United States remains firmly opposed to the proposed treaty. There have been a number of efforts to set norms of behavior in space in order to guard against misunderstanding and conflict in space. Most recently, the 2013 UN Group of Governmental Experts (GGE) on Transparency and Confidence-Building Measures in Outer Space Activities released a set of recommended initiatives for states to implement, including improved communications about objects in orbit.8 Unfortunately, little work has been done since to implement the recommendations, either at the multilateral level or by individual states. However, the United States, Russia and China have recommended that the UN Disarmament Commission, based in New York, and the deliberative body on arms control issues, take up the question of implementation of the GGE recommendations. While the initial proposal has been received favorably, a decision regarding whether to put the issue on the Commission’s formal agenda will not be made until Fall. III. POLICY QUESTIONS FOR THE UNITED STATES In view of the increased uncertainties affecting the use of outer space, particularly in the area of international security, the United States needs to address several issues with some urgency. First, what is the appropriate mix of resiliency measures to apply in the coming years? A subsidiary question in this regard is what is an appropriate role for commercial providers? And should the U.S. military switch to constellations of small satellites for some national security missions? The budgetary implications of achieving objectives, and establishing appropriate requirements, are important components of pursuing this mix. And there is the inevitable bureaucratic overlap between the Department of Defense and the Intelligence Community. Such “turf” issues require constant attention lest they adversely impact on the fulfillment of national, vice institutional, objectives. Lengthy acquisition programs put systems at risk of becoming obsolescent earlier than they would otherwise become outdated. As part of this latter issue, the United States will need to consider what reforms are needed in the acquisition process, and related organizational arrangements. The integration of Department of Defense and Intelligence Community programs and activities is inevitably a delicate matter; it will require especial focus from the White House, in particular as resiliency is now being embedded into the requirements for acquisition of new systems. A more far reaching issue is how best to strike a balance between the defensive aspects of counterspace and the offensive aspects. And integral to addressing this balance is the impact of U.S. options to respond to hostile space activities on the stability of the strategic/nuclear relationships: U.S.-Russia, U.S.-China, and a large number of other such relationships involving the nuclear-weapon-possessing states. If “arms racing” resumes, or, in the case of India and Pakistan, continues, how will the use of space, specifically for counterspace activities, impact on these races, and vice-versa? Will there be a deterioration in nuclear deterrence? Will an offensive strategy involving the targeting of an adversary’s nuclear-related satellites emerge? These are questions that beg answers in the near-term, as budgetary and policy decisions are being made. **It is also important to consider the role of diplomacy in dealing with international security for outer space.** Diplomacy, in the form of both self-restraint and in reassurance of potential adversaries regarding intentions, has been a part of the tool kit for managing competition in space from the beginning of the space age. Can effective “rules of the road” be further developed? The limited success, but slow pace, of multilateral efforts should not be seen as failure, however. Diplomacy is a difficult business, often characterized by a “one step forward, one step back” dynamic. There is some optimism to be found in the ongoing COPUOS effort, which while a slightly sideways approach, will have positive impacts on international security if successful. While the Disarmament Commission has little power, the advent of discussions there would provide a much needed multilateral forum for addressing the security issues for space given the decades-long impasse at the Conference on Disarmament. Finally, **one should not overlook the value of bilateral diplomacy, particularly among the Big Three space powers. Further work will also be needed to regulate the proliferation of technologies in the commercial sector**. This will likely involve export control, and measures for the management of “traffic” in space (STM). However, care must be given to weigh national security concerns against the needs of commercial industry to thrive in the international marketplace. There is a tendency in the national security community to try to “close the barn door after the horses have escaped” that must not be indulged in the space domain, given the reliance of the national security sector on commercial capabilities and technological innovation. IV. THE NEED FOR A “TIME OUT” To date, no state is deploying dedicated anti-satellite weapons. Testing of capabilities does not a program make. That said, the trend lines are currently negative and require both time and analysis to mitigate. It would be irresponsible for the United States, or any other country, to leap to conclusions about the “inevitability” of all-out war in space. A balanced strategy, which combines resiliency, deterrence, and diplomacy **will be required to** protect national security and **ensure international security**. While development of some anti-satellite capabilities for potential future use may be wise, a run-away space arms race is not desirable for any party. It may be that a viable modus vivendi could be a situation of “implied deterrence:” i.e., the development of dual-use technologies with inherent weapons capabilities in a transparent manner so as to provide the knowledge to others that, if pushed, antisatellite weapons could be deployed. And despite the difficulties to date, **the prospect of the multilateral establishment of norms shows some possibility of promise.** This involves the implementation of recommendations by the Group of Governmental Experts discussed above; of the COPUOS LTS (long-term sustainability) best practices work making progress by 2018; the successful efforts to codify the legal regime that are underway (e.g., those at McGill University in Montreal), and perhaps the UN Disarmament Commission addressing TCBMs in 2018. These efforts must be given a chance to ripen, however much frustration is involved in the processes. It can perhaps be helpful to think of the world as being surrounded on all sides by a large fishbowl, of indefinite dimensions in the outward direction, with the atmosphere at the intersection between “outer” space and the land and waters below. Looked at in this way, human activities in outer space have little room to be confined to a single state: the world as a whole is impacted by those activities. Accordingly, when dealing with outer space, traditional concepts of absolute roles for state sovereignty must inevitably be modified to serve the objectives of global peace, security and stability. Whether this reality will at some point lead to an appreciation that reliance on force, nuclear weapons in particular, cannot play the role in space that it does on the Earth, remains to be seen.

## Case

### Global Commons

#### NU – space is already a global commons

#### Plan fails –

#### Global commons still allow for private appropriation

#### China inevitably undermines solvency

#### Too many private actors ensure conflict

#### Turn – limitations on commons access such as private entity restrictions lead to backlash

Stang 13

Gerald Stang (associate fellow at the EUISS) , 2013, "Global Commons: between cooperation and competition" European Institute for security studies, https://www.iss.europa.eu/sites/default/files/EUISSFiles/Brief\_17.pdf, // HW AW

Rapid economic development and increasing international trade are leading to a more crowded international stage and raising new challenges in the ‘global commons’ – those domains that are not under the control or jurisdiction of any state but are **open for use by countries, companies and individuals from around the world**. Their management involves increasingly complex processes to accommodate and integrate the interests and responsibilities of states, international organisations and a host of non-state actors. Shared rules regarding the usage of - and access to - the global commons encourage their peaceful and cooperative use. Over the last seven decades, the US has led in the creation of a liberal international order which has attempted to define these rules in such a way as to make it easier and more beneficial to join the order and follow the rules than it does to operate outside of (or undermine) it. With the rise of nonWestern, less liberal powers - particularly **China - questions must be asked regarding the durability of the existing processes for managing the global commons,** along with the potential for developing effective new processes that can address new threats and challenges. The EU is uniquely positioned to play an important role in giving value to existing multilateral frameworks and in developing new ones for international cooperation in these domains. But with a multitude of competing interests among stakeholders, much work remains to be done. What exactly are the global commons? Security analysts generally identify **four domains as global commons: high seas, airspace, outer space** and, now, cyberspace. From a security perspective, the primary concern is safeguarding ‘access’ to these domains for commercial and military reasons. It is important to highlight that this language differs from the discourse on commons developed by environmental analysts: their arguments focus on damage to the ‘condition’ of the commons from overuse by actors who do not have to pay direct costs. They worry about the depletion of shared resources such as ocean fish stocks, or the damage to shared domains such as Antarctica or the atmosphere. A third strand of analysis looks not at the need for ‘access’ to or preservation of the ‘condition’ of the commons, but at the capacity of the commons to provide ‘global public goods’. As there is no accepted definition of a global public good (a functioning trading system, peace, clean water, electricity, the internet, and many other things are often included), it may be wiser to focus on the four global commons relevant to security analysts mentioned above. While there are major differences between the ‘access’ views of security analysts and the ‘condition’ views of environmentalists, both are concerned about how the Global commons: Between cooperation and competition by Gerald Stang Photo by NASA / Rex Features (1568628a) European Union Institute for Security Studies April 2013 2 rules for use of the commons are set and enforced. In today’s interconnected world, **any limitations on access to the commons would be highly disruptive**. Militaries rely on access to the commons to pursue security goals in domains outside their sovereign control. Economic actors rely on the commons to trade and conduct business. **Changes to the condition of the commons can therefore disrupt commerce and security, not to mention the status of the global environment.** Each of the four commons discussed below possesses unique attributes and poses unique challenges for international cooperation and governance. Sea As the primary avenue for international commerce since ancient times, norms for access to and passage on the seas have developed and evolved over many years. Only in recent decades, however, have there been agreed regulatory frameworks and institutions to manage them. The UN Convention on the Law of the Sea (UNCLOS), first initiated in 1956 though not legally in force until 1994, is the primary international treaty regarding the sea, laying out rules for territorial boundaries (22km from shore), resource management and the rights of states within their exclusive economic zones (370km from shore). The International Tribunal for the Law of the Sea (ITLOS), created by UNCLOS, has the power to resolve disputes by States Parties. Except for the US, most countries and all global powers - including the EU-27 - have signed and ratified UNCLOS. The UN International Migratory Organization (IMO), created in 1948, regulates international shipping and rulings on safety, environmental and technical cooperation issues (the EU has observer status). As the world’s only global sea power, the United States has historically seen itself as the protector of free movement on the seas. With 11 carrier groups (Russia has one, rarely used) and hundreds of naval bases and allied ports throughout the globe, the US has a naval footprint that dwarfs all its allies and competitors. While countries such as Iran and China may be uncomfortable with US capacity to deny others access to the sea, US support for the creation and respect of transparent international regulations for use of the sea (which they adhere to themselves despite not having ratified UNCLOS), has allowed for the stable management of access to the seas. Except for the disruptive (but still rare) threat of piracy, access to the seas is generally a smooth and well-regulated process. The massive and relatively effective, if ad hoc, global response to the localised piracy problem off the coast of Somalia (for which the EU launched Atalanta, its own anti-piracy mission under the CSDP) highlighted the world’s impressive capacity to handle disruptions of this type. Territorial disputes exist in places like the South China Sea, but relate to historical boundary disagreements rather than conflict over rules of sea access. Normally, no state has an interest in disrupting sea trade. Even in times of crisis, while individual states may wish to deny their opponents access to certain regions, they are unlikely to harm their own interests by disrupting traffic on the world’s oceans. Environmental ‘condition’ issues in the sea commons are disconnected from ‘access’ issues. No single international treaty or body addresses pollution, overfishing or the various challenges in the melting Arctic. A confusing patchwork of sea basin cooperation groupings, regional fisheries management organisations and pollution monitoring agreements is in place. The integrated marine policy of the EU recognizes the need to improve governance of the seas while avoiding treaty congestion. While no unifying treaty or body to manage maritime issues is likely to appear, years of patient discussion in a variety of venues (of the type that the EU excels at) may lead to greater coherence and cooperation in managing environmental threats. Air International air travel requires the use of national airspace for continuous transit and involves detailed agreements that define transit rights. The UN International Civil Aviation Organisation, established in 1947, is the leading institution for regulating air travel. All EU countries are members, while the EU has observer status. As with piracy at sea, any potential disruption of access to the air commons is likely to come from non-state actors. While terrorist events can disrupt air traffic, however, intergovernmental cooperation between national police and security agencies is well established. Any systemic threat to the air commons appears so unlikely that some security analysts do not even include air as a one of the commons. Also like the sea commons, issues of management of environmental ‘condition’ are disconnected from ‘access’ issues. The accumulation of greenhouse gases is a form of pollution of the atmosphere, but the alarm stems from their effects on the biosphere rather than from the risk that the atmosphere may become unbreathable or inaccessible. The EU is a global leader on climate change, with the world’s most comprehensive emissions trading scheme and intense efforts to regulate and limit emissions. The Union has set the tone at the international level but has been unable to win agreement for an internal carbon tax or stronger emissions targets from external partners. European Union Institute for Security Studies April 2013 3 Space More than a thousand orbiting satellites facilitate communications in both the military and the civilian spheres, regulated by a mix of UN guidelines, bilater- al Cold War agreements and industry standards. The UN International Telecommunications Union (ITU) allocates radio spectrum and satellite orbits and develops international technical standards. Established in 1869, the ITU has almost universal membership among existing states, including all EU countries - though not the EU itself. The 1967 Outer Space Treaty, signed by all spacefaring nations, provides the minimal framework for activities in space, banning weapons of mass destruction and preventing states from claims to celestial bodies. The Treaty does not establish infrastructure for coordination, and consultation among party states is ad hoc. Following China’s destruction of one of its own satellites in 2007, there has been increasing concern about protection of satellites from attack. During the later stages of the Cold War, the US and the USSR tacitly agreed to a moratorium on testing anti-satellite weapons (ASAT) - but there are no binding rules in place. The satellite’s destruction also created a debris cloud which could have damaged other satellites or spacecraft. Unlike the sea and air domains, the problem of debris management in space indicates an overlap between ‘access’ and ‘condition’ issues. While access to space has previously been limited to a small number of states, **the increasing role of new actors (including from the private sector) suggests that the creation of comprehensive and binding regulations for the space commons may become more difficult.** The EU has pushed to become a key actor in space matters, working with the European Space Agency (ESA) - an intergovernmental body - on Galileo, Europe’s civilian satellite navigation system. In an effort to get ahead of the curve and manage uncertainty, the European Council approved a voluntary Code of Conduct for Outer Space Activities in late 2008 (revised in 2010) to address both space operations and space debris. It has only limited operational requirements but develops important cooperation, consultation, and notification mechanisms. To make it more palatable to the US and other states, it is not binding and has no enforcement mechanism. As with many efforts in multilateral regulation of the global commons, the US has been hesitant to agree to the Code for fear of diminishing its own freedom of manoeuvre. It may be an important step, however, in setting the groundwork for future space cooperation if the EU can follow up on the Code’s development with diplomatic action by bringing other space-faring countries on board. Cyberspace Cyberspace differs from the other commons because it is not a physical domain and because of the preponderant role of the private sector in both the infrastructure and the management of the domain. All of the physical nodes of the internet also exist within states and are subject to national law, rather than existing physically outside of national control as for the other commons. The American and security-related roots of the internet are reflected in how technical internet standards are managed. The Internet Corporation for Assigned Names and Numbers (ICANN), a private non-profit entity under contract with the US government, has ensured the coordination of internet addresses and registries since 1998. While ICANN operations have been stable - and their inclusive governance style has won imitators for handling technical issues - many countries prefer a formal international body to manage technical internet issues. The ITU has been suggested as a neutral management body, but this idea has been resisted by most Western states. Interestingly, non-Western states are pushing for international management of the internet within a framework that provides individual countries with rights and roles, rather than leaving it to the nonprofit sector to decide how the internet works. All EU-27 countries are members of the ITU and, following a European Parliament deliberation, voted as a bloc against the measures granting more power to the ITU, concerned over states wishing to regulate, control, and limit internet use. The UN Internet Governance Forum (IGF) has become the leading multi-stakeholder platform for states and other actors to debate internet governance. Regardless of the ICANN/ITU issue, states can filter and censor within their territories, and for the time being, efforts to protect against cyber attacks remain within the national sphere. Cyberspace allows for the spread of information, creating pressures for transparency in both democratic and non-democratic states. Discussions on the management of cyberspace, therefore, have become connected with those on the power of states to control information. Finally, although there is no environmental constitu- ency for cyberspace, there are constituencies of users and providers - private and public - who play a similar role in pushing for the protection of certain conditions in cyberspace. Unlike for sea and air domains, therefore, there is overlap between ‘access’ and ‘condition’ discussants. With worries about Cold War-style espionage and cyber conflict between states, cyber security problems European Union Institute for Security Studies April 2013 4 QN-AK-13-017-2A-N | ISSN 2315-1110 are expected to grow worse and are unlikely to be addressed through multilateral fora. Problems with hackers of various types make problems of attribution, response and coordination of policing very difficult. Cyber conflict involving states will ebb and flow along with the quality of the relationship between those states and competing states will continue to test each other’s cyber defences.

#### The term global commons leads to a false sense of security when in actuality makes whatever is supposedly being protected exploited

**Clancy 98** (The Tragedy of the Global Commons, Spring 1998, <https://www.repository.law.indiana.edu/cgi/viewcontent.cgi?article=1136&context=ijgls> pecial Assistant to the Deputy Secretary of State, US Department of State, Indiana Journal of global legal studies)//HWLND

The inherent problem in this communal property is the idea put forth byGarrett Hardin in his 1968 article entitled The Tragedy of the Commons." Hardin theorized that in communal property systems, each individual enjoys the benefit of exploiting the resource to its maximum, while the cost of this increased utilization is spread out over all users. Consequently, there is incentive for individual over exploitation. Applying this theory to global expanses shows that "the disadvantage inherent in this doctrine is that nations are free to make maximum use of resources because no outside mechanism exists to force their acceptance of external costs, either the cost of resource degradation or the cost of resource depletion."'" Much like the herding commons depicted in Hardin's essay, global commons are susceptible to overuse. 19 This problem is indeed a serious one. Global commons become, in effect, a target for over exploitation. Moreover, critics have addressed the problems of free riders and the Prisoner's Dilemma in dealing with commons.2 " The end result is the same, however. These global commons fall victim to the predatory interest of individual exploiting nations.

#### Even a worst-case Kessler syndrome would have little effect—the math checks out.

Fange 17

Daniel Von Fange, senior enginneer @ Origin Protocol, 5-21-2017, "Kessler Syndrome is Over Hyped," Braino.org, <http://braino.org/essays/kessler_syndrome_is_over_hyped/> //MLT

Let’s imagine a worst case scenario. An evil alien intelligence chops up everything in High LEO, turning it into 1cm cubes of death orbiting at 1000km, spread as evenly across the surface of this sphere as orbital mechanics would allow. Is humanity cut off from space? I’m guessing the world has launched about 10,000 tons of satellites total. For guessing purposes, I’ll assume 2,500 tons of satellites and junk currently in High LEO. If satellites are made of aluminum, with a density of 2.70 g/cm3, then that’s 839,985,870 1cm cubes. A sphere for an orbit of 1,000km has a surface area of 682,752,000 square KM. So there would be one cube of junk per .81 square KM. If a rocket traveled through that, its odds of hitting that cube are tiny - less than 1 in 10,000. So even in the worst case, we don’t lose access to space. Now though you can travel through the debris, you couldn’t keep a satellite alive for long in this orbit of death. Kessler Syndrome at its worst just prevents us from putting satellites in certain orbits. In real life, there’s a lot of factors that make Kessler syndrome even less of a problem than our worst case though experiment. Debris would be spread over a volume of space, not a single orbital surface, making collisions orders of magnitudes less likely. Most impact debris will have a slower orbital velocity than either of its original pieces - this makes it deorbit much sooner. Any collision will create large and small objects. Small objects are much more affected by atmospheric drag and deorbit faster, even in a few months from high LEO. Larger objects can be tracked by earth based radar and avoided. The planned big new constellations are not in High LEO, but in Low LEO for faster communications with the earth. They aren’t an issue for Kessler. Most importantly, all new satellite launches since the 1990’s are required to include a plan to get rid of the satellite at the end of its useful life (usually by deorbiting) So the realistic worst case is that insurance premiums on satellites go up a bit. Given the current trend toward much smaller, cheaper micro satellites, this wouldn’t even have a huge effect. I’m removing Kessler Syndrome from my list of things to worry about.

#### Status quo efforts to remedy the space environment can solve Kessler syndrome – their impact is also overhyped and at best non-unique. Prefer our card’s probability analysis report and empirical examples

Lewis 15 [Hugh Lewis, Senior Lecturer in Aerospace Engineering. “Space debris, Kessler Syndrome, and the unreasonable expectation of certainty.” Room Space Journal of Asgardia. 2015. <https://room.eu.com/article/Space_debris_Kessler_Syndrome_and_the_unreasonable_expectation_of_certainty>] HW AL

There is now widespread awareness of the space debris problem amongst policymakers, scientists, engineers and the public. Thanks to pivotal work by J.C. Liou and Nicholas Johnson in 2006 we now understand that the continued growth of the debris population is likely in the future even if all launch activity is halted. The reason for this sustained growth, and for the concern of many satellite operators who are forced to act to protect their assets, are collisions that are expected to occur between objects – satellites and rocket stages – already in orbit. In spite of several commentators warning that these collisions are just the start of a collision cascade that will render access to low Earth orbit all but impossible – a process commonly referred to as the ‘Kessler Syndrome’ after the debris scientist Donald Kessler – the reality is not likely to be on the scale of these predictions or the events depicted in the film Gravity. Indeed, results presented by the Inter-Agency Space Debris Coordination Committee (IADC) at the Sixth European Conference on Space Debris show an expected increase in the debris population of only 30% after 200 years with continued launch activity. **Collisions are still predicted to occur, but this is far from the catastrophic scenario feared by some.** Constraining the population increase to a modest level can be achieved, the IADC suggested, through widespread and good compliance with existing space debris mitigation guidelines, especially those relating to passivation (whereby all sources of stored energy on a satellite are depleted at the end of its mission) and post-mission disposal, such as de-orbiting the satellite or re-orbiting it to a graveyard orbit. Nevertheless, the anticipated growth of the debris population in spite of these robust efforts merits the investigation of additional measures to address the debris threat, according to the IADC. On the face of it, there appears to be considerable procrastination or, worse, apathy towards the development of guidelines for debris removal in spite of calls for action. But is this really the case? This probability tree shows the possible outcomes from drawing two cards from a pack of 52 regular playing cards. It can be used to illustrate the difficulties accociated with the choice of which piece of space junk to remove. No progress? In the nine years following the publication of the work by Liou and Johnson **there has been considerable interest shown in remediation of the space environment. In particular, significant effort has been invested across the globe in the development of methods to remove objects from low Earth orbit.** The European Space Agency, for example, recently announced its intention to seek ministerial approval for a mission to deorbit a European spacecraft in the next decade. The Agency has conducted numerous studies to investigate appropriate and reliable methods to achieve this. A key driver for these widespread efforts has come from the work conducted using computer codes – evolutionary models – of the debris environment, which suggest that the growth of the debris population can be prevented if particular spacecraft or rocket stages are removed. In the computer simulations, these objects are identified as the most likely to collide and so the consequence of their removal in reality should be a reduction in the number of collisions that will occur in the environment, which would curb the generation of new fragmentation debris. Given that is has been nearly a decade since the publication of the work by Liou and Johnson, it is surprising to some that no guidelines have yet been introduced at the international or national level, which detail the remediation measures that can be taken by government and industry. In fact, a recent announcement by NASA of a focus on technology development rather than in-flight demonstrations of debris removal technologies was greeted with some criticism. On the face of it, there appears to be considerable procrastination or, worse, apathy towards the development of plans or guidelines for debris removal in spite of calls for action. But is this really the case? The real issue comes from the seemingly simple task of identifying the correct debris to remove from orbit … In fact, the situation is not as simple as it might appear; there are some fundamental questions that remain to be answered about debris removal. Of particular concern are issues relating to ownership, liability and transparency. Many of the technologies that have been put forward for debris removal could also be used to remove or disable an active spacecraft, for example. Hence, it can be argued that these technologies could be used as weapons. There are also questions about the cost of a sustained programme of debris removal – some engineers put it at tens of trillions of dollars. However, perhaps the most important reason for the lack of relevant guidelines is that we don’t yet know how to accomplish remediation, by which we mean cleaning up space, in practice. That is not to say that we don’t know what technologies we might need. As mentioned above, there has been considerable effort already expended towards understanding these requirements and moving the necessary technology forwards. For one-off use, some technologies are very nearly ready. The real issue comes from the seemingly simple task of identifying the correct debris to remove from orbit. Until we can solve this problem, the likelihood is that debris remediation will not succeed, the debris population will continue to grow – seemingly out of our control – and the attempt will come at great cost. Without the reasonable expectation of success, it is virtually impossible to define appropriate and robust guidelines that can be used to direct remediation endeavours.