#### The advantage is Debris –

#### Privatization of space leads to unchecked debris.

Muelhaupt et al. 19 – Theodore, Marlon Sorge, Jamie Morin, and Robert Wilson, 6/18/19, Center for Orbital and Reentry Debris Studies, Center for Space Policy and Strategy, The Aerospace Corporation, 30 year Space Systems Analyst and Operator, [“Space traffic management in the new space era,” Journal of Space Safety Engineering, <https://www.sciencedirect.com/science/article/pii/S246889671930045X?via%3Dihub>] Justin

The last decade has seen rapid growth and change in the space industry, and an explosion of commercial and private activity. Terms like NewSpace or democratized space are often used to describe this global trend to develop faster and cheaper access to space, distinct from more traditional government-driven activities focused on security, political, or scientific activities. The easier access to space has opened participation to many more participants than was historically possible. This new activity could profoundly worsen the space debris environment, particularly in low Earth orbit (LEO), but there are also signs of progress and the outlook is encouraging. Many NewSpace operators are actively working to mitigate their impact. Nevertheless, NewSpace represents a significant break with past experience and business as usual will not work in this changed environment. New standards, space policy, and licensing approaches are powerful levers that can shape the future of operations and the debris environment. 2. Characterizing NewSpace: a step change in the space environment In just the last few years, commercial companies have proposed, funded, and in a few cases begun deployment of very large constellations of small to medium-sized satellites. These constellations will add much more complexity to space operations. Table 1 shows some of the constellations that have been announced for launch in the next decade. Two dozen companies, when taken together, have proposed placing well over 20,000 satellites in orbit in the next 10 years. For perspective, fewer than 8100 payloads have been placed in Earth orbit in the entire history of the space age, only 4800 [1] remain in orbit and approximately 1950 [2] of those are still active. And it isn't simply numbers – the mass in orbit will increase substantially, and long-term debris generation is strongly correlated with mass. Table 1. Some announced NewSpace constellations. Operator Number of satellites Altitude (km) Country SpaceX V-band 7518 335–345 US Capella 48 350–650 US Planet Swift 6 350–650 US Black Sky 60 450 US Satellogic NuSat 300 500 Argentina Kepler 140 550 US SpaceX Starlink 1584 550 US Skybox 30 576 US Fleet 100 580 Australia Amazon Kuiper 3236 590–630 US Commsat 800 600 China Kineis 20 600 France Yalini 135 600 Canada Spire 100 651 US Planet Doves 150 675 US Orbcomm 31 750 US Iridium 72 780 US Theia 112 800 US Lucky Star 156 1000 China Telesat LEO 72 1000 Canada Hongyan 300 1100 China Xinwei 32 1100 China SpaceX Starlink 2825 1110–1325 US OneWeb 720 1200 ESA Telesat LEO 45 1248 Canada Astrome Tech 600 1400 India LeoSat 108 1400 US Globalstar 40 1412 US This table is in constant flux. It is based largely on U.S. filings with the Federal Communications Commission (FCC) and various press releases, but many of the companies here have already altered or abandoned their original plans, and new systems are no doubt in work. Although many of these large constellations may never be launched as listed, the traffic created if just half are successful would be more than double the number of payloads launched in the last 60 years and more than 6 times the number of currently active satellites. Current space safety, space surveillance, collision avoidance (COLA) and debris mitigation processes have been designed for and have evolved with the current population profile, launch rates and density of LEO space. By almost any metric used to measure activity in space, whether it is payloads in orbit, the size of constellations, the rate of launches, the economic stakes, the potential for debris creation, the number of conjunctions, NewSpace represents a fundamental change. 3. Compounding effects of better SSA, more satellites, and new operational concepts The changes in the space environment can be seen on this figurative map of low Earth orbit. Fig. 1 shows the LEO environment as a function of altitude. The number of objects found in each 10 km “bin” is plotted on the horizontal axis, while the altitude is plotted vertically. Objects in elliptical orbits are distributed between bins as partial objects proportional to the time spent in each bin. Some notable resident systems are indicated in blue text on the right to provide an altitude reference. The (dotted) red line shows the number of objects in the current catalog tracked by the U.S. Space Surveillance Network (SSN). All the COLA alerts and actions that must be taken by the residents are due to their neighbors in the nearby bins, so the currently visible risk is proportional to the red line.



Fig. 1. Objects in LEO orbit by altitude per 10 km altitude bin. Elliptical orbit objects distributed by portion spent in each bin. Some notable existing resident systems are listed on the right. New residents, including some replacement systems, are on the left. (For interpretation of the references to color in this figure, the reader is referred to the web version of this article.) The red line of the current catalog does not represent the complete risk; it indicates the risk we can track and perhaps avoid. A rule of thumb is that the current SSN LEO catalog contains objects about 10 cm or larger. It is generally accepted that an impact in LEO with an object 1 cm or larger will cause damage likely to be fatal to a satellite's mission. Therefore, there is a large latent risk from unobserved debris. While we cannot currently track and catalog much smaller than 10 cm, experiments have been performed to detect and sample much smaller objects and statistically model the population at this size [3]. The (solid) blue line represents the model of the 1 cm and larger debris that is likely mission-ending, usually called lethal but not trackable. If LEO operators avoid collisions with all the objects in the red line, they are nonetheless inherently accepting the risk from the blue line. This risk is already present. The (dashed) orange line is an estimate of the population at 5 cm and larger and is thus an estimate of what the catalog might conservatively be a few years after the Space Fence, a new radar system being built by the Air Force, comes on line (currently planned for 2019) [4]. Commercial companies offering space surveillance services, such as LeoLabs, ExoAnalytics, Analytic Graphics Inc., Lockheed, and Boeing, might also add to the number of objects currently tracked. Space Policy Directive 3 (SPD-3) [13] specifically seeks to expand the use of commercial SSA services. Existing operators can expect a sharp increase in the number of warnings and alerts they will receive because of the increase in the cataloged population. Almost all the increase will come from newly detected debris [5]. The pace of safety operations for each satellite on orbit will significantly change because of the increase in the catalog from the Space Fence. This effect is compounded because the NewSpace constellations described in Table 1 will drastically change the profile of satellites in LEO. The green bars in Fig. 1 represent the number of objects that will be added to the catalog (red or orange lines) from only the NewSpace large LEO constellations at their operational altitudes. This does not include the rocket stages that launch them, or satellites in the process of being phased into or removed from the operational orbits. Neighbors of one of these new constellations may face a radically different operations environment than their current practices were designed to address. Satellites in these large LEO constellations typically have planned operational lifetimes of 5–10 years. Some companies have proposed to dispose of their satellites using low thrust electric propulsion systems, which would spiral satellites down over a period of months or years from operating altitudes as high as 1500 km through lower orbits where the Hubble Space Telescope, the International Space Station, and other critical LEO satellites operate [6]. Similar propulsive techniques would raise replacement satellites from lower launch injection orbits to higher operational orbits. These disposal and replenishment activities will add thousands of satellites each year transiting through lower altitudes and posing a risk to all resident satellites in those lower orbits. More importantly, failures will occur both among transiting satellites and operational constellations, potentially leaving hundreds more stranded along the transit path. Aerospace studies [7–9] have shown that failed satellites, whether they fail during operations or fail during disposal, can pose as great or even greater risk than the many thousands of operational satellites (Fig. 2). Given the rapid flux in the proposed large LEO constellations (LLC), we created a Future Constellations Model (FCM) with elements that represented the characteristics of the different systems being proposed. In our models, almost all the collisions and the resulting debris from those collisions occur because of failed systems. Most large constellation operators intend to perform active collision avoidance for active systems, whether operational or in some stage of check-out or disposal, but failed satellites are assumed to be incapable of maneuver. Fig. 2 also shows that satellites in the disposal phase can contribute to collisions similarly to satellites in the operational phase. Fig 2 Download : Download full-size image Fig. 2. Collisions during operations and disposal over 10 years for various NewSpace Future Constellation Models (FCMs). 4. A notional illustration of workload The highest risk to operational satellites comes from the lethal but non-trackable debris that is depicted in the blue line in Fig. 2. However, operators perform collision avoidance only on the objects that can be tracked and cataloged. Advances in tracking and NewSpace launches will both act to increase this workload. A key element of the problem is that an increase in the LEO population will lead to an increase in close approaches to existing satellites [5], and the potential for accidental collisions. Conjunction prediction, collision probability (Pc), and maneuver planning for most existing satellite operators is a time- and personnel-intensive operation. Orbit analysts, and propulsion, navigation, and communications systems personnel are involved in evaluating and planning maneuvers over several days and must do so even if the ultimate decision is to “fly through” a close approach. Since most existing systems have small numbers of vehicles and the number of conjunctions any given operator experiences is relatively small, COLA remains a manual process. For systems not designed with automated maneuver planning, a COLA assessment that progresses all the way to a maneuver plan can consume considerable effort, whether or not the maneuver is executed. If a large constellation is deployed next to an existing resident system, the existing system may experience many conjunctions and alerts due to its close proximity of the dense new constellation. A sufficiently large constellation will, in effect, form a “shell” where frequent opportunities for conjunctions will be created. For example, Fig. 3 depicts a fictional scenario where 1225 “New” satellites are distributed in 35 planes in circular orbits at 1000 km altitude, at 98° inclination. These are placed near a hypothetical “Old” six-satellite constellation operating in a nearly circular orbit at the same altitude and 63° inclination. Following a common operations practice, we assume that the Old satellite operators flag a conjunction at Pc> 10−7, start COLA assessment with additional tracking at Pc> 10−6, and plan a COLA maneuver when the Pc> 10−5. A conjunction with Pc > 10−4 would typically be considered a significant risk leading most operators to maneuver. Fig 3 Download : Download full-size image Fig. 3. “New” large LEO constellation at same average altitude as “Old” existing constellation. Currently, the Old system in this example would typically see a warning (Pc > 10−6) a few times a month at this altitude, and of those, a few per year might cross the maneuver threshold. For the operations center, this would be multiplied by the number of satellites in the constellation. When the New system parks nearby, the number of COLA alerts jumps substantially. But the number of alerts depends entirely on the error bubble, (covariance) used. If the typical errors of the public external tracking data and the orbit propagation methods that are widely available (General Perturbations, or GP) are used for both constellations, over a 30-day period we see 129 conjunctions that cross the threshold for COLA assessment (Pc> 10−6), and 53 that cross the maneuver planning threshold (Pc> 10−5) (Fig. 4). This is nearly 2 per day. This could be an enormous workload for a manual process. If a high accuracy catalog (Special Perturbations, or “SP”) and a high-fidelity propagator with its typical covariances is used, the number of conjunctions goes from 129 to a more manageable 10. SP data is maintained by the Air Force, but it is not widely available. It is interesting to note that nine of those 10 crossed the maneuver-planning threshold, and of those, four crossed the Pc> 10−4 where many operators would choose to execute a maneuver. Compared to GP, the SP-quality data resulted in far fewer warnings and flagged four very close conjunctions. The operations center would have been able to concentrate on fewer “false alarms”. We also computed the case where GPS-quality owner-operator data was used for both systems, in which we assumed near-real-time owner-operator position data of very high quality was provided by both operators and used in the collision analysis. In this case, NONE of the conjunctions resulted in a warning and no COLA alerts were generated. The closest approach was 99 m, with a Pc of 3.7 × 10−7 using SP. But because of the quality of the GPS-based position data, this conjunction did not raise an alert because the fully-informed operators could be confident that a collision would not occur. Fig 4 Download : Download full-size image Fig. 4. Number of COLA alerts in 30 days for various qualities of position knowledge when a fictional new system is deployed near an existing one. In the example, an operations center for the Old constellation of six satellites could go from about one COLA assessment a week to nearly one per day per satellite, if only the published satellite catalog is available. If a new constellation operates too close to an existing system, the operator workload may become unreasonable using existing processes. But high accuracy data makes this manageable, and GPS-quality owner-operator data for both systems makes the problem vanish. Since these constellations are likely to be operated by different companies or governments, sharing high-quality position data would likely require an active space traffic management organization. Existing operators will not necessarily have large constellations parked nearby, but they will nonetheless be affected by the new activity. The new large constellations’ satellites typically will have relatively short lifetimes and will need frequent replenishment. The traffic transiting up and down will be substantial, and failures could leave stranded objects at intermediate altitudes, permanently increasing the collision risk. 5. Conjunction warning overload NewSpace operators will face a different challenge due to the vast increase in numbers of satellites. While there are likely as many operational plans as there are operators, a large constellation must consider close approaches with itself. Even if there are no neighboring systems, self-conjunctions can occur between two members of the same constellation. Depending on the configuration, a given operator could see hundreds to thousands of self-conjunctions that cross typical warning thresholds each day using current practices. This could be an issue for a space traffic management (STM) agency, even if it is not an issue for the operator. Aerospace models show that for one possible NewSpace constellation, more than 500,000 self-conjunctions each year could result that cross the typical Pc > 10−6 warning threshold. If no action were taken, we would expect 2–3 collisions per year. This is clearly unacceptable. Thus, current tracking accuracy and processes might produce millions of warnings per year for NewSpace operators to prevent half a dozen actual collisions. Under current practices operators would need to sort through an enormous haystack to find the needles, and because a handful of actual collisions will occur, the warnings cannot be ignored.

#### Feedback loops of technology causes increasing development and debris.

Bernat 20 – Pawel, 2020, Military University of Aviation, [“ORBITAL SATELLITE CONSTELLATIONS AND THE GROWING THREAT OF KESSLER SYNDROME IN THE LOWER EARTH ORBIT,” SAFETY ENGINEERING OF ANTHROPOGENIC OBJECTS, Volume 4, PDF] Justin

The second decade of the 21st century has brought a dynamic and somewhat surprising development of the space industry. Since 1972 – the Apollo 17 crew mission to the Moon, the humankind has not left the safe environment of Earth’s orbit, and for years the global space sector has been progressing in slow but steady pace run by a few largest space agencies like American NASA, European ESA, Japanese JAXA, and Chinese CNSA. The most significant achievement of the “old ways” of managing outer space exploration is the International Space Stations (ISS) that has facilitated more than 20 years of continuous crewed operations. The situation started to change at the turn of the century when new generations of private entrepreneurs began to invest in and develop space technologies like rocket boosters, spaceships, and what most important for the subject of the paper – satellites and their constellations. This new shift is known among the space industry as “Space 2.0”, and its emergence is dated around 2000-2002 when the companies like SpaceX, Blue Origin, and Virgin Galactic were established. (Pyle, 2019). The real change, however, came in 2012 when the first SpaceX commercial mission was successfully launched to the ISS (NASA, 2012). Since then, the participation of the private sector in the space industry has skyrocketed, especially in the United States. Today, SpaceX is the only entity that provides reusable rockets (first stage and fairings) that is capable of vertical launch and landing. Their current flagship rocket – Falcon 9 has carried out 23 successful missions in 2020 (SpaceX, 2020) and another four are planned for December of that year (Weitering, 2020). Moreover, thanks to Crew Dragon spaceship developed by the company, Americans have regained this year the capacity of sending astronauts from their own soil after nine years of buying the seats on Russian Soyuz capsule. SpaceX is now in the process of building a communication satellites constellation that will be addressed and analyzed in the paper. Nowadays, in the space industry, we witness a very productive cybernetic feedback look between the development of space technologies, the democratization of those technologies, and a substantial reduction of prices. The latter is even more significant if we compare the cost of launching cargo into orbit now and 20 years ago – Falcon 9 is over ten times cheaper than Space Shuttle (Jones, 2018). This, of course, directly translates into the mass and number of objects that we are able to put in the orbit viably. Once the constellations consisting of thousands of satellites were unthinkable, but in the current environment, they become a reality. Space 2.0 also has brought new threats and challenges in the sphere of national and international security. The increase in launch capacity, among other factors, has led to progressive militarization and weaponization of space and new arms race (Bernat, 2019), which has also contributed to the growing numbers of orbiting objects. The goal of the paper is to present the argumentation that the threat posed by the cascading collisions in the Earth’s orbit (Kessler syndrome) is becoming more severe due to the construction of orbital satellite constellations; the threat that presents a real danger for people during their EVAs and orbital infrastructure, which may bare immediate consequences for safety and security systems on Earth. In order to provide the theoretical context for the above claim, the following issues will be presented and discussed: (1) space debris, (2) the Kessler syndrome, (3) orbital debris models, (4) the legal issues related to space debris and mitigation actions against their proliferation, and (5) the planned and being currently developed orbital satellite constellations and how they contribute to the growing threat of the Kessler syndrome.

#### Invisible tipping points trigger the Kessler Syndrome.

Thompson 21 – Clive, 11/17/21, Clive Thompson is a contributing writer for the New York Times Magazine, a columnist for Wired and Smithsonian magazines, and a regular contributor to Mother Jones. He’s the author of Coders: The Making of a New Tribe and the Remaking of the World, and Smarter Than You Think: How Technology is Changing our Minds for the Better. He’s @pomeranian99 on Twitter and Instagram, [“Get Ready for the “Kessler Syndrome” to Wreck Outer Space,” OneZero, <https://onezero.medium.com/get-ready-for-the-kessler-syndrome-to-wreck-outer-space-7f29cfe62c3e>] Justin

Back in 1978, the astrophysicist Donald Kessler made an alarming prediction: Space junk could wreck our ability to keep satellites aloft. In a fascinating paper, Kessler noted that “low earth orbit” — a region between 99 miles and 1,200 miles up — was getting pretty crowded. In 1978 there were already 3,866 objects being tracked in space. That included satellites used by scientists (say, to monitor weather) or spy agencies. It also included a lot of debris: Every time a rocket launches a satellite into orbit, it tends to leave stray bits of material. The thing is, when objects are zooming through space about 2 km/s, even something as tiny as a chip of paint can smash through glass or steel. Pieces of debris become bullets. What Kessler predicted is that sooner or later, objects in low-earth orbit would start colliding, and produce chain effects, like billiard balls colliding on a crowded pool table. If a piece of debris hit a satellite, it would produce more debris, which would to increase the risk of other collisions … and so on, and so on. At some point, you could reach a tipping point. There’d be so many chunks of debris that collisions would be inevitable, leaving low-earth orbit a junkyard where no satellites could survive. Remember the scene in Wall-E where they blast off Earth, and the planet is utterly ringed with crap? That’s what Kessler worried about. Except in our situation the pieces of junk could be quite small — billions of objects the size of grains of sand, which is actually a lot harder to deal with, because you can’t see it coming. In essence, Kessler predicted we could create an artificial asteroid belt of junk: The result would be an exponential increase in the number of objects with time, creating a belt of debris around the earth. This process of mutual collisions is thought to have been responsible for creating most of the astroids from larger planetlike bodies. Space folks began calling this the “Kessler Syndrome”. It was hard to predict when this might start happening. Kessler worried that conditions could be ripe by as early as 2000. Thankfully, that estimate turned out to be premature. But wow, it looks like it might happen soon. What’s happened recently that makes the “Kessler Syndrome” more likely? A couple of things: Way more satellites are going up The pace at which satellites are going up in the sky is simply exploding. Back when Kessler wrote his paper in 1978, we humans were launching about 53 new satellites a year. Going to space was hard. But now launches are an order of magnitude more common, and they’re increasing in pace rapidly. SpaceX in particular is launching oodles of satellites as it builds its orbital Internet-access service Starlink. In the last two years, it has put 1,740 satellites in low-earth orbit, with plans to eventually shoot 30,000 up there. This is part of a larger trend, which is … The privatization of outer space The private sector is rapidly becoming the dominant actor in space. There’s a huge demand for satellite data — everyone wants better info about weather, crops, traffic patterns, tree coverage, emissions, you name it, on top of the explosive use of satellites for communication and Internet. SpaceX’s remarkable innovations in rocketry (the leading folks, though others are following in their footsteps) have made it cheaper than ever to get a satellite into orbit. It is unlocking a huge pent-up demand for near-earth-orbit tech. More launches mean not only more intentional objects in orbit but unintentional ones — bits of rocket parts and detritus from launches.

#### Privatization exponentially increases the curve but ending dangerous missions stops it.

Bernat 20 – Pawel, 2020, Military University of Aviation, [“ORBITAL SATELLITE CONSTELLATIONS AND THE GROWING THREAT OF KESSLER SYNDROME IN THE LOWER EARTH ORBIT,” SAFETY ENGINEERING OF ANTHROPOGENIC OBJECTS, Volume 4, PDF] Justin

5. Orbital satellite constellations and the growing threat of the Kessler syndrome Space 2.0 – the new era of space exploration that we witness now in the 21st century means, in words of Buzz Aldrin, “moving human enterprise into space” (Pyle, 2019, p. xiv). The process of commercialization of outer space has already begun and is not limited to private companies providing technologies and services for national or international space agencies, as it was in the past. On the contrary, private companies from the space sector have now matured to carry out their own independent projects. As for 2020, SpaceX is a company that serves as the best example – it launches satellites to the orbit, both for state and private contractors, it successfully realized two crew missions to the International Space Station, and is in the process of constructing Starlink satellite constellation that will provide high-speed internet access across the planet. Each satellite weighs around 260 kg, is equipped with an ion propulsion system, autonomous collision avoidance system, and orbits Earth at approximately 540-560 km altitude (Starlink, 2020). At the beginning of November 2020, more than 860 Starlink satellites were orbiting the Earth (Jewett, 2020). Immediate plans include launching 12,000 satellites, but they assume a potential later extension to 42,000 (Henry, 2019a). Of course, SpaceX has employed, at least declaratively, all necessary measures to keep the space clean – the satellites are equipped with the deorbiting system, and in the event of inoperability of the propulsion system (Starlink, 2020). The orbital collisions are, however, inevitable. As it was shown before, the possibility of collisions grows with the number of orbital objects. Bastida Virgili with the team compared (2016, p. 154-155) orbital debris environment development without and with a large hypothetical constellation consisting of merely 1080 satellites, distributed across 20 orbital planes at 1,100 km altitude (Fig. 5).

Chart, line chart

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It has to be noted that although SpaceX’s Starlink is the only constellation that is being built in orbit, it is not the only one planned. There are at least a few initiatives aiming at the same goal – to construct internet infrastructure at the Earth’s orbit. The planned Kuiper Systems LLC, which is a subsidiary of Amazon and intends to place 3,236 broadband satellites in the LEO, is one of Starlink’s biggest competitors (Henry, 2019b). Now, there is even a rivalry between the two companies because Kuiper’s lowest orbital shell is planned to be 590 km, with a tolerance of 9 km either above or below (Cao, 2020), which is the altitude of Starlink satellites. Moreover, the race for space in orbit is now at the beginning. The outer space is vast. It increasingly becomes more cluttered with both operational satellites and space debris. The threat of collisions increases and no institution or body has enough power to license, coordinate and regulate what is sent to the orbit. The UNOOSA has not such power. National states decide what the companies from the space industry can launch to space. In the United States, which is most advanced in the area of private constellations, it is the Federal Aviation Administration (FAA) that issues the appropriate approvals. The race to put broadband internet satellites bears similarities to the gold rush – there are no rules, at the global level, apart from first-come, first-served.

#### Models are rigorous and robust.

---To clarify this is the methodology for above chart.

Virgili et al. 16 – Bastida, J.C. Dolado, H.G. Lewis, J. Radtke, H. Krag, B. Revelin, C. Cazaux b , C. Colombo, R. Crowther, M. Metz, 4/26/16, [“Risk to space sustainability from large constellations of satellites,” Act Astranautica, <https://sci-hub.se/10.1016/j.actaastro.2016.03.034>.] Justin

1.3. Simulation approach and result analysis A Monte Carlo (MC) approach was used to simulate the evolution of the object population over a period of 200 years under different post-mission disposal requirements, with four different tools (MEDEE – Modelling the Evolution of Debris on Earth's Environment [9], LUCA – Long Term Utility for Collision Analysis [10], DAMAGE – Debris Analysis and Monitoring Architecture to the Geosynchronous Environment [11] and DELTA – Debris Environment Long Term Analysis [12]). For analysis purposes, the effective number of objects was used where the contribution to the population by each object was weighted by the proportion of the orbital period spent in LEO. In a first step, four different evolutionary models performed an analysis of two reference scenarios. One scenario considered only the evolution of the background population and non-constellation traffic. The second scenario augmented the first with the addition of the representative constellation, with the requirement that 90% of the constellation satellites achieved post-mission disposal to orbits with remaining lifetimes of 25 years. The manoeuvres performed at the mission end to meet the disposal requirement are assumed to be impulsive (i.e. instantaneous) and result in an eccentric orbit with the apogee near the original (constellation) altitude and the perigee at an altitude such that the effects of atmospheric drag would cause the orbit to decay within 25 years. Two of the models considered an apogee remaining at the operational constellation altitude, while the other two reduced the apogee by 50 km. The purpose of these scenarios is to provide a cross-comparison of the models in terms of their predictions of the total object population, which take into account the effects of the constellation. As the distribution of the MC results for the models is of the same nature and the results are independent, a bootstrapping [20] approach is used to derive the mean, the standard deviation and the confidence levels at 95% of the combined results of all the MC runs from the four models (cf. Fig. 1), although not all the models performed the same number of MC runs (see Table 1). The main source of variation inside a particular model's MC runs included the randomness in collision activity, while the different models used their own solar activity forecast.

#### Debris triggers miscalculated war.

Peter Dockrill 16. Award-winning science & technology journalist. “Space Junk Accidents Could Trigger Armed Conflict, Study Finds.” <https://www.sciencealert.com/space-junk-accidents-could-trigger-armed-conflict-expert-warns>.

The increasingly crowded space in Earth's low orbit could set the stage for an international armed conflict, says a new study. Researchers from the Russian Academy of Sciences warn that accidents stemming from the steady rise in space junk floating around the planet could incite political rows and even warfare, with nations potentially mistaking debris-caused incidents as the results of intentional aggressive acts by others. In a paper published in Acta Astronautica, the team suggests that space debris in the form of spent rocket parts and other fragments of hardware hurtling at high speed pose a "special political danger" that could dangerously escalate tensions between nations. According to the study, destructive impacts caused by random space junk cannot easily be told apart from military attacks. "The owner of the impacted and destroyed satellite can hardly quickly determine the real cause of the accident," the authors write. The risks of such an event occurring are compounded by the sheer volume of debris now orbiting Earth. Recent figures from NASA indicate that there are more than 500,000 pieces of space junk currently being tracked in orbit, travelling at speeds up to 28,160 km/h (17,500 mph). The majority of those objects are small – around the size of a marble – but some 20,000 of them are bigger than a softball. In addition to these 500,000 or so fragments – which are big enough for scientists to know about them – NASA estimates that there are millions of undetectable pieces of debris in orbit that are too small to be monitored. But even extremely small fragments such as these pose a threat – in fact, they're considered a greater risk than trackable debris, as their invisible status means spacecraft and satellites can't do anything to avoid them until it's too late. As NASA observed in 2013: "Even tiny paint flecks can damage a spacecraft when travelling at these velocities. In fact a number of space shuttle windows have been replaced because of damage caused by material that was analysed and shown to be paint flecks… With so much orbital debris, there have been surprisingly few disastrous collisions." While we may have been lucky in the past, we can't rely on that to continue. The study by the Russian team cites the repeated sudden failures of defence satellites in past decades that were never explained. The researchers attribute two possible causes: either unrecorded collisions with space junk, or aggressive actions from adversaries. "This is a politically dangerous dilemma," the authors write.

#### Specifically---China, Iran, and Noko.

Beauchamp 14 – Zack, 4/21/14, Zack Beauchamp is a senior correspondent at Vox, where he covers global politics and ideology, and a host of Worldly, Vox's podcast on foreign policy and international relations. His work focuses on the rise of the populist right across the West, the role of identity in American politics, and how fringe ideologies shape the mainstream. Before coming to Vox, he edited TP Ideas, a section of Think Progress devoted to the ideas shaping our political world. He has an MSc from the London School of Economics in International Relations and grew up in Washington, DC, where he currently lives with his wife, daughter, and two (rescue) dogs [“How space trash could start a nuclear war,” Vox, <https://www.vox.com/2014/4/21/5625246/space-war-china-north-korea-iran>] Justin \*Brackets added for ableist language

If debris from a Chinese test destroys a US military satellite, the US could mistake it as a preemptive strike against its space capabilities — some of which are designed to detect nuclear missile launches. If the US thinks China is trying to take out its ability to detect a nuclear launch, things could get very bad, very quickly. Accidents aren't the only concern. Zenko also worries about intentional space attacks, either during peacetime or a crisis. Here, Iran and North Korea are probably bigger threats, though their ASAT capabilities are far from proven. North Korea has a pattern of ~~crazy~~ [irrational] military moves designed to extort concessions from South Korea and the West; it could extend that behavior to space. Iran, according to Zenko, "already views space as a legitimate arena in which to contest US military power." He worries that Iran might fire missiles into space "during a major crisis, especially if it believes war is imminent — an assessment that could have self-fulfilling consequences."

#### Public pressure forces retaliation.

Nancy Gallagher 15. Interim director of the Center for International and Security Studies in Maryland, previous Executive Director of the Clinton Administration’s CTBT Treaty Committee, an arms control specialist at the State Dept., and a faculty member at Wesleyan, “Antisatellite warfare without nuclear risk: A mirage,” May 29, Bulletin of Atomic Scientists, <http://thebulletin.org/space-weapons-and-risk-nuclear-exchanges8346>

In recent decades, however, as space-based reconnaissance, communication, and targeting capabilities have become integral elements of modern military operations, strategists and policy makers have explored whether carrying out antisatellite attacks could confer major military advantages without increasing the risk of nuclear war. In theory, the answer might be yes. In practice, it is almost certainly no. Hyping threats. No country has ever deliberately and destructively attacked a satellite belonging to another country (though nations have sometimes interfered with satellites' radio transmissions). But the United States, Russia, and China have all tested advanced kinetic antisatellite weapons, and the United States has demonstrated that it can modify a missile-defense interceptor for use in antisatellite mode. Any nation that can launch nuclear weapons on medium-range ballistic missiles has the latent capability to attack satellites in low Earth orbit. Because the United States depends heavily on space for its terrestrial military superiority, some US strategists have predicted that potential adversaries will try to neutralize US advantages by attacking satellites. They have also recommended that the US military do everything it can to protect its own space assets while maintaining a capability to disable or destroy satellites that adversaries use for intelligence, communication, navigation, or targeting. Analysis of this sort often exaggerates both potential adversaries’ ability to destroy US space assets and the military advantages that either side would gain from antisatellite attacks. Nonetheless, some observers are once again advancing worst-case scenarios to support arguments for offensive counterspace capabilities. In some other countries, interest in space warfare may be increasing because of these arguments. If any nation, for whatever reason, launched an attack on a second nation's satellites, nuclear retaliation against terrestrial targets would be an irrational response. But powerful countries do sometimes respond irrationally when attacked. Moreover, disproportionate retaliation following a deliberate antisatellite attack is not the only way in which antisatellite weapons could contribute to nuclear war. It is not even the likeliest way. As was clearly understood by the countries that negotiated the Outer Space Treaty, crisis management would become more difficult, and the risk of inadvertent deterrence failure would increase, if satellites used for reconnaissance and communication were disabled or destroyed. But even if the norm against attacking another country’s satellites is never broken, developing and testing antisatellite weapons still increase the risk of nuclear war. If, for instance, US military leaders became seriously concerned that China or Russia were preparing an antisatellite attack, pressure could build for a pre-emptive attack against Chinese or Russian strategic forces. Should a satellite be struck by a piece of space debris during a crisis or a low-level terrestrial conflict, leaders might mistakenly assume that a space war had begun and retaliate before they knew what had actually happened. Such scenarios may seem improbable, but they are no more implausible than the scenarios that are used to justify the development and use of antisatellite weapons.

#### Any nuclear war causes extinction – ice age and famine.

Steven Starr 15 [Director of the University of Missouri’s Clinical Laboratory Science Program, as well as a senior scientist at the [Physicians for Social Responsibility](http://www.psr.org/). He has worked with the Swiss, Chilean, and Swedish governments in support of their efforts at the United Nations to eliminate thousands of high-alert, launch-ready U.S. and Russian nuclear weapons. “Nuclear War: An Unrecognized Mass Extinction Event Waiting To Happen.” Ratical. March 2015. <https://ratical.org/radiation/NuclearExtinction/StevenStarr022815.html>] TG

A war fought with 21st century strategic nuclear weapons would be more than just a great catastrophe in human history. If we allow it to happen, such a war would be a mass extinction event that [ends human history](https://ratical.org/radiation/NuclearExtinction/StarrNuclearWinterOct09.pdf). There is a profound difference between extinction and “an unprecedented disaster,” or even “the end of civilization,” because even after such an immense catastrophe, human life would go on. But extinction, by definition, is an event of utter finality, and a nuclear war that could cause human extinction should really be considered as the ultimate criminal act. It certainly would be the crime to end all crimes. The world’s leading climatologists now tell us that nuclear war threatens our continued existence as a species. Their studies predict that a large nuclear war, especially one fought with strategic nuclear weapons, would create [a post-war environment in which for many years it would be too cold and dark to even grow food](http://climate.envsci.rutgers.edu/pdf/RobockToonSAD.pdf). Their findings make it clear that not only humans, but most large animals and many other forms of complex life would likely vanish forever in a nuclear darkness of our own making. The environmental consequences of nuclear war would attack the ecological support systems of life at every level. Radioactive fallout, produced not only by nuclear bombs, but also by the destruction of nuclear power plants and their spent fuel pools, would poison the biosphere. Millions of tons of smoke would act to [destroy Earth’s protective ozone layer](https://www2.ucar.edu/atmosnews/just-published/3995/nuclear-war-and-ultraviolet-radiation) and block most sunlight from reaching Earth’s surface, creating Ice Age weather conditions that would last for decades. Yet the political and military leaders who control nuclear weapons strictly avoid any direct public discussion of the consequences of nuclear war. They do so by arguing that nuclear weapons are not intended to be used, but only to deter. Remarkably, the leaders of the Nuclear Weapon States have chosen to ignore the authoritative, long-standing scientific research done by the climatologists, research that predicts virtually any nuclear war, fought with even a fraction of the operational and deployed nuclear arsenals, will leave the Earth essentially uninhabitable.

#### Satellites solves the grid and every extinction threat.

Pellegrino & Stang 16 --- Massimo Pellegrino, Master’s Degree in Space Studies from ISU, with Gerald Stang, Senior Associate Analyst at the EUISS, holds BSc and MSc degrees in chemical engineering from the University of Saskatchewan and an MA in international affairs from the School of International and Public Affairs at Columbia University (“Space Security for Europe”, *EU Institute for Security Studies*, published July 2016, <https://www.iss.europa.eu/content/space-security-europe>, accessed 7-10-2019) bm

Modern societies are highly dependent on the continuous operation of critical infrastructure to ensure the provision of basic goods and services. They consist of assets, systems or parts thereof which are so vital, that their disruption would significantly impact the economy, national security, public health, safety, or social well-being. Examples of critical infrastructure include energy, water, food supply, communication, transportation, and waste processing systems. Space assets are so deeply embedded in developed economies that a day without fully functioning space capabilities would severely restrict or even endanger our lives. Space systems are critical for running energy grids and telecommunication networks, border and maritime surveillance, crisis management and humanitarian operations, environmental and climate monitoring, verification of international treaties and arms control agreements, and the fight against organised crime and terrorism. Space assets also provide the technological backbone for other critical infrastructures. The synchronisation of power grids and telecommunication networks, for example, is heavily dependent on GNSS timing signals and any disruption would create a domino effect on other critical infrastructures (see Figure 5). Satellites also play a central role in supporting defence systems and military operations. They are force multipliers that provide intelligence, surveillance, and reconnaissance (ISR) capabilities, as well as communication, navigation, positioning and timing signals. Armed forces do not only use their own space systems, but are also significant consumers of space services provided by private operators. In fact, about 90% of US military communications traffic passes through civilian satellites, many of which privately owned, rather than through dedicated systems designed to withstand attempted interruptions.1 The reliance of both civilian and military users on space systems therefore places them firmly in the area of critical infrastructure. Some critical space systems, such as the American GPS, are under foreign control, and the governments controlling those systems retain the authority to disrupt services, even for allies, in case of a national emergency. While the United States announced that it has no intention of ever intentionally degrading public GPS signals (also known as ‘Selective Availability’) and that the next generation of GPS satellites will not include this feature, other governments might still do so.2 These dependences engender new and growing vulnerabilities. Reliance on space is likely to increase further as space capabilities and services improve in diversity, quality and affordability. Close to 1,500 satellites with a launch mass of over 50 kg are expected to be launched over the next decade; an increase of 50% compared to 2005-2014. This estimate excludes both the expected proliferation of smaller satellites (such as CubeSats), but also the planned OneWeb and Steam mega-constellations for global internet broadband service. Advances in small satellite capabilities and in launch technology (e.g. SpaceX’s Falcon rocket family) have already lowered the cost of access to space. About 45% more CubeSats were launched in 2014 than in 2013 (130 vs. 91), accounting for 63% of all satellites launched3 . However, just as the reliance on space increases, so too do threats and vulnerabilities. Therefore, in order to realise the full potential of investments in space, critical space systems need to be adequately protected and the space environment properly managed.

#### Grid collapse causes extinction.

Friedemann 16 --- Alice, transportation expert, founder of EnergySkeptic.com, citing Dr Peter Vincent Pry, executive director of the Task Force on National and Homeland Security, a Congressional advisory board dedicated to achieving protection of the United States from electromagnetic pulse and other threats, (“Electromagnetic pulse threat to infrastructure (U.S. House hearings)”, 1-24-2016, <http://energyskeptic.com/2016/the-scariest-u-s-house-session-ever-electromagnetic-pulse-and-the-fall-of-civilization/>)

Modern civilization cannot exist for a protracted period without electricity. Within days of a blackout across the U.S., a blackout that could encompass the entire planet, emergency generators would run out of fuel, telecommunications would cease as would transportation due to gridlock, and eventually no fuel. Cities would have no running water and soon, within a few days, exhaust their food supplies. Police, Fire, Emergency Services and hospitals cannot long operate in a blackout.Government and Industry also need electricity in order to operate. The EMP Commission warns that a natural or nuclear EMP event, given current unpreparedness, would likely result in societal collapse.

#### Externally, acidification.

Land et al 15 --- Phys.org, citing a study sanctioned by the University of Exeter by [Peter E. Land](https://pubs.acs.org/action/doSearch?field1=Contrib&text1=Peter+E.++Land), [Jamie D. Shutler](https://pubs.acs.org/action/doSearch?field1=Contrib&text1=Jamie+D.++Shutler), [Helen S. Findlay](https://pubs.acs.org/action/doSearch?field1=Contrib&text1=Helen+S.++Findlay), [Fanny Girard-Ardhuin](https://pubs.acs.org/action/doSearch?field1=Contrib&text1=Fanny++Girard-Ardhuin), [Roberto Sabia](https://pubs.acs.org/action/doSearch?field1=Contrib&text1=Roberto++Sabia), [Nicolas Reul](https://pubs.acs.org/action/doSearch?field1=Contrib&text1=Nicolas++Reul), [Jean-Francois Piolle](https://pubs.acs.org/action/doSearch?field1=Contrib&text1=Jean-Francois++Piolle), [Bertrand Chapron](https://pubs.acs.org/action/doSearch?field1=Contrib&text1=Bertrand++Chapron), [Yves Quilfen](https://pubs.acs.org/action/doSearch?field1=Contrib&text1=Yves++Quilfen), [Joseph Salisbury](https://pubs.acs.org/action/doSearch?field1=Contrib&text1=Joseph++Salisbury), [Douglas Vandemark](https://pubs.acs.org/action/doSearch?field1=Contrib&text1=Douglas++Vandemark), [Richard Bellerby](https://pubs.acs.org/action/doSearch?field1=Contrib&text1=Richard++Bellerby), and [Punyasloke Bhadury](https://pubs.acs.org/action/doSearch?field1=Contrib&text1=Punyasloke++Bhadury) ("Satellite images reveal ocean acidification from space," 2-17-2015, https://phys.org/news/2015-02-satellite-images-reveal-ocean-acidification.html, accessed 8-24-2019) bm

Pioneering techniques that use satellites to monitor ocean acidification are set to revolutionise the way that marine biologists and climate scientists study the ocean. This new approach, that will be published on the 17 February 2015 in the journal Environmental Science and Technology, offers remote monitoring of large swathes of inaccessible ocean from satellites that orbit the Earth some 700 km above our heads. Each year more than a quarter of global CO2 emissions from burning fossil fuels and cement production are taken up by the Earth's oceans. This process turns the seawater more acidic, making it more difficult for some marine life to live. Rising CO2 emissions, and the increasing acidity of seawater over the next century, has the potential to devastate some marine ecosystems, a food resource on which we rely, and so careful monitoring of changes in ocean acidity is crucial. Researchers at the University of Exeter, Plymouth Marine Laboratory, Institut français de recherche pour l'exploitation de la mer (Ifremer), the European Space Agency and a team of international collaborators are developing new methods that allow them to monitor the acidity of the oceans from space. Dr Jamie Shutler from the University of Exeter who is leading the research said: "Satellites are likely to become increasingly important for the monitoring of ocean acidification, especially in remote and often dangerous waters like the Arctic. It can be both difficult and expensive to take year-round direct measurements in such inaccessible locations. We are pioneering these techniques so that we can monitor large areas of the Earth's oceans allowing us to quickly and easily identify those areas most at risk from the increasing acidification." Current methods of measuring temperature and salinity to determine acidity are restricted to in situ instruments and measurements taken from research vessels. This approach limits the sampling to small areas of the ocean, as research vessels are very expensive to run and operate. The new techniques use satellite mounted thermal cameras to measure ocean temperature while microwave sensors measure the salinity. Together these measurements can be used to assess ocean acidification more quickly and over much larger areas than has been possible before. Dr Peter Land from Plymouth Marine Laboratory who is lead author of the paper said: "In recent years, great advances have been made in the global provision of satellite and in situ data. It is now time to evaluate how to make the most of these new data sources to help us monitor ocean acidification, and to establish where satellite data can make the best contribution." A number of existing satellites can be used for the task; these include the European Space Agency's Soil Moisture and Ocean Salinity (SMOS) sensor that was launched in 2009 and NASA's Aquarius satellite that was launched in 2011. The development of the technology and the importance of monitoring ocean acidification are likely to support the development of further satellite sensors in the coming years.

#### Extinction.

Merchant 15 (Brian, Senior Editor, Motherboard at VICE Media, Inc. He’s appeared on CNN, MSNBC, BBC World News, and NPR, VICE, April 9, 2015, http://motherboard.vice.com/read/the-last-time-our-oceans-got-this-acidic-it-drove-earths-greatest-extinction)

The biggest **extinction** event in planetary history was driven by the rapid acidification of our oceans, a **new study** concludes. So much carbon was released into the atmosphere, and the oceans absorbed so much of it so quickly, that marine life simply died off, from the bottom of the food chain up. That doesn’t bode well for the present, given the disturbingly similar rate that our seas are acidifying right now. Parts of the Pacific, for instance, are already so acidic that sea snails’ shells begin dissolving as soon as they’re born. The biggest die-off in history, the Permian Extinction event, aka the Great Dying, extinguished over 90 percent of the planet's species—and 96 percent of marine species. A lot of theories have been put forward about why and how, exactly, the vast majority of Earth life went belly up 252 million years ago, but the new study, published in Science, offers some compelling evidence acidification was a key driver. A team led by University of Edinburgh researchers collected rocks in the United Arab Emirates that were on the seafloor hundreds of millions of years ago, and used the boron isotopes found within to model the changing levels of acidification in our prehistoric oceans. Through this “combined geochemical, geological, and modeling approach,” the scientists say, they were able to accurately model the series of “perturbations” that unfolded in the era. They now believe that a series of gigantic volcanic eruptions in the Siberian Trap spewed a great fountain of carbon into the atmosphere over a period of tens of thousands of years. This was the first phase of the extinction event, in which terrestrial life began to die out. The study explains that the second phase of the event happened much more quickly. “During the second extinction pulse, however, a rapid and large injection of carbon caused an abrupt acidification event that drove the preferential loss of heavily calcified marine biota," the authors write. So does this study mean we should be especially worried about the phenomenon taking hold today? "**Yes**," said Dr. Rachel Wood, a professor of carbonate geoscience at the University of Edinburgh and one of the paper's authors. "We are concerned about modern ocean acidification," she told me in an email. "Although the amount of carbon added to the atmosphere that triggered the mass extinction was probably greater than today's fossil fuel reserves, the **rate** at which the carbon was released was at a rate similar to modern emissions." In other words, the Siberian Traps probably spewed out more carbon in total, but we're spewing out just as fast. And that's **overwhelming** the **planetary equilibrium**. "This fast rate of release was a critical factor driving ocean acidification," Wood said. Why? "The rate of release is critical because the oceans absorb a lot of the carbon dioxide (CO2) from the atmosphere, around 30 percent of the carbon dioxide **released by humans**," Wood said. "To achieve chemical equilibrium, some of this CO2 reacts with the water to form carbonic acid. Some of these molecules react with a water molecule to give a bicarbonate ion and a hydronium ion, thus increasing ocean 'acidity' (H+ ion concentration)." Marine animals whose skeletons are comprised of calcium carbonate—and that’s a lot of them (think snails, coral), which form **a crucial part** of the food chain—dissolved or couldn’t form in the first place. And that is what’s happening today. "Between 1751 and 1994, surface ocean pH is estimated to have decreased from approximately 8.25 to 8.14, representing an increase of almost 30 percent in H+ ion concentration in the world's oceans," Wood said. That's a major uptick in ocean acidity in a relatively short amount of time, and it's happening because **humans** have **burned fossil fuels** like coal, oil, and gas with **reckless abandon** since the Industrial Revolution. That's fueling climate change, of course, as well as its less-discussed, but potentially **equally cataclysmic** sibling, **ocean acidification**. "Scientists have long suspected that an ocean acidification event occurred during the greatest mass extinction of all time, but direct evidence has been lacking until now,” study coordinator Dr. Matthew Clarkson said in a statement. “This is a worrying finding, considering that we can already see an increase in ocean acidity today that is the result of human carbon emissions." Much of marine life is already **in grave danger** from acidification. It's contributing to the **bleaching of coral reefs** around the world, and, as mentioned before, it's **killing sea snails** in the Pacific. If it worsens, **acidification** could **threaten the** whole of the marine biosphere, and, obviously, the land-dwelling creatures that depend on it too. In 2013, marine scientists released a "State of the Oceans" report that found that the rate of current acidification was “unprecedented.” They noted that the seas were acidifying faster than any point in the last 300 million years. That study didn’t take into account the new data, of course, but that’s the timeline we’re dealing with: The last time the oceans were so acidic was in the midst of the greatest **extinction** in the history of the world.

## Plan

#### Plan – The appropriation of outer space through the production of space debris by private entities is unjust.

#### Revising the Outer Space Treaty curbs the impact of space debris – timeframe is crucial.

Shah 20 – Sachin, 8/30/20, [“Aug 30 The International Legal Regulation of Space Debris,” CORNELL UNDERGRADUATE LAW & SOCIETY REVIEW, Administrative, Policy, Technology, <https://www.culsr.org/articles/the-international-legal-regulation-of-space-debris>] Justin

In this article, I have demonstrated that the existing laws and regulations pertaining to space debris are best captured in the Outer Space Treaty of 1967. While many scholars do believe that Articles VII and IX of the Treaty does provide basic accountability for space debris, many also agree that its vague, non-technical legal language creates problems in mitigating the ever-growing problem of space debris in orbit around Earth. Despite this lack of legal clarity, some scholars have proposed solutions to the space debris issue. Some have simply called for a revised, specific version of the Outer Space Treaty. Others have recommended implementing an entire regulatory regime with the authority to create laws which specifically pertain to holding actors accountable for space debris production. While lawmakers have yet to update the existing regulations regarding space debris, more effective space debris mitigation techniques lie in the private sector. The profit-based incentives of private satellite companies ensure their responsibility in and around Earth's orbit. In the example of SpaceX, the loose legal regulations of satellite use by the FCC and the ITU have allowed the company to send thousands of satellites into orbit. We live in a different world today than we did in 1967. In order to maintain our current safety and our future ability to voyage outer space, stronger legal frameworks must be created to prevent the uncontrollable expansion of space debris around Earth. Used effectively, legal action can accomplish these goals, but lack thereof may result in disaster.

#### Exemptions destroy the coercive power of legal regimes – causes circumvention across the board.

Hickman and Dolman 2 – John and Everett, 2002, Associate professor in the Department of Government and International Studies at Berry College in Mt. Berry, [“Resurrecting the Space Age: A State–Centered Commentary on the Outer Space Regime,” Volume 21 Number 1, <https://doi.org/10.1080/014959302317350855>] Elmer Recut Justin

Thus a state party need merely announce its intention to withdraw and then wait one year. Withdrawal of a single state party to the treaty, however, would not necessarily terminate the treaty between the other state parties. Yet, the decision of an important state not to be bound by a regime–creating treaty obviously endangers the entire treaty. The decision of the United States or China to withdraw from the OST would have far greater implications for the survival of the international space regime than the same decision by Bangladesh, Burkina Faso, or Papua New Guinea—the equality of states under international law remains nothing more than a useful  ction. For the OST to remain good international law, it must be accepted as such by the major space faring states of the 21st Century: the United States, Russia, the European Union, Japan, and China. One defection from the regime by a member of this group would no doubt lead to its effective collapse, as the remaining space faring states are unlikely to use the kind of coercion necessary to enforce the regime. A more likely response to such a defection is a scramble to make similar claims to sovereignty, based on historical precedent and effective occupation. Similar rushes to stake claims for territory sovereignty in other celestial bodies might follow.

## FW

#### The standard is maximizing expected wellbeing.

#### 1] Actor spec—governments must use util because they don’t have intentions and are constantly dealing with tradeoffs—outweighs since different agents have different obligations—takes out calc indicts since they are empirically denied.

#### 2] Death is bad and outweighs – a] agents can’t act if they fear for their bodily security which constrains every ethical theory, b] it destroys the subject itself – kills any ability to achieve value in ethics since life is a prerequisite which means it’s a side constraint since we can’t reach the end goal of ethics without life

#### 4] Extinction outweighs

MacAskill 14 [William, Oxford Philosopher and youngest tenured philosopher in the world, Normative Uncertainty, 2014]

The human race might go extinct from a number of causes: asteroids, supervolcanoes, runaway climate change, pandemics, nuclear war, and the development and use of dangerous new technologies such as synthetic biology, all pose risks (even if very small) to the continued survival of the human race.184 And different moral views give opposing answers to question of whether this would be a good or a bad thing. It might seem obvious that human extinction would be a very bad thing, both because of the loss of potential future lives, and because of the loss of the scientific and artistic progress that we would make in the future. But the issue is at least unclear. The continuation of the human race would be a mixed bag: inevitably, it would involve both upsides and downsides. And if one regards it as much more important to avoid bad things happening than to promote good things happening then one could plausibly regard human extinction as a good thing.For example, one might regard the prevention of bads as being in general more important that the promotion of goods, as defended historically by G. E. Moore,185 and more recently by Thomas Hurka.186 One could weight the prevention of suffering as being much more important that the promotion of happiness. Or one could weight the prevention of objective bads, such as war and genocide, as being much more important than the promotion of objective goods, such as scientific and artistic progress. If the human race continues its future will inevitably involve suffering as well as happiness, and objective bads as well as objective goods. So, if one weights the bads sufficiently heavily against the goods, or if one is sufficiently pessimistic about humanity’s ability to achieve good outcomes, then one will regard human extinction as a good thing.187 However, even if we believe in a moral view according to which human extinction would be a good thing, we still have strong reason to prevent near-term human extinction. To see this, we must note three points. First, we should note that the extinction of the human race is an extremely high stakes moral issue. Humanity could be around for a very long time: if humans survive as long as the median mammal species, we will last another two million years. On this estimate, the number of humans in existence in the The future, given that we don’t go extinct any time soon, would be 2×10^14. So if it is good to bring new people into existence, then it’s very good to prevent human extinction. Second, human extinction is by its nature an irreversible scenario. If we continue to exist, then we always have the option of letting ourselves go extinct in the future (or, perhaps more realistically, of considerably reducing population size). But if we go extinct, then we can’t magically bring ourselves back into existence at a later date. Third, we should expect ourselves to progress, morally, over the next few centuries, as we have progressed in the past. So we should expect that in a few centuries’ time we will have better evidence about how to evaluate human extinction than we currently have. Given these three factors, it would be better to prevent the near-term extinction of the human race, even if we thought that the extinction of the human race would actually be a very good thing. To make this concrete, I’ll give the following simple but illustrative model. Suppose that we have 0.8 credence that it is a bad thing to produce new people, and 0.2 certain that it’s a good thing to produce new people; and the degree to which it is good to produce new people, if it is good, is the same as the degree to which it is bad to produce new people, if it is bad. That is, I’m supposing, for simplicity, that we know that one new life has one unit of value; we just don’t know whether that unit is positive or negative. And let’s use our estimate of 2×10^14 people who would exist in the future, if we avoid near-term human extinction. Given our stipulated credences, the expected benefit of letting the human race go extinct now would be (.8-.2)×(2×10^14) = 1.2×(10^14). Suppose that, if we let the human race continue and did research for 300 years, we would know for certain whether or not additional people are of positive or negative value. If so, then with the credences above we should think it 80% likely that we will find out that it is a bad thing to produce new people, and 20% likely that we will find out that it’s a good thing to produce new people. So there’s an 80% chance of a loss of 3×(10^10) (because of the delay of letting the human race go extinct), the expected value of which is 2.4×(10^10). But there’s also a 20% chance of a gain of 2×(10^14), the expected value of which is 4×(10^13). That is, in expected value terms, the cost of waiting for a few hundred years is vanishingly small compared with the benefit of keeping one’s options open while one gains new information.

## UV

#### The alt cedes the celestial commons to the hands of global imperialism. Only IR education can create momentum to demilitarize space.

Raymond Duvall 6 – Professor of Political Science @ Univ of Minnesota, Taking Sovereignty Out of This World: Space Weapons and Empire of the Future, October 2006, <https://www.files.ethz.ch/isn/111193/Taking%20Sovereignty%20Out%20of%20This%20World.pdf>

III. Space Weapons, Sovereignty, and the Constitution of Empire Each of the three new forms of military use of space, if brought into effect, will dramatically affect political societies on Earth. Missile defense has as its aim the creation of a shield for the territory of the U.S. (and possibly some selected allies). To the extent that it is accomplished, this would partially re-inscribe, through a truly three-dimensional shield, the borders of the United States—in Herz’s terms, its “hard shell”—and accordingly its effective sovereignty as political subject. At the same time, it would reduce or even eliminate the capacity of other political subjects to exercise an effective deterrent defense against U.S. intervention in their affairs—that is to say, it would further erode their sovereignty. The second type of militarization—space control—is both a form of “privatizing” the commons of orbital space and a form of military exclusion, an extra-territorial complement to the effort to create an exclusive territorial “hard shell” for just one state (and perhaps its “friends”) through missile defense. In the first respect, it can be understood as a type of “primitive accumulation”,48 whereby the commons of orbital space is effectively colonized and “made safe” for the capitalist interests that flow through it—primarily information services at this point in time. Here, the project of space control is constitutive of the U.S. as expressly capitalist state—sovereign subject of a particular global socio-economic order. In the second respect, that moment of constitution is conjoined with the constitution of an exclusive—a singular—sovereignty in regard to the workings of that socio-economic order through the global commons of orbital space. Finally, the placing of weapons in space capable of targeting objects on or near the Earth’s surface creates a new form of territorial rule. Whereas modern military action has been concerned principally with occupying and controlling territory, and whereas modern sovereignty is accordingly territorially defined, this form of weaponization of space would dispense with the need for such cumbersome military practices, and the pretense of sovereign territorial authority. Instead, through increased precision in space-based weapons systems, combined with the ability to target and attack anywhere on the Earth on a very short notice—ranging from minutes to seconds depending upon the weapon system—it becomes possible to “surveil and punish” any potential enemy of such a system.49 This is constitutive of a globally singular sovereign, capable of deciding the exception for the entirety of humanity, with no terrestrial “outside” to the scope of its sovereignty.50 Our argument, in simple terms, is that the militarization of space reconstitutes and alters the social production of political society in three interlocked ways that are rooted respectively in three distinct forms of putting economies/cartographies of violence into practice in outer space. The conjoint effect of those three processes of reconstitution is to substitute the consolidation of an extra-territorial system of rule—which we refer to as empire of the future—for the competitive sovereignties of the modern states-system. Missile defense The first instance of weaponization of space will probably be the deployment of a spacebased missile defense system. Indeed, the U.S. military is already testing several prototypes of components of such a system. Two of the most notable examples of this are NFIRE (Near Field Infrared Experiment) and the MDA (Missile Defense Agency) Space Test Bed. “NFIRE … is an experimental satellite to be launched in on (sic) a rocket in 2006 that is designed to distinguish between a ballistic missile’s fiery plume and the rocket itself, according to an official at the Missile Defense Agency (MDA)”.51 The MDA Space Test Bed is slated to receive funding in 2008, with the aim of integrating already existing space technologies into a system that can intercept ballistic missiles in their boost phase from orbital space.52 Such a system replaces deterrence with defense. In realist literature, the sovereignty of states is often closely linked to their ability to deter enemies from attacking. During the Cold War, nuclear weapons, through their capacity to deter attack, were cited as one of the potential means by which states could protect their territorial integrity, and, in turn, their sovereignty.53 Kenneth Waltz has argued that the proliferation of nuclear weapons and their deterrent effects actually stabilizes international relations, making the world safer and, implicitly, strengthening the security of sovereign states.54 A missile defense system, developed by and operative for only one state (or that state and its allies), undermines the logic of deterrence. States lacking the missile defense system become increasingly vulnerable to (even nuclear) attack by the state that has such a system.55 In a fashion entirely consistent with the logic of John Herz’s predictions made in the 1950s, the “hard shell” of defensible territory is thereby lost for those states. The realist argument that has largely carried the day for the past half century in critical response to Herz—that the deterrent effect of mutual assured destruction of two states possessing nuclear weapons re-inscribes the logic of territorial state sovereignty—accordingly is brought into doubt. With the advent of exclusive missile defense, it is worth re-examining—indeed reinvigorating—Herz’s original argument, because if the U.S. were to develop a sufficiently sophisticated missile defense shield the deterritorializing effect on the sovereignty of other states would be precisely those that he forecasted. There would be a significant twist, however, because, for the U.S., control of an effective missile defense system would markedly re-inscribe its territorial “hard shell” and its sovereignty in exclusively shielding it from the threat of (missile-based) nuclear attack by others. The sovereignty of one state is reproduced, while that of other states is eroded. Space control The doctrine of space control has emerged in the U.S. military out of the belief that assets in space represent a potential target for enemies of the U.S.56 There are two kinds of vulnerable U.S. assets: private-commercial; and military. One concern is that rivals may attack commercial satellites, thereby disrupting the flow of information and potentially inflicting significant harm on global markets. Militarily, a second concern is that, through its increasing reliance on satellites for its Earth-based military operations, the U.S. has created an “asymmetrical vulnerability”. An adversary (including a non-state, “terrorist” organization) could effectively immobilize U.S. forces by disabling the military satellites that provide communication, command, and control capabilities. As noted above, U.S. military planners are already warning about a possible “Space Pearl Harbor”. Consequently, the doctrine of space control is designed to protect commercial and military satellites from potential attacks, and ultimately to prevent rivals from having access to space.57 As of the year 2000 there were over 500 satellites in orbit owned by 46 countries, worth in excess of $250 billion. With the rise of the information economy, satellites are playing an increasing role in international trade and finance. As such, U.S. military planners are concerned about commercial satellites. One rationalization for the weaponization of space is that these commercial assets represent a vulnerability to economic sabotage and terrorism. As Lambeth has argued, The most compelling reason for moving forward for dispatch toward acquiring at least the serious elements of space control capability is that the United States is now unprecedentedly invested and dependent upon on-orbit capabilities, both military and commercial. Since these equities can only be expected to grow in sunk cost, it is fair to presume that they will eventually be challenged by potential opponents.58 Notice how this description of space control discusses space in terms of a set of capital assets that should be protected from external threats. While scholars have for a long time debated whether one, if not the, primary objective of U.S. military endeavors is to protect the interests of business, when it comes to questions of space control it is one of only two things in space to protect. There are no human populations in space—with the exception of the two or three occupants on the International Space Station—that could be killed by conflict in space, so the thing that is being secured through the project of space control is technology—either commercial satellites or military assets. In Volume One of Capital, Marx chided classical political economists for their inability to explain how workers became separated from the means of production. Whereas political economists such as Adam Smith argued that a previous accumulation of capital was necessary for a division of labor, Marx argued that this doctrine was an absurd doctrine. Division of labor existed in pre-capitalist societies where workers were not alienated from their labor. Instead, Marx argued that the actual historical process of primitive accumulation of capital was carried out through brute force. The discovery of gold and silver in America, the extirpation, enslavement and entombment in mines of the indigenous population of that continent, the beginnings of the conquest and plunder of India, and the conversion of Africa into a preserve for the commercial hunting of blackskins, are all things which characterize the dawn of the era of capitalist production. These idyllic proceedings are the chief moments of primitive accumulation.59 While not a perfect analogy, because of the lack of labour occurring in orbital space, the doctrine of space control is part and parcel of an ongoing process of such primitive accumulation. One of the purposes of the 1967 Outer Space Treaty was to keep outer space a commons where all states, regardless of technical ability or economic or military power, could participate in the potential benefits space has to offer. In the years since this treaty was signed, the primary economic use of space has been for commercial communications satellites. This industry has expanded dramatically in the last two decades. Total revenues for commercial space-related industries in 1980 were 2.1 billion dollars; by 2003 this figure had expanded to $91 billion and it was expected to increase at least as rapidly into the foreseeable future.60 On the economic front, space control is about determining who has access to this new economy. Positions in orbit for satellites are a new form of “real estate,” and by controlling access to outer space the U.S. would be forcibly appropriating the orbits around Earth, thereby placing the U.S. in a position to determine which governments and corporations could use space. In effect, orbital slots around earth would be turned into private property. This process of primitive accumulation is of importance to our concerns in two ways. First, the doctrine of space control represents the extension of U.S. sovereignty into outer space. In addition to being a clear violation of international law, it reinforces the constitutive effect identified in the previous section on missile defense, namely to re-inscribe the “hard shell” borders of the U.S., which are now extended to include the “territory” of outer space. This simultaneously constitutes the exclusive sovereignty of the U.S., while displacing the sovereignty of other states Second, space control bears significantly on the production of political subjectivities. The original Star Trek series would begin with the voice of Captain Kirk describing space as the “final frontier”. While presenting the exploration of space as a largely peaceful enterprise, the TV show was also drawing upon its viewers’ “memories” of the “western frontier” of 19th century U.S. expansion. At least since the writings of Frederick Turner, there has been the notion that the frontier represents the well-spring of U.S. ingenuity, freedom, and creativity. According to Turner, because as they expanded westward settlers in the U.S. had to continually adapt to a new environment, they became increasingly “American”. The theme of the frontier as essential for American identity has had a significant discursive role in U.S. imperialist expansion.61 Although Turner concluded that the American frontier had closed by the late 1890s, he argued that the U.S. could extend it frontier into new countries, such as Latin America. Theodore Roosevelt, influenced by the Turner thesis, concluded that in order to maintain the exceptional American identity new frontiers had to be opened overseas. The notion of frontiers, then, has been integral to the U.S. imperialist project since its outset. The doctrine of space control, seen in this light, is simply an extension of the imperial logic. By expanding into and taking control of the “final frontier” the U.S. is continuing to renew an exceptional—an exclusive—identity by adapting itself to the harsh realities of a new environment. So, the doctrine of space control can be read as extending U.S. sovereignty into orbit. While a clear violation of international law, this de facto expansion of U.S. sovereignty will have two effects. First, it enables a process of primitive accumulation, whereby orbital spaces around earth are removed from the commons initially established by the Outer Space Treaty, and places them under the control of the U.S. for use and perhaps even ownership by businesses sympathetic to U.S. interests. The U.S. becomes even more than it is now the state for global capitalism, the global capitalist state. Second, this doctrine of space control is part of the ongoing re-production of American subjects as “Americans”. Embedded within space control is the notion that space is a new frontier. Following the Turner thesis and Roosevelt’s doctrine of imperialist expansion, there has long been a drive for Americans to seek out new frontiers as a way of renewing the American identity and promoting American values of individuality, innovation, and exceptionalism. Force application from orbital space Force application entails using weapons either based in space or passing through space to attack targets within Earth’s atmosphere. For technical reasons, such weapons systems are still many years off, but substantial research is being conducted, and military strategists and policy analysts are already discussing how these weapons might be used.62 The major advantage of space-based weapons aimed at Earth-based targets is that they can deliver an attack to any point on the Earth in an extremely short period of time, and it is virtually impossible to defend against them. They become the violent parallel to the surveillance panopticon. In order to investigate what the constitutive effects on sovereignty and political subjectivities would be of force application from outer space, we need to look at two aspects of these weapons: what they can do—their technical aspects—and how they would be useful—their tactical aspects.63 Technically, the two types of weapons systems discussed in the previous section—laserenergy and kinetic-energy—would have different uses. Laser weapons are the quickest and most precise, but they also apply the least amount of force. In theory, such weapons would take only seconds to use and could reach any target on earth instantaneously. They are not very destructive, however, and as such would not be very useful against large-scale and/or heavily shielded targets. Conversely, kinetic-energy weapons have the potential to deliver very destructive amounts of force. They would take a few hours to deploy, however. While they could also be designed to attack any point on earth, they are only useful against fixed targets, because of the time they take to deploy. In addition to laser and kinetic-energy systems, conventional weapons, such as bombs and missiles, might also be placed in space. They would occupy a middle ground. It would take approximately ten minutes to launch these weapons from space, and they could attack any targets that earth-based conventional weapons do.64 The tactical advantages of these types of weapons are obvious. Their tremendous range enables space-based weapons to reach targets that other weapons cannot, and because they are based in outer space there are no concerns about violating the airspace of other states in transit. They can also be used on very short notice, in contrast to the days to weeks typically required to deploy earth-based weapons, such as airplanes, ships, or troops. The major drawback of these weapons is their cost. In addition to the very high cost of developing state-of-the-art weaponry, there is also the high cost associated with placing these weapons into orbit.65 As such, they would likely have relatively limited use,66 particularly if other types of military forces can accomplish the same mission for a lower cost. Why, for instance, would the military use a kinetic-energy weapon orbiting in space against a terrestrial target when a similar result could be produced by an Earth-based system, such as a cruise missile or a bomb? The prime advantage of these weapons is their ability to be used on short notice at targets that are out of the reach of conventional weapons. In what kind of military operations, then, would space-based weapons be primarily useful? Military policy analysts have speculated on just such questions of the political utility of these weapons. Alternatively, a space weapon might be the weapon of choice for an otherwise lower-value target if the space weapon were the only choice available in time, particularly for a time critical political effect. For example, a locomotive might not be worth a space-delivered smart munition. However, it might be well worth the use of a space-delivered smart munition to target a locomotive pulling a train full of people forced from their homes for transport to the border or to a concentration camp at the beginning of an ethnic cleansing campaign – particularly if aircraft and helicopters cannot reach the train because air defenses have not been suppressed, basing and overflight rights have not been granted, or coalition consensus on the action has not been reached.67 This scenario is fascinating for the political logic at work within it—space weapons are required to launch an attack at an otherwise inaccessible target. The three reasons that the target might be inaccessible all have to do with potential gaps in imperial power. Either the defenses of the target country have not been suppressed, or other states have not consented to let the forces fly through their airspace, or other coalition members—presumably in NATO or the UN—have not consented to the action. The first “justification” for the use of the weapon involves clear erasure of the sovereignty of the targeted state, as it eliminates any pretense of that country’s defensibility. The second and third “justifications” diminish, by circumvention, the sovereignty of other states. All three buttress the exclusive capacity of the U.S. to act unilaterally in deciding the exception globally. In all three cases, the only practical use for this weapon is in an imperial project! The chief advantage of space weapons is their ability on very short notice to attack a target that is out of reach of conventional forces. What places these targets “out of reach” is the sovereignty of other states as exercised through those states’ abilities to defend their territory, control their airspace, and/or participate (jointly) in authorized decision of the (global) exception. The constitutive effect of these weapons, then, is to strip states of their sovereignty—they are constituted as subjects lacking authorization of decision, and lacking boundary effectively demarcating inside from outside. What modern sovereignty does (as identified in section I. above) is taken from them. Furthermore, given the potential targets that these weapons could destroy, and how they are used, space-based systems are most useful against small groups and individuals. While the purpose of the use of space-based weapons in the above example was to prevent genocide, the means by which this attack was carried out was essentially assassination—the assassination of those driving the vehicle to carry out the ethnic cleansing. Space-based weapons, then, are most useful at targeting individuals and groups on short notice in order to achieve a political objective. We have already seen potential glimpses of this type of warfare in recent years. Consider, for example, that the Iraq War began with a so called “decapitation strike” aimed at assassinating Saddam Hussein in the hope of ending the war before it began. Similar tactics have been used by the Israeli Defense Forces to kill specific leaders of the Palestinians. Also, the U.S. has used Unmanned Aerial Vehicles equipped with missiles to target specific members of Al Qaeda and the Taliban in Afghanistan and Pakistan. Placing weapons in space aimed at terrestrial targets would only accelerate the ability to carry out these types of “targeted killings” (a.k.a. assassinations). Space weapons would enable those who control them to kill any person at any point on Earth on extremely short notice. Thus, application of force from outer space would have at least three crucially important constitutive effects. First, it would constitute the possessor of these weapons—presumably the U.S.—as the center of a globally extensive, late-modern empire,68 a sovereign of the globe. But this global sovereign would exercise its power in a new way. Rather than needing to control the land, sea, and airspace of all of the Earth, it could rely on space weapons— because they enable the precise application of force at any point on earth, on short notice— to control the globe. While these weapons are not particularly useful in fighting large-scale wars, or in the conquest of territory, they make such conventional uses of military power moot, in large part. There is no longer a need to exercise sovereign power through the control of territory, all one has to do is kill—or perhaps even threaten to kill—potential adversaries around the world in order to gain one’s wishes. In short, the type of power potentially wielded by such a sovereign would be far more absolute than any encountered throughout history.69 Second, these weapons, just as space-based missile defense was seen above to do, would effectively strip states of their ability to exercise sovereignty over their territories. While de jure sovereignty may remain intact, their de facto sovereignty would be effectively erased. For decades, realist international relations scholars have promoted the idea that states secure their sovereignty through self-help.70 If states lack the capacity to defend themselves from adversaries they are particularly vulnerable to attack and conquest. While other scholars from liberal and constructivist schools of thought have questioned how closely sovereignty is linked to military capability, throughout history states with disproportionate military power have repeatedly violated the sovereignty of weaker states.71 While space-based weapons in and of themselves would not enable conquest of another state, they could be used very effectively to achieve precise political objectives without a credible possibility of retaliation. Imagine what impact these weapons would have on U.S. foreign policy with respect to two of its most pressing objectives at this point in time. Consider, for one, how useful such weapons might be with respect to preventing a rival state such as Iran or North Korea from acquiring nuclear weapons. While there has been speculation that the U.S. or Israel may launch air strikes against potential nuclear weapons manufacturing facilities in these countries, the logistics—getting access to airspace from neighboring countries, and the possibility of retaliation against military forces in the area—make such operations difficult to carry out. Using weapons in space to conduct such missions would avoid these logistical difficulties, thereby making them easier (and presumably more likely). The threat of using space weapons on either the manufacturing sites of weapons of mass destruction or on the political leadership of an adversary in most cases probably would be sufficient to alter the behaviour of governments. In short, if the U.S. were to deploy such weapons in space, they would likely be used to much the same effect as the gunboat diplomacy of the 19th century. A second contemporary policy objective is to fight specific non-state actors. The 9/11 Commission Report discussed in great detail the logistical obstacles that prevented the Clinton administration from capturing or killing Osama Bin Laden.72 The primary obstacle was the difficulty in either launching cruise missiles into Afghanistan through another state’s airspace or deploying U.S. Special Forces in an area so remote from U.S. military bases. Again, had the U.S. had space-based weapons at the time, they probably would have been the weapons of choice. When combined with intelligence about the location of a potential target, they could be used to kill that target on very short notice without violating the air space of other states, or needing to have a military base nearby to offer a support role. In effect, any person or group of people anywhere on Earth could be targeted on very short notice, thereby constituting everyone everywhere as objects of the global sovereign. All would be subject to the rule of the U.S. state. The sovereignty of states would no longer be an obstacle to killing enemies, and these assassinations could be carried out rather easily without the threat of retaliation by the state whose sovereignty has been violated. The example of using space weapons to target non-state actors such as Osama Bin Laden and Al Qaeda points to a third constitutive effect of space weapons. Because these weapons could target anyone, anywhere, at anytime, everyone on the Earth is effectively reduced to “bare life.”73 As Agamben demonstrates in Homo Sacer (1998), one of the constitutive powers of the sovereign is to determine who is outside the laws and protections of the state. While human rights regimes and the rule of law may exist under a late-modern global empire policed by space weapons,74 the global sovereign will have the ability to decide the exception to this rule of law, and this state of exception in many cases may be exercised by the use of space weapons that constituted this sovereign in the first place. Constituting empire of the future Each of the three forms of space weaponization has important constitutive effects on modern sovereignty, and, in turn, productive effects on political subjectivities. Exclusive missile defense constitutes a “hard shell” of sovereignty for one state, while erasing the sovereign political subject status of other states. Space control reinforces that exclusive constitution of sovereignty and its potentiality for fostering unilateral decision. It also constitutes the ‘space-controlling’ state, the U.S., as sovereign for a particular global social order, a global capitalism, and as a state populated by an exceptional people, “Americans.” Space weaponization in the form of capacities for direct force application obliterate the meaning of territorial boundaries for defense and for distinguishing an inside from an outside with respect to the scope of policing and law enforcement—that is authorized locus for deciding the exception. States, other than the exceptional “American” state, are reduced to empty shells of sovereignty, sustained, if at all, by convenient fiction—for example, as useful administrative apparatuses for the governing of locals. And their “citizens” are produced as “bare life” subject to the willingness of the global sovereign to let them live. Together, these three sets of effects constitute what we believe can appropriately be identified as late-modern empire, the political subjects of which are a global sovereign, an exceptional “nation” linked to that sovereign, a global social order normalized in terms of capitalist social relations, and “bare life” for individuals and groups globally to participate in that social order. If our argument is even half correct, the claim with which this paper began—that modes of political killing have important effects—would be an understatement! IV. Coping with Empire of the Future If the logic of space weaponization is to constitute a new, historically unprecedented form of empire, there are significant theoretical and practical implications. By way of conclusion, we take up some of the most important of those implications briefly in this section. Re-theorizing empire Broadly speaking, recent theorizing on imperialism has posited two competing pictures of empire. On the one hand, scholars have put forward a global hegemonic view of empire in which a great power – presumably the United States – through a combination of hard and soft power dominates the international system to such an extant that it becomes the de facto sovereign of a global order.75 On the other hand, theorists such as Hardt and Negri have posited a de-centered version of Empire in which a network of loosely integrated institutions govern the various facets of the lives of subjects to such an extent that all political subjects on the planet are governed under a single, dispersed regime that they have labeled Empire. Our paper rejects both these images of Empire, and uses the site of space weaponization to posit a third version of Empire that is neither the de-centered late modern vision of Hardt and Negri, nor the centralized hegemonic vision of both advocates and opponents of American Imperialism. Imagining resistance Given these grim prospects for a de-territorialized global rule of late-modern empire, are there any possibilities for resistance? Historically, every advance in the weaponry of imperial powers has always been met with an advance in counter hegemonic weaponry. Most recently, insurgents in Afghanistan and Iraq have been able to counter the technological superiority of the U.S. forces with very simple yet effective Improvised Explosive Devices. As such, it is reasonable to conclude that space weaponry could be countered through a variety of asymmetrical tactics such as disabling space weapons while in orbit through energy, kinetic or even nuclear anti-satellite attacks, attacking the locations where space weapons are produced or launched, attack the research and development centers (such as universities) that are integral to the production of these systems, organizing strikes for the workers involved in harvesting the raw materials for these systems, and refusing to pay taxes to the political apparatuses that control these systems. While it is difficult to imagine what precise form resistance to these systems might take, it is not unreasonable to conclude that even in a context of space-based empire, some for of political and military resistance will be possible. That being said, just because resistance to space-based empire is a possibility, it by no means follows that such space-based empires are either inevitable or desirable. That is why we believe that resistance to placing weapons in space must begin now. Such resistance could take several forms. In the last 15 years social constructivists have made a convincing case that taboos against the use of chemical weapons, nuclear weapons and land mines have shamed states into abstaining from using these weapons.76 IR scholars should build on this research to focus on creating a taboo against the use and hopefully even the development of space weapons. Second, there is a need to educate the public about the dangerous consequences of placing weapons in space. As of this moment, most information about weapons in space is produced by defense agencies and related think tanks with a vested interest in them. As such, most research largely ignores the dangers of these weapons. An increased awareness of those dangers, not only to those potentially targeted by such weapons but also citizens of countries such as the U.S. that may deploy them, may create public pressure to cut funding to the development programs. If action is not taken now, we believe that the possibilities for resistance to these weapons will decrease dramatically once they are placed in orbit. The state of global domination constituted by such a weapons regime would mean that those who dared to speak out against such a regime might themselves become potential targets of such weapons.