# Case

## Framing

#### I affirm the resolution

#### 1] Pleasure and pain are intrinsic valuable – everything else regresses.

Blum 18

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**Pleasure** is not only one of the three primary reward functions but it also **defines reward.** As homeostasis explains the functions of only a limited number of rewards, the principal reason why particular stimuli, objects, events, situations, and activities are rewarding may be due to pleasure. This applies first of all to sex and to the primary homeostatic rewards of food and liquid and extends to money, taste, beauty, social encounters and nonmaterial, internally set, and intrinsic rewards. Pleasure, as the primary effect of rewards, drives the prime reward functions of learning, approach behavior, and decision making and provides the **basis for hedonic theories** of reward function. We are attracted by most rewards and exert intense efforts to obtain them, just because they are enjoyable [10]. Pleasure is a passive reaction that derives from the experience or prediction of reward and may lead to a long-lasting state of happiness. The word happiness is difficult to define. In fact, just obtaining physical pleasure may not be enough. One key to happiness involves a network of good friends. However, it is not obvious how the higher forms.

#### [2] Extinction first –

#### A] – reversibility and magnitude – precludes infinite future potential lives and destroys millennium of human progress

#### B] – Moral uncertainty – if we’re unsure about which interpretation of the world is true – we ought to preserve the world to keep debating about it

#### C] – Quantifiability – body count is the most objective way to calculate impacts

#### Appropriation is the act of taking or using something especially in a way that is illegal, unfair, etc. Merriam Webster merriam-webster.com/dictionary/appropriation

#### Justice is the process or result of using laws to fairly judge and punish crimes and criminals (Merriam Webster) and the quality of being just, impartial, or fair

#### Because just means it has to be either fair or lawful, appropriation cannot be just.

## C1: Space junk

#### Mega-constellations are coming now – space companies are planning to launch thousands of satellites – even low failure rates cause massive debris fields in orbit

Mcfall-Johnsen 20 [Morgan Mcfall-Johnsen, science reporter at Insider with a Bachelor of Science in Journalism from Northwestern University, 11-3-2020, "About 1 in 40 of SpaceX's Starlink satellites may have failed. That's not too bad, but across a 42,000-spacecraft constellation it could spark a crisis.," Business Insider, https://www.businessinsider.com/spacex-starlink-internet-satellites-percent-failure-rate-space-debris-risk-2020-10[/Kankee

SpaceX is launching satellites into space by the dozens to realize Starlink, a globe-encircling constellation of spacecraft that beam affordable, high-speed internet across Earth. So far, the scheme — envisioned by SpaceX founder Elon Musk in 2015 — seems to be working. The aerospace company has even opened a public beta test across the northern US and southern Canada for $99 a month, plus $499 for a startup kit. "Other countries to follow as soon as we receive regulatory approval," Musk tweeted on October 8. However, the unprecedented project has left a trail of seemingly unresponsive spacecraft in its wake. All of the satellites are designed to be maneuverable in space using an ion engine, and even deorbit themselves to burn up in Earth's atmosphere. But satellites with malfunctioning communication or propulsion systems can fly uncontrolled and pose a hazard to other satellites, and even astronauts, circling Earth. SpaceX launched its first batch of 60 prototypes in May 2019 and, to date, has flown 895 total Starlink internet satellites. But so far around 2.5% of those spacecraft may have failed, according to data collected by Jonathan McDowell, an astronomer at the Harvard-Smithsonian Center for Astrophysics. "I would say their failure rate is not egregious," McDowell told Business Insider in early October. "It's not worse than anybody else's failure rates. The concern is that even a normal failure rate in such a huge constellation is going to end up with a lot of bad space junk." Some of those failures may be intentional tests, but how many (if any) is not publicly known because SpaceX hasn't released such information. As a result, astronomers like McDowell have resorted to analyzing satellite-movement data gleaned from SpaceX and the US government, showing which Starlink satellites have fallen back toward Earth and which ones are not maneuvering. (McDowell's failure calculations do not include 45 "version 0.9" satellites that SpaceX is known to have intentionally deorbited.) Before the end of October, McDowell was measuring a 3% apparent failure rate, but a recent reanalysis indicates improvement in the newest Starlink batches. Of the last 413 "version 1.0" satellites, only one appears to have died, giving these batches a failure rate of just 0.2%. Still, McDowell notes that many of these satellites have only been in space for a few months, so more of them are likely to fail going forward. "Nevertheless it does seem that the reliability of the satellites has noticeably increased," he tweeted on October 29. SpaceX has permission from the US government to launch nearly 12,000 Starlink satellites through 2027, though it's asked to launch 30,000 more for a total of nearly 42,000. In either case, SpaceX is on track to form a "megaconstellation" that outnumbers all prior spacecraft ever launched by humanity. If 3% of the maximum planned Starlink constellation fails, that could mean 1,260 dead, 550-pound satellites the size of a desk aimlessly circling the planet. A 2.5% failure rate could mean more than 1,000 inoperative spacecraft. There were about 3,200 nonfunctional satellites in Earth's orbit as of February, according to the European Space Agency. Many of these dead spacecraft regularly threaten to collide with others and create a space-debris crisis. In mid October, for example, satellite trackers flagged a "very high risk" close pass between a dead satellite and a discarded rocket body, with one company calculating a 10% chance of collision. (Fortunately, they didn't.) SpaceX says its satellites will naturally deorbit, or burn up in Earth's atmosphere, if their propulsion systems don't work. But that process can take up to five years, according to Starlink's website. In the meantime, defunct satellites rocket around Earth faster than a bullet, with nobody to steer them away from other spacecraft that may fly in their path. SpaceX did not acknowledge Business Insider's requests for comment. However, in filings to the Federal Communications Commission, SpaceX has downplayed the risk, stating that it "views satellite failure to deorbit rates of 10 or 5 percent as unacceptable, and even a rate of 1 percent is unlikely." If 1% of its satellites did fail with no capacity to maneuver, the company said, "there is approximately a 1 percent chance per decade that any failed SpaceX satellite would collide with a piece of tracked debris." The company also claimed that its practices "effectively eliminate the chance that such rates will ever occur." Dead satellites can collide and build up a space-debris crisisSpaceX is not alone in pushing to launch large numbers of internet satellites. OneWeb, which the UK government recently purchased out of bankruptcy, has already launched 74 satellites for its proposed constellation of 48,000, while Amazon aims to launch more than 3,200 for its Kuiper fleet. It's unclear how many dead satellites those constellations might also leave in orbit. Since nobody can maneuver them, failed satellites sometimes hurtle toward other spacecraft — including the International Space Station and its crew of astronauts. Even if a satellite crashes into another satellite with no humans on board, it can create perilous conditions. "We replace two satellites with essentially two shotgun blasts of debris," Dan Ceperley, the CEO of satellite-tracking company LeoLabs, told Business Insider in January. That month, two dead satellites almost crossed paths and exploded into hundreds of thousands of bits of debris. It wouldn't have been the first such explosion, and it doesn't take many to exacerbate the debris problem. In 2007, China tested an anti-satellite missile by obliterating one of its own weather satellites. Two years later, one American and one Russian spacecraft accidentally collided. Those two events alone increased the amount of large debris in low-Earth orbit by about 70%. India conducted its own anti-satellite missile test in 2019, and the explosion created an estimated 6,500 pieces of debris larger than an eraser. All in all, more than 500 such "fragmentation events" have created nearly 130 million bits of debris in Earth's orbit. Those chunks of debris zip around the planet at more than 17,500 mph, or roughly 10 times the speed of a bullet. That's not only a problem for robotic spacecraft, but ones carrying people. Just last month, a piece of debris careened within a mile of the football field-sized space laboratory. To avoid a collision, mission controllers fired the thrusters of an attached Russian cargo spaceship to maneuver the station out of possible harm's way. The three crew members sealed themselves inside an ISS segment with a Soyuz spaceship, so they could escape if the debris struck. If the space-junk problem gets extreme, a chain of collisions could spiral out of control and surround Earth in a practically impassable field of debris. This possibility is known as the Kessler syndrome, after Donald J. Kessler, who worked for NASA's Johnson Space Center and calculated in a 1978 paper that it could take hundreds or even thousands of years for such debris to clear up enough to make spaceflight safe again. "It is a long-term effect that takes place over decades and centuries," Ted Muelhaupt, who leads The Aerospace Corporation's satellite system analysis, previously told Business Insider. "Anything that makes a lot of debris is going to increase that risk." The sheer number of objects in Earth's orbit may already be having a Kessler-like effect, as Rocket Lab CEO Peter Beck described last week."This has a massive impact on the launch side," he told CNN Business, adding that rockets "have to try and weave their way up in between these [satellite] constellations." Starlink is already a space-debris hazard SpaceX has barely launched 2% of its planned constellation, but it has already had a close call. In September 2019, the European Space Agency had to maneuver one of its spacecraft at the last minute to avoid possibly colliding with a Starlink satellite. The chance of that crash was 1 in 1,000. While that may sound low, NASA routinely moves the ISS for chances of 1 in 100,000. The ESA said it had to move its satellite because SpaceX had "no plan to take action." SpaceX said it missed the ESA emails about the issue due to a "bug" in its communications systems. Overall, close approaches like that seem to be happening more frequently. "We are seeing recently a decided uptick in the number of conjunctions," Dan Oltrogge, an astrodynamicist at Analytical Graphics, Inc, where he uses a software that has been assessing conjunction data since 2005, told Business Insider. "And it looks to be very well aligned with the new large-constellation spacecraft that have been launched." As new satellite constellations launch, regulatory agencies like the FCC may need to evaluate how many dead spacecraft they're willing to accept. "What is an acceptable failure rate?" McDowell said. "That, I'm maybe not competent to have an opinion on."

#### Private actors are uniquely key to avoid debris cascades – they have lower safety standards and won’t cooperate with others

Yuan 21 [Alda Yuan, Public Health Analyst U.S. Department of Health and Human Services and visiting attorney at the Enivornmental Law Institute with a JD from Yale, 2021, “FILLING THE VACUUM: ADAPTING INTERNATIONAL SPACE LAW TO MEET THE PRESSURES CREATED BY PRIVATE SPACE ENTERPRISES,” Hein Online, https://heinonline.org/HOL/P?h=hein.journals/denilp49&i=27]/Kankee

C. Non-state Actors Introduce Practical Challenges that Endanger the Future of Space Travel If companies are permitted to access space without a proper legal framework or sufficient coordination, the practical risks may doom the project of humanity in outer space for the near future. The opening anecdote dramatized the risks, but the fact that a chain of cascading destruction might preclude the use of whole bands of outer space or make launches impossible is not farfetched. 99 Indeed, it is already happening.0 Because space missions always create debris and there is a correlation between the number of objects orbiting earth and the chances of collision, which thereby creates more debris, even no further activity in space will eventually result in a belt of debris encircling the earth.10 1 This cascade effect, called the Kessler Syndrome, 102 has the potential to speed up astronomically if activities in outer space expand without contingent regulation and mitigation measures.1 1 3 At current rates and in the absence of a catastrophic event, lower earth orbit, in particular, might reach a tipping point within the next ten to fifty years.1 4 If the space debris problem is permitted to reach this tipping point, access to space may well be cut off for the near future because it will be impossible to launch satellites.1 5 Given that we do not have the technology to clean up debris yet, space travel faces an existential threat. In light of this, most space-faring states cooperate, working together to develop guidelines and pool resources to track the debris already orbiting the earth to minimize the chances of a collision.106 Given the high speeds the debris travels at, approximately 10 km/second,107 and the amount of damage even tiny pieces can do, 108 the existing tracking systems are not an absolute fix. At these speeds, a piece of debris weighing a mere two grams can produce an impact force equivalent to a kilogram of TNT.109 More than three hundred thousand pieces of debris greater than one cm in diameter," and therefore capable of causing enormous damage, orbit the earth while the US Space Surveillance Network (SSN) system can only track objects over five cm in diameter." There are millions of fragments smaller than one cm, which are impossible to track and yet can still cause significant damage.11 2 Still, the tracking system is important. In the last twenty years, the International Space Station has carried out several avoidance maneuvers to avoid potential collision with pieces of space debris being tracked by the SSN system.113 Between April of 2011 and April of 2012, the ISS performed four evasive maneuvers." 4 On two additional occasions, the crew fell back to the Soyuz since there was no time to set up an evasive maneuver." 5 This sort of cooperation works given the limited number of actors involved and the aligned interests of the nation-state parties. Commercial space companies do not have the same incentives to cooperate to share data and new technologies. This is why many have called for the creation of a new convention on managing orbital debris. 16 However, escalation of the Kessler Syndrome is not the only problem that might arise by failing to accommodate for the rise of the commercial corporations, so such a convention would not eliminate the threat. For instance, many satellites use nuclear power sources (NPS), which can break up upon reentry." As early as 1978, the Cosmos-954 incident scattered radioactive debris over Canada.118 Other accidents of this type could raise fallout concerns, especially if they occur over more densely populated regions. In an attempt to alleviate this risk and decrease the chances of collisions, various nations have cooperated to design and standardize methods of decommissioning satellites. 119 One strategy is to supply spacecraft with additional fuel and nudge it out of orbit so it will burn up in the atmosphere over the ocean. 120 Another is to push the ailing satellite into a graveyard orbit. 121 These methods require additional research and design and incur additional costs. 12 2 Private companies may not spontaneously take the steps necessary to comport with the common practices of space-faring nations. Thus, the rise of private corporations, while opening up new possibilities, may also threaten space travel itself and the international legal order in which coordination currently occurs. The coordination necessary to prevent and manage the unique problems that arise in space requires a more pragmatic framework. Directly binding private non-state actors benefits the international community because it prevents abusive practices and permits the coordination of efforts that make space safer. However, it will also benefit the private sector by providing companies with a background legal structure, neutral dispute resolution, and common guidelines to even the playing field. More importantly, if companies not subject to regulation and oversight are permitted to operate in outer space, disasters cannot be effectively prevented. In that case, space exploration and the benefits stemming from it might be closed off for all. III. SPACE IS A GLOBAL COMMONS UNDER CUSTOMARY INTERNATIONAL LAW

### **2 impacts**

### 1.

#### **Space junk grows exponentially triggering Kessler syndrome, which causes death, economic collapse, and rendering orbits key to monitoring climate change unusable**

Undseth, Jolly and Olivari 20 (Marit Undseth has more than ten years’ experience in public policy research; developing and analysing economic indicators for the space sector as well as evaluating space-related policies, especially as regards to innovation. She holds degrees in political science and public sector administration from London School of Economics and the College of Europe. Claire Jolly is Head of the OECD Space Forum, in the Organisation for Economic Co-operation and Development (OECD)’s Directorate for Science, Technology and Industry. She has eighteen years of experience in policy and economic analysis, having worked for both public and private organisations in aerospace and defence in Europe and North America, before joining the OECD in 2003.Economist working in the international organisations setting since 2013, with a strong focus on space sector dynamics and the economics of innovation <https://read.oecd-ilibrary.org/science-and-technology/space-sustainability_a339de43-en#page26>)

In a worst-case scenario, researchers suggest that the low-earth orbit could be rendered unusable for future generations, because collisions and the continued generation of debris would become self sustaining, the so-called Kessler syndrome (Kessler and Cour-Palais, 1978[36]). Exactly when and if this ecological tipping-point is reached, is subject to great uncertainty, with current modelling capabilities unable to provide an answer. A US National Research Council report found that this could take place within the coming two decades (National Research Council, 2011[23]), while Kessler himself, who in a 1978 paper suggested it would happen by year 2000, has later prolonged the forecast by a century (Kurt, 2015[37]). Either way, the economic tipping point, where operations in low-earth orbit become economically unsustainable, may be reached well before (Adilov, Alexander and Cunningham, 2018[38]). Human spaceflight operations in the lower earth orbits may also be considered too risky, due to the concentrations of cubesats and broadband satellites.The loss of certain orbits would have wide-reaching, significant consequences, some of which are summarised below: • Unique applications and functionalities may be lost • Lives lost • Interrupted time series for earth science and climate research • Increased crowding and pressures on other orbits • Curbed economic growth and slowdown in investments in the sector • Distributional effects: Negative impacts could be felt more heavily in rural low-density residential areas and low-income countries Most affected orbits and applications The disruption or loss of certain low-earth orbits would, in some cases, have severe impacts on terrestrial applications, for which space observations (from these orbits) are either the best or the only source of data and signals. This applies in particular to polar-orbiting weather and earth observation satellites, which make unique contributions to weather forecasting and climate change observations and research.

#### **Satellites monitor key climate change statistics – without them we can’t target anti-warming strategies**

Mulhernnov 20 – Owen Mulhern is a biologist with a specialisation in image analysis and a passion for satellite imaging. His previous work involved 3 dimensional brain reconstructions developing new algorithms for image processing. He is now focused on bringing powerful visualisations of the current state of our climate to life as Data Science Team Lead.

(Owen Mulhernnov, 9/20/2020, "How Satellites Help Tackle Climate Change," Earth.Org - Past | Present | Future, https://earth.org/data\_visualization/how-satellites-help-tackle-climate-change/)

Satellite remote sensing allows us to collect data and information about earth surface, oceans and the atmosphere at several spatio-temporal scales in a timely , regular and accurate manner. Satellite data help us understand the climate system and identify ways to mitigate climate change. Various organisations like NASA, NOAA and ESA use satellite data to monitor greenhouse gases concentration in atmosphere, weather patterns, vegetation health, melting of glaciers and polar ice, bleaching of coral reefs, ocean acidification, changes in wildlife migratory patterns, and many other environment indicators. Satellites not only monitor the global environments, its technological innovations such as miniaturization of sensors, high-speed data transfer, and upgraded storage capacity have revolutionized climate science. Here are a few examples that illustrate how. Deforestation, a significant source of global climate change accounts for around a quarter of global greenhouse gas emissions. Satellites monitor forest cover worldwide generating global datasets to predict trends and areas where deforestation occurs. As per research, depleting forest cover in old, carbon-rich tropical rainforests like those in Brazil and Indonesia is one of the worst sources of emissions. According to NASA Earth Observatory, once home to 208,000 km² of forest (about 51.4 million acres) , the State of Rondônia in western Brazil is now one of the most deforested parts of Amazon. With the breaking of a huge iceberg away from the Antarctic landmass in 2007, the world map was changed forever. Copernicus Sentinel-3 Delay-Doppler altimeter was the first mission to study the ice sheet patterns over Antarctica. For the first time, we were able to measure volume change, mass balance and sea-level rise contribution in vast and inaccessible regions. Satellites have thus allowed us to study the cryosphere, one of the most fundamental and influential factors of climate change. Because of increasing global temperatures, coral reefs are both the world’s most biodiverse and most threatened ecosystem. This is due to a phenomenon called bleaching, where corals lose their symbiotic zooxanthellae (algae) at higher water temperatures. The satellite image above shows how climate change is affecting the world’s ocean temperatures, giving us insight on which coral reefs are most at risk and why. A NASA satellite was used to track the flooding due to hurricane Florence, and the images showed how the dark, polluted water from the rivers was flowing into the Atlantic ocean. Another problem that is less related to climate change and more to environmental degradation is plastic pollution, which can also be tracked with satellites. It is predicted that by 2050 there will be more plastic in the ocean than fish. The European Space Agency’s Sentinel-2 satellites can distinguish plastic debris from other materials, it’s concentration, movement and even sometimes origin with high accuracy. With other technological innovations – including drones and high-resolution satellites – it will be easy and quick to monitor global marine plastic pollution, thus helping clean-up operations and regulation. According to The United Nations Convention to Combat Desertification (UNCCD), desertification is now a global social and environmental problem. Desertification referred to as land degradation – through soil deterioration, erosion and loss of vegetation- in arid, semi-arid and dry sub-humid areas due to global climate variations and human activities. Using satellite data early information on areas at risk and under vegetation stress due to environmental conditions enables remediation or reversal of dryland desertification to a large extent.

#### Reentry of satellites causes ozone depletion and climate change

Organski et al. 21 [Lee Organski, graduate Aerospace Engineering student at Purdue University, Cayman Barber, Shawn Barkfelt, Madison Hobbs, Roy Nakagawa, Dr. Martin Ross, Dr. William Ailor, 2021, “Environmental Impacts of Satellites from Launch to Deorbit and the Green New Deal for the Space Enterprise,” Aerospace Corporation, https://aas.org/sites/default/files/2021-03/Viasat%20Ex%20Parte.pdf.pdf]/Kankee

\*\*\*GG: gigagram, 1000 grams or 1 metric ton

Conclusion There is substantial research and analysis focused on what may remain upon reentry and survive to reach the surface, but there is ostensibly no research into what happens to the remainder. Due to proposed mega constellations, we estimate the future annual mass flux of satellites to reenter the atmosphere to be 0.8 to 3.2 Gg, plus up to 1.0 Gg per year of launch vehicle mass needed to maintain these constellations, bringing a worst-case estimate to 4.2 Gg per year. It is concluded that the marked increase in these pollutants calls for the close tracking of mass flux, further research on the particulate distribution and radiative forcing, general research into reentry physics, and a study of possible solutions to mitigate the issue. With the potential for broad environmental policy in coming years, it is important to consider how such policy would extend to regulate and quantify the environmental impacts of the space enterprise. Mass Flux from Deorbit The max flux of future reentries is an order-of-magnitude issue, even when compared to peak reentry flux over the entire course of human spaceflight. An estimated 60% of rocket bodies and 60-90% of satellite mass is expected to burn up upon reentry, with aluminum likely making up much of the burnt-off mass (Ailor et al., 2019). As upper stratospheric pressures range below 100 Pa, the boiling point of aluminum could be around 1330 deg C, well within range of reentry temperatures (Li et al. 2019) such that aluminum could be vaporized or ignited to form aluminum oxides during reentry. Radiative Forcing and Ozone For a four-year residency time of reentry particulate, global residencies of alumina could reach up to 10 Gg at the steady state of mass satellite constellations. In this case, radiative forcing caused by reentering satellite particulate has the capability to warm Earth’s atmosphere, but without precise modeling, the exact extent is unknown. Reentering space debris' ability to deplete ozone also poses a global threat because as it increases, so does ozone depletion from launch. The aircraft industry, despite having about the same relative impact on radiative forcing as rockets have on ozone depletion, is under policy pressure in the form of carbon taxes in an effort to reduce its impact (Ross et al. 2009). Satellite Reentry Distribution With the substantial burden of sub-micron particles entering the atmosphere, it is also possibly of importance to understand the distribution of the reentries of satellites with respect to the latitude. While stratospheric circulation will likely redistribute particles in a difficult-to-predict manner, the initial loading latitudes may play a significant role in how heat is displaced. It is recommended to further investigate the impact of latitudinal distributions of reentries on a larger climate model. Top 10 Upcoming LEO Constellations

#### **Climate change is an extinction level impact**

Smith, 17 – Writer at Georgia Straight for 25 years

(Charlie Smith, 2-11-2017, "Could abrupt climate change lead to human extinction within 10 years?," Georgia Straight, <span class="skimlinks-unlinked">https://www.straight.com/news/868051/could-abrupt-climate-change-lead-human-extinction-within-10-20-years</span>)

One of the world's most outspoken climate-change Cassandras is U.S. conservation biologist Guy McPherson. A professor emeritus of natural resources and the environment at the University of Arizona, he's warned that sharply rising methane emissions are going to create a catastrophe in our lifetimes. McPherson, author of Going Dark, has even predicted the nearterm extinction of many species, including human beings, by the middle of 2026. It's because of something called abrupt climate change, also known as nonlinear climate change. This results when feedback loops caused by rising atmospheric greenhouse gas levels cause the climate system to rapidly transition to a different mode, occurring on a scale that human or natural systems cannot adapt to. In the first two decades after methane is released into the atmosphere, it's about 85 times more powerful as a heat-trapping gas than carbon dioxide. Large amounts of methane are stored in "clathrates", which are chemical substances along the Arctic continental shelves storing methane molecules. McPherson and coauthor Carolyn Baker addressed this in their 2014 book, Extinction Dialogs: How to Live with Death in Mind. On his website, McPherson criticizes scientists, who know about this problem, for not doing nearly enough to educate the public. He also blames politicians and the leaders of corporations and nongovernmental organizations for not raising the alarm. "Worse than the aforementioned trolls are the media," MacPherson writes. "Fully captured by corporations and the corporate states, the media continue to dance around the issue of climate change. Occasionally a forthright piece is published, but it generally points in the wrong direction, such as suggesting climate scientists and activists be killed (e.g., James Delingpole’s 7 April 2013 hate-filled article in the Telegraph). Leading mainstream outlets routinely mislead the public." Author and former professor Guy McPherson fears that methane releases could lead to the demise of humankind. Writer says jet stream changes are having an effect A recent post on the Arctic News blog by its editor, Sam Carana, has even declared that human extinction could occur within a decade. Carana cites "the decreasing difference in temperature between the Equator and the North Pole causes changes to the jet stream, in turn causing warmer air and warmer water to get pushed from the North Atlantic into the Arctic". "Warmer water flowing into the Arctic Ocean in turn increases the strength of further feedbacks that are accelerating warming in the Arctic," Carana writes. "Altogether, these feedbacks and further warming elements could trigger a huge abrupt rise in global temperature making that extinction of many species, including humans, could be less than one decade away." At the root of this extinction prediction is methane, which is being released from sea floors along continental shelves in the Arctic as a result of melting ice. The Counterpunch website has an article by Dave Lindroff explaining how this could rapidly increase the average global temperature by three degrees Celsius over pre-industrial times. Lindroff suggests this would be "enough to actually reverse the carbon cycle, so that plants would end up releasing more carbon into the atmosphere rather than absorbing it". This is what abrupt climate change looks like. McPherson has maintained that abrupt climate change could even result in the average global temperature soon rising four degrees Celsius over pre-industrial times. Many scientists warn that increases of just two degrees will cause enormous havoc; four degrees is unfathomable.

### 2.

#### Large constellations cause debris cascades

Murtaza et al. 20 [Abid Murtaza, educator at the School of Electronic and Information Engineering at Beihang University pursuing a Ph.D. in space technology applications with Beihang University, Syed Jahanzeb Hussain Pirzada, educator at the School of Cyber Science and Technology at Beihang University pursuing a Ph.D. in space technology applications with Beihang University, Tongge Xu, Associate Professor with the School of Cyber Science and Technology at Beihang University, and Liu Jianwei, educator at the School of Electronic and Information Engineering at Beihang University, 03-09-2020, “Orbital Debris Threat for Space Sustainability and Way Forward (Review Article),” IEEE, https://ieeexplore.ieee.org/abstract/document/9028136]/Kankee

Despite the potential as mentioned above, the big question on their impact on the space debris environment has also become the most critical concern for every space concern entity. Concerning the space debris collision threat, SpaceX and OneWeb have both selected an altitude (above 1100 km) that is less densely populated. Additionally, both have told the FCC that their constellation will comply with international mitigation standards, such as reentry to earth Earth’s atmosphere being accomplished within approximately one year after completion of their mission. Additionally, OneWeb’s Orbital Debris Mitigation Plan reports that the probability of a OneWeb satellite becoming disabled as a result of collisions with small debris is 0.003, while SpaceX stated that “there is approximately 1% chance per decade that, any failed SpaceX satellite would collide with a piece of tracked debris” [97]. Apart from the claims of SpaceX and OneWeb, some studies have been performed to understand the effect of these constellations on the space environment and the reliability and collision possibilities of the mega constellation with this populated debris environment [10], [98], [99]. A study shows that there is substantial uncertainty in the prediction of the reliability of mega constellation satellites, with considerable risk to the space environment. This is because much of the information about mega constellation satellites, including the detailed designs, is not available [10]. Another recent study shows that a high probability exists for the occurrence of at least one catastrophic collision, i.e., 5% for OneWeb and 45.8% for SpaceX constellations, during an operational phase of 5 years [97]. The study [98] showed that it was estimated that an impact of approximately 3 cm in diameter would lead to a catastrophic collision of a OneWeb sized satellite, while the proposed size of a SpaceX constellation satellite is larger than a OneWeb satellite. The study also shows that the satellites in the constellation would have a 35% probability of fragmenting during the described mission lifecycle catastrophically. Thus, what we can confidently say is that despite the claims of mega constellation proposers, there are serious concerns, doubts, and uncertainty about the interaction of debris and satellites in mega constellations that exist. NASA has recently completed a parametric study to understand how significantly proposed large satellite constellation can contribute to the existing orbital debris problem. The objective was to quantify the potential negative debris-generation effects from mega constellation to the LEO environment and provide recommendations for mitigation measures [99]. The results show that for the 25-year decay rule at the end of their missions, with a 90% reliability of post-mission disposal, the additional debris population increase with respect to that without these big constellations is approximately 290% in 200 years. Even with 95% post-mission disposal reliability for the mega constellation spacecraft, the additional population increase is still close to 100% as shown in Fig. 12. While with 99% post-mission disposal, the additional population increase is reduced to 22%. The cumulative numbers of catastrophic collisions are shown in Fig. 13, which shows that in 90% scenario a non-linear increase from 27 to a total of 260 catastrophic collisions in 200 years. In 95% scenario, the total number of catastrophic collisions is 90 in 200 years. Based on results from this study NASA recommended that 99% spacecraft PMD reliability is needed to mitigate the serious long-term debris generation potential from mega constellation similar in scope to the study scenarios. Besides this, there are many aspects which are nevertheless not under the control of anyone, such as a collision of two large retired satellites or rocket bodies. Additionally, there could be many hypothetical scenarios that could lead to a catastrophic collision. For example, the accuracy error in tracking the debris data thorough SSN, the human or technical errors in estimated the timing of the collision threats, failure in a collision avoidance maneuver by satellites due to onboard control problems or anomalies in the propulsion system, and any deliberate political reasons and so on. Additionally, so far there is no legal restriction of using ASAT. So, what if the use of ASAT continues in future just like India did recently? Also what if the war between two advanced nations extends from ground to space that could result in the use of ASAT weapons to destroy the satellites of enemies? Thus, the argument is that there could be any reason for a catastrophic collision, and one or more such accident could make the situation worse, which would have severe consequences for everyone especially such as Kessler syndrome. Hence, we can say that mega constellation projects, despite their potential benefits are not going to help in improving debris and space environment in any way; instead, fair chances of worsening of debris and space environment can be envisioned from the above discussion. It might be negligence if we deliberately continue to underestimate debris challenge and its potential threat to the space environment in the future. SECTION VII.Legal and Regulatory Issues

#### Debris cascades cause US-Russia war

Barrett 16 [Anthony Barrett, Cofounder and director of research of the Global Catastrophic Risk Institute and senior risk analyst at ABS Consulting, 2016, “False Alarms, True Dangers? Current and Future Risks of Inadvertent U.S.-Russian Nuclear War” https://www.semanticscholar.org/paper/False-Alarms%2C-True-Dangers-Current-and-Future-Risks-Barrett/dbc441aca0ddacb96598f78cfec7306ea85d1f71//]/Kankee

This scenario could take place over the next three years: Falling oil and gas prices make it difficult for Russia to maintain its early warning system components. One of the northern-facing Russian radars begins failing some of its reliability tests, and a month later the Russian early warning satellite constellation loses its only geostationary satellite. A combination of technical problems and budget pressures prevent either a radar overhaul or a launch of a replacement satellite for at least a year. Two months after the geostationary satellite loss, one of several remaining Russian early warning satellites in a highly elliptical Molniya orbit detects flares of some kind in the area of the ICBM fields in the northern United States. At that moment, the satellite is the only component of the Russian early warning satellite constellation that is in an orbital position allowing it to see the northern United States. The satellite cannot immediately determine whether the flares are due to launches at ICBM bases or to something else, such as fires at oil or gas facilities in the same region, or perhaps the reflection of sunlight off high-altitude clouds. The satellite is able to transmit its flare-detection signal to other parts of the Russian early warning system, alerting system operators in Russia. However, the Russian satellite is then struck, by orbital debris and it instantly ceases communication with Russian early warning system operators. Russian early warning system operators must quickly decide what to tell their leaders. Did the satellite detect a launch of U.S. ICBMs? Was the loss of communications capabilities caused by sabotage? Could Russian radar systems rule out the possibility of incoming ICBMs? These questions could be quite serious during a period of seeming calm between the United States and Russia, but they would be especially urgent during a period of heightened tension or crisis. This Perspective represents the various pathways for a false alarm scenario for both nations in one fault tree (Figure 1), given the assumption that both Russia and the United States have similar procedures to respond to early warning alarms and use roughly analogous categories of low-, mid-, and high-level alarm events. The outcome of concern here, of course, is the launch of nuclear missiles when one country mistakenly concludes that it is under attack by the other. As shown in the second level of the tree, a launch in response to a false alarm could occur either during a U.S.-Russian crisis or during a period of low tension. The next layer in the tree shows that a launch in response to a false alarm could occur if a midlevel false alarm is promoted to a high level and involves senior national leadership who choose a launch response. Each of those steps in the decision process for false alarms has an associated node in the fault tree that is a key risk factor in the model. That all applies to both crisis and noncrisis periods. However, as is shown farther down the tree, during crisis conditions, the effective total rate of false alarms includes both midlevel false alarm events and any low-level events whose resolution (identification as a false alarm) cannot be completed before the “use them or lose them” point where a launch response decision needs to be made by leaders.1

### Solvency

#### Aff requires the cleanup of space debris created by companies

Muñoz-Patchen 18 [Chelsea Muñoz-Patchen, J.D. Candidate at The University of Chicago Law School, 2018, “Regulating the Space Commons: Treating Space Debris as Abandoned Property in Violation of the Outer Space Treaty,” Chicago Journal of International Law, https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=1741&context=cjil]/Kankee

. Failing to Clean Up Space Debris Violates These Legal Principles If one considers the orbital space taken up by debris and the collision threat posed by debris, it becomes hard to claim that states are not violating the basic norms of spacefaring. Debris and other nonfunctional objects serving no useful purpose take up orbital space, which could be used by other nations. If, or when, the Kessler Syndrome cascade is reached, the contributing nations will have made segments of Earth’s orbit unusable for any nation. Thus, according to some scholars, the very existence of space debris is illegal internationally according to the initial Outer Space Treaty of 1967.147 They suggest that this treaty, which “states that all activities must be carried on for the ‘benefit and interests of all countries,’ and that outer space shall never be subject to national appropriation” is now part of customary international space law.148 They argue that leaving space debris violates Principle 21 of the 1972 Stockholm Declaration which allows states to exploit their resources pursuant to their own environmental policies, provided that their activities do not cause damage to areas beyond their national jurisdiction. Thus, a defunct satellite or space debris left behind in any orbit violates the Outer Space Treaty because: (a) it does not produce a benefit for mankind; (b) its use is not in the interest of all countries; and (c) it occupies a portion of space, causing national appropriation.149 Even short of a cascade removing or limiting the availability of space debris can, and indeed has, begun to affect the use of space. As described earlier, debris has caused the ISS and other space objects to use fuel to avoid collisions or risk the destruction of their craft and loss of life.150 There is already crowding in the geostationary orbit, used especially for communications satellites, causing fear of collisions and signal overlap.151 Initial access to space has been delayed because the launches of new spacecraft have had to be held back due to the risk of debris in their path.152 Other protective measures that spacefaring nations are contemplating include launching with more fuel to allow for avoidance maneuvers and protective shields—both of which cost money and add extra weight, requiring more fuel.153 These protective measures, which must be added due to the conduct of existing spacefaring nations, serve as an extra barrier to space access by increasing the cost of space operations. Thus, states creating debris violate other nations’ right to use space as enshrined in the space treaty regime, and they violate their own obligations to not appropriate space. C. Using Market -Share Liability to Implement the Obligation to Clean Up Space Debris