# 1AC-slow

## Framework

#### I affirm the resolution, The appropriation of outer space by private entities in unjust.

#### The value is justice as per the word unjust in the resolution –

#### Only pleasure and pain are intrinsically valuable, other frameworks collapse and it’s the only starting point of justice

Moen 16 [Ole Martin Moen, Research Fellow in Philosophy at University of Oslo “An Argument for Hedonism” Journal of Value Inquiry (Springer), 50 (2) 2016: 267–281]

Let us start by observing, empirically, that a widely shared judgment about intrinsic value and disvalue is that pleasure is intrinsically valuable and pain is intrinsically disvaluable. On virtually any proposed list of intrinsic values and disvalues (we will look at some of them below), pleasure is included among the intrinsic values and pain among the intrinsic disvalues. This inclusion makes intuitive sense, moreover, for there is something undeniably good about the way pleasure feels and something undeniably bad about the way pain feels, and neither the goodness of pleasure nor the badness of pain seems to be exhausted by the further effects that these experiences might have. “Pleasure” and “pain” are here understood inclusively, as encompassing anything hedonically positive and anything hedonically negative.2 The special value statuses of pleasure and pain are manifested in how we treat these experiences in our everyday reasoning about values. If you tell me that you are heading for the convenience store, I might ask: “What for?” This is a reasonable question, for when you go to the convenience store you usually do so, not merely for the sake of going to the convenience store, but for the sake of achieving something further that you deem to be valuable. You might answer, for example: “To buy soda.” This answer makes sense, for soda is a nice thing and you can get it at the convenience store. I might further inquire, however: “What is buying the soda good for?” This further question can also be a reasonable one, for it need not be obvious why you want the soda. You might answer: “Well, I want it for the pleasure of drinking it.” If I then proceed by asking “But what is the pleasure of drinking the soda good for?” the discussion is likely to reach an awkward end. The reason is that the pleasure is not good for anything further; it is simply that for which going to the convenience store and buying the soda is good.3 As Aristotle observes: “We never ask [a man] what his end is in being pleased, because we assume that pleasure is choice worthy in itself.”4 Presumably, a similar story can be told in the case of pains, for if someone says “This is painful!” we never respond by asking: “And why is that a problem?” We take for granted that if something is painful, we have a sufficient explanation of why it is bad. If we are onto something in our everyday reasoning about values, it seems that pleasure and pain are both places where we reach the end of the line in matters of value.

#### Thus, the value criterion is maximizing expected wellbeing, to clarify, utilitarianism.

#### Prefer our framework--

#### 1] Actor specificity

#### ---A] Aggregation – every policy benefits some and harms others, which also means side constraints freeze action.

#### ---B] No act-omission distinction – choosing to omit is an act itself – governments actively decide not to act so there is no omission

#### 2] Util is a lexical pre-requisite to any other framework: Threats to life preclude the ability for moral actors to effectively utilize and act upon other moral theories since they are in a constant state of crisis – that inhibits the ideal moral conditions which other theories presuppose.

#### 3] Extinction matters under any framework:

#### ---A] It precludes the possibility of any kind of moral value – we can’t confer value onto anything if we’re not alive.

#### ---B] Future generations means infinite magnitude – we have to look towards future lives too

#### 4] Resolvability—util can explain degrees of wrongness, which means it is key to weighing between advocacies.

## The Advantage

#### The kessler syndrome is REAL and coming soon – that means debris cascades that prevent us from using any part of outerspace, stopping debris is a pre-requisite to the negative’s disadvantages

Kelvey 22 (Kelvey, Jon. “Kessler Syndrome: How Runaway Space Junk Could Trap Humans on Earth.” Inverse, Inverse, 3 Jan. 2022, https://www.inverse.com/science/what-is-kessler-syndrome. [Jon Kelvey is a science writer covering space, aerospace, and biosciences. His work has appeared in publications such as Air & Space Magazine, Earth and Space News, Slate, and Smithsonian in addition to Inverse. Kelvey studied cognitive neuroscience at UC Berkeley and prior to a career in journalism worked in the California wine industry, in construction as an electrician, and as a motel housekeeper.])//LK [Accessed 1/27/22]

When you’re screaming through the void faster than a speeding bullet, any traffic you encounter might as well be made of, well, speeding bullets. Defensive driving is recommended. Hazardous space debris has twice threatened the International Space Station recently. On or around November 12, a debris field generated by a Russian military anti-satellite missile, or ASAT test, sent ISS crew members — including Russian cosmonauts — to shelter in the station’s Dragon and Soyuz spacecraft in case they needed to evacuate, while on December 2, the station maneuvered around a chunk of a defunct American Pegasus rocket. No one was hurt in either case, and the risks were hardly novel — the ISS has maneuvered around space debris more than 30 times since 1999. But it’s also a problem that’s almost guaranteed to worsen given worrying trends in the militarization of space and the fact that all signs point to ever more objects being launched into space every year. Take into consideration mega-constellations like SpaceX’s Starlink, for which “the plan is to launch 100,000 active satellites in the next few years,” Jonathan McDowell, a Harvard astrophysicist who has been tracking satellites on the side for more than a decade, tells Inverse. “The collision rate grows as the square of the number of satellites. If you have 10 times as many satellites, you will have 100 times as many collisions.” And the thing is, space debris is not simply the detritus of old space missions. A satellite stricken by orbital debris becomes debris itself, which can then hit another satellite, creating debris that can strike another, and so on. It’s a chain reaction known as Kessler Syndrome, and while it doesn’t take place in the half-hour time frame as dramatized in the movie Gravity, the result may be the same: no more outer space for anybody. “At least some models suggest that, yeah, it's already underway,” McDowell says, “it's just going to take a century to play out.” Space Junk basics It’s a good thing the sky is so big, because humans have flung a lot of things up there. And every bit of it, from large spacecraft to tiny pieces of cloth, are careening around at 17,500 miles-per-hour or faster. At those speeds, even collisions between somewhat small objects can be catastrophic. “The unit I like to use is a megajoule, which is the kinetic energy of a one-ton truck hitting you at 100 miles an hour,” McDowell says. Collisions between small satellites can generate tens of thousands of megajoules of kinetic energy, while even tiny pieces of debris still pack enough of a punch to drill bullet holes in the ISS and other space assets. The Hubble Space Telescope carries a Whipple shield, for instance, a sort of bulletproof vest to absorb the energy of more minor debris impacts. hubble micrometeroid shield The radiator shield from Hubble’s Wide Field Planetary Camera II, as seen at the National Air and Space Museum. Each hole is where NASA drilled to find debris fragments. John Wenz It’s an imperfect solution, “smaller” being relative and “big” being game over. “If you get hit by a big enough piece of debris, [a Whipple shield] is not gonna be enough,” McDowell says. “And if something comes down the telescope aperture and hits the Hubble mirror, that’s also not good.” The good news is that organizations that track debris, such as the US Space Command, have a pretty good handle on the big stuff in orbit — anything from multi-ton dead satellites to debris 10 centimeters across. “The trackable debris we follow as individual objects, and we’re tracking about 40,000 objects, of which 5,000 or so are working satellites and the rest is junk,” McDowell says. “If you look at stuff down to just one centimeter, there’s probably a million of those. But we don’t really know because they’re too small.” There are two main sources of space debris at the moment, the primary being old rocket stages still in orbit decades after the delivery of their payload. “The fuel and the oxidizer get together because the seals fail,” McDowell says, “And they go bang.” The secondary source is military anti-satellite tests, he says, which generate debris clouds that can persist for decades. But if a Kessler Syndrome cascade is already underway, and continues apace unmitigated, eventually the most significant source of space debris will be the pulverized remains of satellites, spacecraft, and space stations dashed upon rocks of our own making. A history of space junking and space punking Putting aside the occasional meteor shower, space debris is an entirely human creation — satellites don’t launch themselves. But not all space debris is created equally. Many objects are merely byproducts of early space exploration, while the birth of others was more intentional. For example, while Russia has drawn international criticism for its ASAT test in November, in the early 1960s, it was the Soviet Union who accused the United States of purposefully polluting the spaceways. Between 1961 and 1963, the United States launched almost half a billion copper needles into low-Earth orbit, Caltech historian of technology Lisa Ruth Rand tells Inverse. Called Project West Ford, it was an attempt to create an artificial ionosphere for long-range radio communications in case a US-USSR nuclear war disrupted other means. The Soviets were not amused, and accused the US of “trying to destroy all space so that no one else could use it, out of spite,” Rand says. Both the Soviet Union and the United States developed and tested anti-satellite missile technologies in the 1970s and 80s, creating orbital debris and leading to a lull in ASAT tests until 2007, when China used an ASAT to destroy an old weather satellite. The US used an ASAT missile to destroy a spy satellite that failed after its launch in 2008, and India launched a small satellite in January of 2019 only to shoot it down with an ASAT in March 2019. The next and most recent ASAT test to actually destroy a satellite in space was the Russian test in November, and all four of the tests created debris, some of which will remain in orbit for years to come. “Most of the debris from the Russian ASAT will be down on a timescale of like five years, and the rest of it will be down on the timescale of 10 to 20 years, which, it’s still not good,” McDowell says. “For the Chinese ASAT, which was up at a higher altitude, more like 900 kilometers, some of that debris is likely going to be up there for many decades.” Such intentional creation of space debris seems irrational and irresponsible given how problematic incidental space debris already is. A 2009 collision between an Iridium communications satellite and a defunct Russian satellite over Siberia first turned Rand on to studying space debris as a research focus while in grad school, and for every impact, there are many more close calls. In 2012, for instance, a defunct Soviet Kosmos satellite threatened the Fermi Gamma-ray Space Telescope and presented its operators with a tough decision, Rand says. “Either light up thrusters that had been dormant for years, that were cold and could blow the whole works,” or hope the debris would pass further from Fermi than projected, such predictions always coming as probabilities rather than certainties. She says that the operators ultimately opted to risk using the thrusters, and the space telescope moved, and all was fine, but it was still a risky situation. And such situations are not always improved when all satellites involved are still live and operational. In September 2019, Rand says, a Starlink satellite and an ESA satellite almost collided when operators at SpaceX failed to check their email and missed some urgent missives from their counterparts at ESA. And over the summer of 2021, McDowell recently tweeted, the Chinese space station twice dodged Starlink satellites that may have passed within 1 kilometer of the station. “These are the kinds of close calls are happening a lot and increasingly more as the number of objects in outer space increases,” Rand says. “The number of functioning satellites in space is just exploding. It’s huge. It’s getting bigger and bigger every day.” What is Kessler Syndrome and why does it matter? In some ways, the Kessler Syndrome is like a slow-moving zombie apocalypse. (In George Romero’s classic Night of the Living Dead, Rand notes, it’s theorized a contaminated satellite returning from Venus triggers the zombie rise.) The space debris chain reaction converts otherwise operational space assets into further navigational hazards. “It’s an unwanted weaponizing of a valuable object into something that becomes dangerous,” Rand says. Had the Fermi telescope thrusters failed, “that would have been the loss of a major scientific instrument and cultural heritage artifact that had become a series of projectiles.” And the threat of losing space assets means the Kessler Syndrome has a costly impact long before the chain reaction has progressed enough to prevent access to space. More satellites in space mean more potential collisions, which means more satellites — and space stations — making more frequent evasive maneuvers to avoid further collisions, all of which can interrupt operations and cost operators money by decreasing the lifespan of their satellites. Every Starlink satellite has a limited amount of krypton propellant onboard for maneuvering around debris and Chinese space stations, for instance, and when the tank is near empty, it’s time for that satellite’s long fiery goodbye bow in the upper atmosphere — failure to do so just increases the problem by adding another dead satellite. “Space is big,” Rand says, “but once things start to collide, it becomes rapidly small.” Rapidly, but not linearly. Unfortunately, if the Kessler cascade is already underway, it will take years to reach a point where it’s happening in what humans perceive as “real-time.” By then, it may be too late. “On a timescale of decades, you’ll have to dodge more and more often, and eventually you won’t be able to dodge anymore because the traffic is so bad,” McDowell says. Adding the caveat that it’s just his back-of-the-envelope math, he says, “we are probably exceeding the carrying capacity of low Earth orbit right now.” The consequence of full bore Kessler syndrome allowed to run its course would be to negate the sci-fi ambitions of people like Elon Musk. To proscribe humans from the cosmos and limit our future to that of a one-planet species for many lifetimes — physically and intellectually. The space debris could ruin ground-based astronomy, too, hemming in our minds as well as our rockets. “It would mean to basically close ourselves off from the rest of the cosmos,” Rand says. “That the endgame of the space age is not so much humanity becoming cosmopolitan, becoming multi-planetary, becoming part of the universe, but instead making it so that we just can’t leave anymore.” What can we do about space debris? There is some good news when it comes to space debris, beginning with the fact that there are some natural processes that help to clear the space lanes of the dead and dying detritus of human space fairing. The Sun goes through an 11-year cycle of solar storms that, at its peak, makes the Earth’s atmosphere a little denser, generating more drag on any objects orbiting in lower orbits. “So there’s sort of a cleaning cycle every 11 years of the lower atmosphere, the lower part of [low-Earth orbit] goes through,” McDowell says. “But in the upper part of [low-Earth orbit] that change is not enough to make a difference, and the stuff keeps orbiting.” On average, objects orbiting around 200 kilometers altitude will re-enter Earth’s atmosphere within a week or two without active boosting, he says. In comparison, objects orbiting at around 400 kilometers will re-enter within a year or two. By 550 kilometers altitude, things take 25 years or more to re-enter the atmosphere, McDowell says, and “above about 600 kilometers, because the air density falls off so quickly, stuff up there will stay up for centuries, for millennia.” These physical realities of orbiting objects considered, there are two major paths to dealing with space debris, and we have to walk both of them. First, we need to safely rid space of the most problematic pieces of space debris. Second, we need to stop making more of it. As to the first, the technical challenges are not as awesome as you might assume, once you accept that you’ll never clear space of all small debris and focus only on the worst offenders. “The leading term in growing the Kessler cascade is the big things hitting each other because they create so much extra debris,” McDowell says. Get rid of the 100 biggest objects — late dead satellites, old rocket stages — and it would reduce the rate at which the runaway is happening. But it’s not yet clear who will do such work, who will pay for it, and if it’s even legal. Unlike ocean salvage, where the Law of the Sea allows third parties to extract resources from abandoned ships or wrecks, spacefaring nations retain responsibility and authority over all objects they have placed in space under the Outer Space Treaty of 1967. “If you want to remove an old Soviet abandoned rocket stage, without causing an international incident, you have to get Russia’s permission,” McDowell says. Since the technology you would use to remove an old satellite could be used to take out a new one, “it’s a bit of a sensitive issue.” So removal of old space debris may require a lot of international negotiation and new agreements, which is just as well, given the same is necessary to tamp down on the addition of new space debris. The United Nations may soon discuss new proposals to ban the test or use of ASAT weapons, and the proposal may have more lift under its wings given the wind condemnation of Russia’s missile test in November. “The bright side is that we are starting to restart discussions about what are the right rules of the road in space,” McDowell says. “Maybe if people get alarmed enough that something will actually be done.”

#### And commercial space appropriation is soon to make the Kessler syndrome a certainty—the probability is high

#### 1] Megaconstellations make management impossible

Boley/Byers, 5/20/2021 – University of British Columbia Professors

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Aaron C. Boley & Michael Byers, “Satellite mega-constellations create risks in Low Earth Orbit, the atmosphere and on Earth”, Scientific Reports volume 11, Article number: 10642 (2021), 20 May 2021, <https://www.nature.com/articles/s41598-021-89909-7.pdf>, accessed 12/1/21, sb

Thousands of satellites and 1500 rocket bodies provide considerable mass in LEO, which can break into debris upon collisions, explosions, or degradation in the harsh space environment. Fragmentations increase the cross-section of orbiting material, and with it, the collision probability per time. Eventually, collisions could dominate on-orbit evolution, a situation called the Kessler Syndrome3. There are already over 12,000 trackable debris pieces in LEO, with these being typically 10 cm in diameter or larger. Including sizes down to 1 cm, there are about a million inferred debris pieces, all of which threaten satellites, spacecraft and astronauts due to their orbits crisscrossing at high relative speeds. Simulations of the long-term evolution of debris suggest that LEO is already in the protracted initial stages of the Kessler Syndrome, but that this could be managed through active debris removal4. The addition of satellite mega-constellations and the general proliferation of low-cost satellites in LEO stresses the environment further5,6,7,8. Results The overall setting The rapid development of the space environment through mega-constellations, predominately by the ongoing construction of Starlink, is shown by the cumulative payload distribution function (Fig. 1). From an environmental perspective, the slope change in the distribution function defines NewSpace, an era of dominance by commercial actors. Before 2015, changes in the total on-orbit objects came principally from fragmentations, with effects of the 2007 Chinese anti-satellite test and the 2009 Kosmos-2251/Iridium-33 collisions being evident on the graph. Although the volume of space is large, individual satellites and satellite systems have specific functions, with associated altitudes and inclinations (Fig. 2). This increases congestion and requires active management for station keeping and collision avoidance9, with automatic collision-avoidance technology still under development. Improved space situational awareness is required, with data from operators as well as ground- and space-based sensors being widely and freely shared10. Improved communications between satellite operators are also necessary: in 2019, the European Space Agency moved an Earth observation satellite to avoid colliding with a Starlink satellite, after failing to reach SpaceX by e-mail. Internationally adopted ‘right of way’ rules are needed10 to prevent games of ‘chicken’, as companies seek to preserve thruster fuel and avoid service interruptions. SpaceX and NASA recently announced11 a cooperative agreement to help reduce the risk of collisions, but this is only one operator and one agency. When completed, Starlink will include about as many satellites as there are trackable debris pieces today, while its total mass will equal all the mass currently in LEO—over 3000 tonnes. The satellites will be placed in narrow orbital shells, creating unprecedented congestion, with 1258 already in orbit (as of 30 March 2021). OneWeb has already placed an initial 146 satellites, and Amazon, Telesat, GW and other companies, operating under different national regulatory regimes, are soon likely to follow. Enhanced collision risk Mega-constellations are composed of mass-produced satellites with few backup systems. This consumer electronic model allows for short upgrade cycles and rapid expansions of capabilities, but also considerable discarded equipment. SpaceX will actively de-orbit its satellites at the end of their 5–6-year operational lives. However, this process takes 6 months, so roughly 10% will be de-orbiting at any time. If other companies do likewise, thousands of de-orbiting satellites will be slowly passing through the same congested space, posing collision risks. Failures will increase these numbers, although the long-term failure rate is difficult to project. Figure 3 is similar to the righthand portion of Fig. 2 but includes the Starlink and OneWeb mega-constellations as filed (and amended) with the FCC (see “Methods”). The large density spikes show that some shells will have satellite number densities in excess of n=10−6 km−3. Deorbiting satellites will be tracked and operational satellites can manoeuvre to avoid close conjunctions. However, this depends on ongoing communication and cooperation between operators, which at present is ad hoc and voluntary. A recent letter12 to the FCC from SpaceX suggests that some companies might be less-than-fully transparent about events13 in LEO. Despite the congestion and traffic management challenges, FCC filings by SpaceX suggest that collision avoidance manoeuvres can in fact maintain collision-free operations in orbital shells and that the probability of a collision between a non-responsive satellite and tracked debris is negligible. However, the filings do not account for untracked debris6, including untracked debris decaying through the shells used by Starlink. Using simple estimates (see “Methods”), the probability that a single piece of untracked debris will hit any satellite in the Starlink 550 km shell is about 0.003 after one year. Thus, if at any time there are 230 pieces of untracked debris decaying through the 550 km orbital shell, there is a 50% chance that there will be one or more collisions between satellites in the shell and the debris. As discussed further in “Methods”, such a situation is plausible. Depending on the balance between the de-orbit and the collision rates, if subsequent fragmentation events lead to similar amounts of debris within that orbital shell, a runaway cascade of collisions could occur. Fragmentation events are not confined to their local orbits, either. The India 2019 ASAT test was conducted at an altitude below 300 km in an effort to minimize long-lived debris. Nevertheless, debris was placed on orbits with apogees in excess of 1000 km. As of 30 March 2021, three tracked debris pieces remain in orbit14. Such long-lived debris has high eccentricities, and thus can cross multiple orbital shells twice per orbit. A major fragmentation event from a single satellite could affect all operators in LEO. Even if debris collisions were avoidable, meteoroids are always a threat. The cumulative meteoroid flux15 for masses m > 10–2 g is about 1.2 × 10–4 meteoroids m−2 year−1 (see “Methods”). Such masses could cause non-negligible damage to satellites16. Assuming a Starlink constellation of 12,000 satellites (i.e. the initial phase), there is about a 50% chance of 15 or more meteoroid impacts per year at m > 10–2 g. Satellites will have shielding, but events that might be rare to a single satellite could become common across the constellation. One partial response to these congestion and collision concerns is for operators to construct mega-constellations out of a smaller number of satellites. But this does not, individually or collectively, eliminate the need for an all-of-LEO approach to evaluating the effects of the construction and maintenance of any one constellation.

#### Starlink is responsible for HALF of all dangerous space near-collisions – full megaconstellation can make collisions ten times more likely and debris avoidance software doesn’t check

Pultarova, 8/18/2021 – journalist, quoting Europe’s leading space debris expert

Tereza is a London-based science and technology journalist, aspiring fiction writer and amateur gymnast. Originally from Prague, the Czech Republic, she spent the first seven years of her career working as a reporter, script-writer and presenter for various TV programmes of the Czech Public Service Television. She later took a career break to pursue further education and added a Master's in Science from the International Space University, France, to her Bachelor's in Journalism and Master's in Cultural Anthropology from Prague's Charles University. She worked as a reporter at the Engineering and Technology magazine, freelanced for a range of publications including Live Science, Space.com, Professional Engineering, Via Satellite and Space News and served as a maternity cover science editor at the European Space Agency. “SpaceX Starlink satellites responsible for over half of close encounters in orbit, scientist says”, August 18, 2021, <https://www.space.com/spacex-starlink-satellite-collision-alerts-on-the-rise>, accessed 12/1/21, sb

Operators of satellite constellations are constantly forced to move their satellites because of encounters with other spacecraft and pieces of space junk. And, thanks to SpaceX's Starlink satellites, the number of such dangerous approaches will continue to grow, according to estimates based on available data. SpaceX's Starlink satellites alone are involved in about 1,600 close encounters between two spacecraft every week, that's about 50 % of all such incidents, according to Hugh Lewis, the head of the Astronautics Research Group at the University of Southampton, U.K. These encounters include situations when two spacecraft pass within a distance of 0.6 miles (1 kilometer) from each other. Lewis, Europe's leading expert on space debris, makes regular estimates of the situation in orbit based on data from the Socrates (Satellite Orbital Conjunction Reports Assessing Threatening Encounters in Space ) database. This tool, managed by Celestrack, provides information about satellite orbits and models their trajectories into the future to assess collision risk. Lewis publishes regular updates on Twitter and has seen a worrying trend in the data that reflects the fast deployment of the Starlink constellation. "I have looked at the data going back to May 2019 when Starlink was first launched to understand the burden of these megaconstellations," Lewis told Space.com. "Since then, the number of encounters picked up by the Socrates database has more than doubled and now we are in a situation where Starlink accounts for half of all encounters." The current 1,600 close passes include those between two Starlink satellites. Excluding these encounters, Starlink satellites approach other operators’ spacecraft 500 times every week. In comparison, Starlink's competitor OneWeb, currently flying over 250 satellites, is involved in 80 close passes with other operators' satellites every week, according to Lewis' data. And the situation is bound to get worse. Only 1,700 satellites of an expected constellation of tens of thousands have been placed into orbit so far. Once SpaceX launches all 12,000 satellites of its first generation constellation, Starlink satellites will be involved in 90% of all close approaches, Lewis’ calculations suggest. The risk of collision Siemak Hesar, CEO and co-founder of Boulder, Colorado, based Kayhan Space, confirms the trend. His company, which develops a commercial autonomous space traffic management system, estimates that on average, an operator managing about 50 satellites will receive up to 300 official conjunction alerts a week. These alerts include encounters with other satellites as well as pieces of debris. Out of these 300 alerts, up to ten might require operators to perform avoidance maneuvers, Hesar told Space.com. Kayhan Space bases their estimates on data provided by the U.S. Space Surveillance Network. This network of radars and telescopes, managed by the U.S. Space Force, closely monitors about 30,000 live and defunct satellites and pieces of debris down to the size of 4 inches (10 centimeters) and provides the most accurate location data of the orbiting objects. The size of this catalog is expected to increase ten times in the near future, Hesar added, partly due to the growth of megaconstellations, such as Starlink, and partly as sensors improve and enable detection of even smaller objects. The more objects in the catalog mean more dangerously close encounters. "This problem is really getting out of control," Hesar said. "The processes that are currently in place are very manual, not scalable, and there is not enough information sharing between parties that might be affected if a collision happens." Hesar compared the problem to driving on a highway and not knowing that there has been an accident a few miles ahead of you. If two spacecraft collide in orbit, the cloud of debris the crash generates would threaten other satellites travelling through the same area. "You want to have that situational awareness for the other actors that are flying in the neighbourhood," Hesar said. Bad decisions Despite the concerns, only three confirmed orbital collisions have happened so far. Earlier this week, astrophysicist and satellite tracker Jonathan McDowell, who's based at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, found evidence in Space-Track data that the Chinese meteorological satellite Yunhai 1-02, which disintegrated in March this year, was actually hit by a piece of space debris. The worst known space collision in history took place in February 2009 when the U.S. telecommunication satellite Iridium 33 and Russia's defunct military satellite Kosmos-2251 crashed at the altitude of 490 miles (789 kilometres). The incident spawned over 1,000 pieces of debris larger than 4 inches (10 cm). Many of these fragments were then involved in further orbital incidents. Lewis is concerned that with the number of close passes growing, the risk of operators at some point making a wrong decision will grow as well. Avoidance maneuvers cost fuel, time and effort. Operators, therefore, always carefully evaluate such risks. A decision not to make an avoidance maneuver following an alert, such as that made by Iridium in 2009, could, however, clutter the orbital environment for years and decades. "In a situation when you are receiving alerts on a daily basis, you can't maneuver for everything," Lewis said. "The maneuvers use propellant, the satellite cannot provide service. So there must be some threshold. But that means you are accepting a certain amount of risk. The problem is that at some point, you are likely to make a wrong decision." Hesar said that uncertainties in the positions of satellites and pieces of debris are still considerable. In case of operational satellites, the error could be up to 330 feet (100 meters) large. When it comes to a piece of debris, the uncertainty about its exact position might be in the order of a mile or more. "This object can be anywhere in this bubble of multiple kilometres," Hesar said. "At this point, and for the foreseeable future, avoidance is our best recourse. People that say 'I'm going to take the risk', in my humble opinion, that's an irresponsible thing to do." Starlink monopoly Lewis is concerned about the growing influence of a single actor — Starlink — on the safety of orbital operations. Especially, he says, as the spaceflight company has entered the satellite operations world only recently. "We place trust in a single company, to do the right thing," Lewis said. "We are in a situation where most of the maneuvers we see will involve Starlink. They were a launch provider before, now they are the world's biggest satellite operator, but they have only been doing that for two years so there is a certain amount of inexperience." SpaceX relies on an autonomous collision avoidance system to keep its fleet away from other spacecraft. That, however, could sometimes introduce further problems. The automatic orbital adjustments change the forecasted trajectory and therefore make collision predictions more complicated, according to Lewis. "Starlink doesn't publicize all the maneuvers that they're making, but it is believed that they are making a lot of small corrections and adjustments all the time," Lewis said. "But that causes problems for everybody else because no one knows where the satellite is going to be and what it is going to do in the next few days."

#### 2] Mining – masses of dust, sublimation, and other causes

Boley and Byers 20 (Arron, Department of Physics and Astronomy, University of British Columbia; Michael, Department of Political Science, University of British Columbia) U.S. policy puts the safe development of space at risk, SCIENCE, 9 Oct 2020, Vol 370, Issue 6513, pp. 174-175 <https://www.science.org/doi/full/10.1126/science.abd3402> EE

Mining can generate serious operational concerns. Lunar dust is a known challenge to operations on the Moon. Any surface activity could exacerbate lunar dust migration, including by lofting dust onto trajectories that cross lunar orbits, such as that of NASA's proposed Lunar Gateway (11). Moreover, without cooperation by all actors, the limited number of useful lunar orbits could quickly become filled with space debris.

On asteroids, low escape speeds will make it difficult to prevent the loss of surface material. Even if full enclosures are used, waste material may be purposefully jettisoned. Mining could also lead to uncontrolled outbursts of volatile sublimation after the removal of surface layers. Because the asteroids targeted for mining are likely to be those with small minimum orbit intersection distances, the resulting meteoroid debris streams could threaten lunar operations as well as satellites in Earth's orbit (12). In a worst-case scenario, a trajectory change resulting from mining could eventually lead to an Earth-impact emergency.

Space missions already provide some evidence of these risks. In 2019, during the course of Japan's Hayabusa2 mission, a small impactor was used to make a crater on (162173) Ryugu (13). Some of the resulting anthropogenic meteoroids could begin reaching Earth during the 2033 apparition. In 2022, NASA will test its ability to deflect an asteroid by striking (65803) Didymos B (Dimorphos) with the Double Asteroid Redirection Test spacecraft. This impact will produce anthropogenic meteoroids, with the possibility of immediate delivery to Earth (14). Although these risks are small, they demonstrate how easily human actions can change the near-Earth environment.

#### Next is the impacts—

#### 1] Public satellites that get destroyed during Kessler are key to fighting climate change—monitoring emissions and enforcement of climate policy

Bender and Custodio 21 (Bender, Bryan, and Jonathan Custodio. “'It Is a Game Changer': Waging War on Climate Change from Space.” POLITICO, POLITICO, 4 Nov. 2021, [https://www.politico.com/news/2021/10/31/climate-change-space-satellites-517773. [Bryan Bender is a senior national correspondent for POLITICO, where he focuses on the Pentagon, NASA, and the defense and aerospace industries. He was previously the national security reporter for the Boston Globe, where he covered U.S. military operations in the Middle East, Asia, Latin America, and the Balkans. He also writes about terrorism and government secrecy. He is an adjunct professor at the Walter Cronkite School of Journalism at Arizona State University and the author of “You Are Not Forgotten,“ the story of an Iraq War veteran’s search for a missing World War II fighter pilot in the South Pacific. Jonathan Custodio is a POLITICO fellow currently reporting for the energy team. Past POLITICO experience includes a three-month rotation on World and National Security and an internship in the New York office, where he contributed regularly to New York Playbook and the New York Real Estate newsletter and covered city campaigns.])//LK](https://www.politico.com/news/2021/10/31/climate-change-space-satellites-517773.%20%5bBryan%20Bender%20is%20a%20senior%20national%20correspondent%20for%20POLITICO,%20where%20he%20focuses%20on%20the%20Pentagon,%20NASA,%20and%20the%20defense%20and%20aerospace%20industries.%20He%20was%20previously%20the%20national%20security%20reporter%20for%20the%20Boston%20Globe,%20where%20he%20covered%20U.S.%20military%20operations%20in%20the%20Middle%20East,%20Asia,%20Latin%20America,%20and%20the%20Balkans.%20He%20also%20writes%20about%20terrorism%20and%20government%20secrecy.%20He%20is%20an%20adjunct%20professor%20at%20the%20Walter%20Cronkite%20School%20of%20Journalism%20at%20Arizona%20State%20University%20and%20the%20author%20of%20) [Accessed 1/27/22]

The battle against climate change — and to mitigate some of its most deadly effects — is increasingly being waged from space. Satellites are measuring the rate of icebergs calving into the Arctic Ocean and outbreaks of phytoplankton from rising water temperatures and pollution. Soon, they will be used to “persistently pinpoint” the amount of methane and carbon dioxide spewing from factories and power plants most responsible for supercharging the planet. As President Joe Biden and other world leaders gather in Scotland this week for the United Nations’ annual climate change conference, the new space age has armed them with some of the best tools yet to diagnose climate change and gauge whether their policies to reverse it are working. “Satellites were absolutely key in understanding we had a climate crisis,” said Krystal Azelton, director of space applications programs at the Secure World Foundation, a nonprofit Washington, D.C., think tank. “We are seeing vast improvements … in data sharing and access” and “the push to have open access to government data around the world is huge.” The surge in new constellations of optical and radar satellites are also now making it possible to limit some of the damage of climate change — by predicting the trajectories of forest fires, measuring soil saturation to reduce flooding and detecting radio signals in remote regions to uncover illicit deforestation or mining. An aerial photograph shows flooding in Kentucky. Satellite images were used to help measure the extent of flooding in Stanton, Kentucky, last spring. | Courtesy of Planet An aerial photograph shows flooding in Kentucky. Satellite images were used to help measure the extent of flooding in Stanton, Kentucky, last spring. | Courtesy of Planet A top priority Biden, who arrives Monday in Glasgow, has made greater reliance on space technologies a major pillar of his ambitious agenda to tackle the climate crisis. One new effort is NASA’s Earth System Observatory program to “create a 3D, holistic view of Earth, from bedrock to atmosphere.” Biden’s first annual budget request for NASA also sought $24.8 billion, including a $2.25 billion for the Earth Science Division, a 12.5 percent boost. And he requested $6.98 billion, or a 22 percent increase, for the National Oceanic and Atmospheric Administration, which operates an extensive constellation of weather satellites. That includes a proposed 25 percent increase for NOAA’s National Environmental Satellite, Data, and Information Service. Biden’s budget proposals have been moving slowly through Congress since they were introduced in May. The NASA budget proposal has been approved by the House Science subcommittee and Senate appropriators, with increases of $240 million and $35.8 million, respectively. NOAA would get nearly $6.3 billion under the Senate appropriations bill and the House Appropriations committee approved a $6.46 billion budget. Rep. Eddie Bernice Johnson (D-Texas), chair of the House Science Committee, backed strong investments in space and Earth observation, while leaving the door open for federal government and private sector collaboration. “The challenge of the climate crisis certainly requires that we examine every opportunity to leverage capabilities and build or enhance partnerships across the government and private sectors,” Johnson said. “One area we are continuing to consider is how to ensure open public access for any commercially provided data by our federal science agencies.” Meanwhile, the National Space Council, the Cabinet-level body headed by Vice President Kamala Harris, has also made improving “our indications and warning of climate change” a priority for the nation’s space agenda. Using satellites to understand changes in the environment is not new; NASA’s first effort to gather facts about natural resources from orbit, as opposed to measuring the weather in the atmosphere, was the launch of the first Landsat satellite in 1972. Now, there are a variety of space-based means available on the commercial market to do it with far more accuracy and frequency. A climate census From September 2011 to August 2020, the number of commercial satellites designed to capture high-resolution images or detect heat or other invisible signatures jumped from 10 to 338, according to the Union of Concerned Scientists, which updates its list several times a year. POLITICO used the final update of each year for the tally. In the most recent update released in May, there were 450 commercial satellites used for earth observation. “The only way to really get a global view is from satellites,” said Walter Scott, chief technology officer at space technology company Maxar Technologies. “You need to be able to make observations over a longer period of time, to be able to see trends that are in fact climate as opposed to local variations in weather.” The tools now available, however, are akin to being able to analyze census data by neighborhood instead of just at the regional or national levels. One class of targets is what climate scientists call “heat islands,” or urbanized areas that experience higher temperatures than outlying areas, which can be better analyzed with higher resolution imaging. “There are things that are happening on very small scales, urban scales,” said Vernon Morris, an atmospheric and climate scientist at Arizona State University. “The ability to gather this granularity of data, so often, is probably the biggest difference,” agreed Matt Tirman, head of Satellogic North America, a division of the Argentine company founded in 2010 that operates a constellation of satellites that can also capture live-motion video. “I do think it is a game changer,” added Morris. An aerial photograph of a glacier in Alaska is shown. Satellite images show changes over time in the Columbia Glacier in Alaska. | Courtesy of Planet An aerial photograph of a glacier in Alaska is shown. Satellite images show changes over time in the Columbia Glacier in Alaska. | Courtesy of Planet Planet, an Earth observation company founded in 2010, recently partnered with NASA’s Jet Propulsion Lab, the state of California and a group of nonprofits to create the Carbon Mapper, which will use its satellites to scan the globe daily for emissions of damaging substances like methane — an invisible, odorless and powerful greenhouse gas. “It will be able to see that it's that building, and that oil pad, and that landfill that are responsible for methane leaks,” said Andrew Zolli, Planet’s chief impact officer. “This is the incredibly sensitive — what we call point source emissions detector.” Another similar effort is Climate TRACE, a collection of scientific institutions that is using Earth observation data to monitor coal-fired power plants. “They are looking at the coal plant and the coal that is flowing through the plant to determine if it is operating,” Zolli said. Another new set of tools is radar satellites that can monitor environmental changes in the Arctic or mountainous regions that are often obscured by clouds and darkness, major limitations for optical satellites. An aerial image shows a rockslide in New Zealand. A large rockslide on Mount Silberhorn in New Zealand is tracked from space. | Courtesy of Planet For instance, ICEYE, a Finnish company founded in 2014, is monitoring floating ice in the Nares Strait near Greenland and the Thwaites Glacier in Antarctica. The new tools are “of great importance especially for small-scale glacier monitoring,” said Eric Jensen, president of ICEYE US, its American subsidiary, Satellites outfitted with synthetic aperture and hyperspectral radars, meanwhile, have “an influence on our ability to better understand wildfires and what causes them and how they can be addressed,” said Azelton. Minimizing the damage Indeed, the growth of satellite imagery and data is providing new means to head off some of the more calamitous effects of climate change. “The ability to observe, which can ultimately lead to the ability to predict, is really what prepares us for hazards and helps us mitigate the disasters that they can lead to,” said Karen St. Germain, director of NASA’s Earth Science division. She noted that satellites can examine the trajectory of forest fires in real time and identify burn scars that cause landslides. “Vegetation is what holds the soil together,” she explained. “So, if the area’s burned and then the precipitation comes, that's when you can get landslides and cascading effects.” ICEYE’s radar satellites can also be used to quickly identify downed or damaged power lines, responsible for starting thousands of forest fires, so that crews can respond before it’s too late. Satellites are also assisting in the aftermath of climate-related natural disasters. Maxar aided several nongovernmental organizations in identifying safe sources of drinking water, accessible transportation routes, and even potentially trapped families after a destructive 2018 earthquake in Indonesia. An aerial photograph shows the Dixie Fire in California. California’s Dixie forest fire earlier this year burned across five counties and grew into the single largest forest fire in the state’s history. | Courtesy of Planet The satellite data of Spire Global, which describes itself as a “space-to-cloud data and analytics company,” boosted the accuracy of climate models and predicted a wildfire south of Lake Tahoe in Northern California 45 days before the inferno. It also forecast where winds would drive the flames. New satellites and sensors are also being used to track human activity that might be taking advantage of environmental calamity. One example is in the Arctic, where melting ice has led to a steady rise in commercial and military activity, particularly in the summer months. “It's really opened up that whole region,” said Adam Bennett, a senior director at HawkEye 360, which operates satellites that can detect radio frequency signals. “People don’t always know what's happening up there. So we did some sweeps and it was interesting to see here how we detected all kinds of additional RF activity in some cases in places we never would have expected.” “We were detecting things even all over the sea ice,” he added. “You know different concentrations of VHF communication. We saw a lot of additional maritime activity. You could even see vessels taking these pathways around the sea ice. You would not even know they were there.” Detections can also be made in real-time when responding to major disasters. Satellites from Maxar, NOAA and the Bureau of Ocean Energy Management were used to map the early October oil spill off California’s Pacific coast. A containment boom blocks oil-contaminated water. In an aerial view, a containment boom blocks oil-contaminated water in the area of the Talbert Marsh wetlands after a 126,000-gallon oil spill from an offshore oil platform on Oct. 4 in Huntington Beach, California. | Mario Tama/Getty Images Unleashing the potential There are, of course, limitations to space-based technology, most notably in ocean environments. Satellites can capture sea surface temperatures and measure coral reefs — and they can even gauge the thickness of the oil on the surface of the water to direct cleanup crews after a spill. But they can only see a few meters deep. According to NOAA’s National Ocean Service, more than 80 percent of the world’s oceans remain unmapped, unobserved and unexplored. “That's why we need to rely on ocean technologies and ocean exploration, and a lot of the marine sensor technologies that are coming online, to understand what's going on in the deeper ocean, both in terms of biodiversity, as well as energy changes,” Morris said. Yet, the game-changing potential of satellite data can make a huge difference if it is matched with the capacity on the ground to analyze, share and apply it. And large swaths of the globe where the effects of climate change are most pronounced are not connected. In West Africa, for example, “people don't know when the big flood is coming because there's no one to really take the satellite data and make it applicable on the ground,” said Gregory Jenkins, a professor of atmospheric science and African studies at Pennsylvania State University, noting that satellite data hasn’t even been fully integrated into weather forecasting on most of the continent. “We need to do much more in terms of assimilating satellite data into the weather forecast to improve them,” Jenkins said. “But we also need ground information to evaluate whatever the forecasts or the satellites are saying.” Finding more ways to share the data needs to be the priority of global leaders, numerous experts and executives say. Jasmine Sanders, a climate scientist and marine biologist who is executive director of climate youth advocacy organization Our Climate, said there remains too wide a gap between satellite companies and the advocacy groups, the scientific community and the government agencies who can make the most of it. “There's no one in between or no entity or organization that is showing how these groups could be connected,” she said. An oil spill is pictured. Multiple satellite images were used to assess the 2020 oil spill off the coast of Mauritania after the MV Wakashio, a Japanese oil tanker, went aground. | Courtesy of Planet Bureaucratic stumbling blocks in industrialized nations like the United States are also stymying efforts to share more climate data gleaned from satellites across government agencies, said Mark Mozena, senior director of government affairs at Planet. “Getting data should not be an issue when you're dealing with an emergency like a hurricane,” he said. “It should not be an issue when you're trying to prepare for next year's fires.” Johnson said one of her priorities is “how to ensure open public access for any commercially provided data by our federal science agencies.” But ultimately applying all this new, increasingly more detailed data is about far more than just diagnosing the extent of climate change and singling out the leading causes. “It's not just about naming and shaming,” said Zolli. “It's about creating the feedback loop so that we know whether we're making progress or not.”

#### Warming causes extinction

Klein 14[(Naomi Klein, award-winning journalist, syndicated columnist, former Miliband Fellow at the London School of Economics, member of the board of directors of 350.org), *This Changes Everything: Capitalism vs. the Climate*, pp. 12-14]

In a 2012 report, the World Bank laid out the gamble implied by that target. “**As global warming approaches and exceeds 2-degrees Celsius, there is a risk of triggering** nonlinear tipping elements. **Examples include** the disintegration of the West Antarctic ice sheet leading to more rapid sea-level rise, or **large-scale Amazon dieback drastically affecting ecosystems, rivers, agriculture, energy production, and livelihoods**. This would further add to 21st-century global warming and impact entire continents.” In other words, once we allow temperatures to climb past a certain point, where the mercury stops is not in our control.¶ But the bigger problem—and the reason Copenhagen caused such great despair—is that because governments did not agree to binding targets, they are free to pretty much ignore their commitments. Which is precisely what is happening. Indeed, emissions are rising so rapidly that unless something radical changes within our economic structure, 2 degrees now looks like a utopian dream. And it’s not just environmentalists who are raising the alarm. The World Bank also warned when it released its report that “**we’re on track to a 4-C warmer world** [by century’s end] **marked by** extreme heat waves**,** declining global food stocks**,** loss of ecosystems **and biodiversity, and** life-threatening sea level rise.” And the report cautioned that, “**there is also** no certainty that adaptation to a 4-C world is possible.” Kevin Anderson, former director (now deputy director) of the Tyndall Centre for Climate Change, which has quickly established itself as one of the U.K’s premier climate research institutions, is even blunter; he says **4 degrees Celsius warming**—7.2 degrees Fahrenheit—**is “incompatible with an organized, equitable, and civilized global community**.”¶ We don’t know exactly what a 4 degree Celsius world would look like, but even the best-case scenario is likely to be calamitous. **Four degrees of warming could raise global sea levels by 1 or possibly even 2 meters by 2100** (and would lock in at least a few additional meters over future centuries). This would drown some island nations such as the Maldives and Tuvalu, and inundate many coastal areas from Ecuador and Brazil to the Netherlands to much of California and the northeastern United States as well as huge swaths of South and Southeast Asia. Major cities likely in jeopardy include Boston, New York, greater Los Angeles, Vancouver, London, Mumbai, Hong Kong, and Shanghai.¶ Meanwhile, **brutal heat waves that can kill tens of thousands of people**, even in wealthy countries, **would become entirely unremarkable summer events on every continent but Antarctica**. **The heat would also cause staple crops to suffer** dramatic yield losses **across the globe** (it is possible that Indian wheat and U.S. could plummet by as much as 60 percent), this at a time **when demand will be surging due to population growth and a growing demand for meat**. And since crops will be facing not just heat stress but also extreme events such as wide-ranging droughts, flooding, or pest outbreaks, the **losses could easily turn out to be more severe than the models have predicted**. **When you add ruinous hurricanes, raging wildfires, fisheries collapses, widespread disruptions to water supplies, extinctions, and globe-trotting diseases to the mix, it indeed becomes difficult to imagine that a peaceful, ordered society could be sustained** (that is, where such a thing exists in the first place).¶ And keep in mind that these are the optimistic scenarios in which warming is more or less stabilized at 4 degrees Celsius and does not trigger tipping points beyond which runaway warming would occur. Based on the latest modeling, it is becoming safer to assume that **4 degrees could bring about a number of extremely dangerous feedback loops**—an Arctic that is regularly ice-free in September, for instance, or, according to one recent study, **global vegetation that is too saturated to act as a reliable “sink**”, leading to more carbon being emitted rather than stored. Once this happens, any hope of predicting impacts pretty much goes out the window. And this process may be starting sooner than anyone predicted. In May 2014, NASA and the University of California, Irvine scientists revealed that glacier melt in a section of West Antarctica roughly the size of France now “appears unstoppable.” This likely spells down for the entire West Antarctic ice sheet, which according to lead study author Eric Rignot “comes with a sea level rise between three and five metres. Such an event will displace millions of people worldwide.” The disintegration, however, could unfold over centuries and there is still time for emission reductions to slow down the process and prevent the worst. ¶ Much more frightening than any of this is the fact that **plenty of mainstream analysts think that** on our current emissions trajectory, **we are headed for** even more than 4 degrees **of warming**. In 2011, the usually staid International Energy Agency (IEA) issued a report predicting that **we are actually on track for 6 degrees Celsius**—10.8 degrees Fahrenheit—of warming. And as the IEA’s chief economist put it: “Everybody, even the school children, knows that **this will have catastrophic implications for all of us**.” (The evidence indicates that **6 degrees of warming is likely to set in motion several major tipping points**—not only slower ones such as the aforementioned breakdown of the West Antarctic ice sheet, but possibly more abrupt ones, **like** **massive releases of methane from Arctic permafrost**.) The accounting giant PricewaterhouseCoopers as also published a report warning businesses that we are headed for “4-C , or even 6-C” of warming.¶ These various projections are the equivalent of every alarm in your house going off simultaneously. And then every alarm on your street going off as well, one by one by one. They mean, quite simply, that **climate change has become an** existential crisis for the human species. The only historical precedent for a crisis of this depth and scale was the Cold War fear that we were headed toward nuclear holocaust, which would have made much of the planet uninhabitable. But that was (and remains) a threat; a slim possibility, should geopolitics spiral out of control. The vast majority of nuclear scientists never told us that we were almost certainly going to put our civilization in peril if we kept going about our daily lives as usual, doing exactly what we were already going, which is what climate scientists have been telling us for years. ¶ As the Ohio State University climatologist Lonnie G. Thompson, a world-renowned specialist on glacier melt, explained in 2010, “**Climatologists**, like other scientists, **tend to be a stolid group. We are not given to theatrical rantings** about falling skies. Most of us are far more comfortable in our laboratories or gathering data in the field than we are giving interviews to journalists or speaking before Congressional committees. When then are climatologists speaking out about the dangers of global warming? The answer is that virtually all of us **are now convinced that global warming poses a** clear and present danger to civilization.”

#### 2] Collision with a military satellite risks miscalculation under use it or lose it pressure – that causes global nuclear war

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Scenario 1: What’s Wrong with Our Satellite? Amid increased tensions, perhaps even an imminent military confrontation between two nuclear-armed adversaries, a high-value (for example, early-warning or strategic communication) satellite stops functioning or communicating instantly and inexplicably. SSA sensors do not pick up any anomalies. This may be the outcome of a technical malfunction or a natural phenomenon, such as the impact of a collision with a meteoroid or piece of space debris small enough to have evaded detection. Alternatively, the satellite perhaps becomes the victim of a deliberate, undetected attack. Earth-to-space kinetic, electronic, or directed energy attacks would leave behind some trails. A cyberattack, which is harder to detect and attribute, is a strong possibility. So is a stealthy attack by hostile spacecraft. In fact, the adversary is known to have experimented with ominous small spacecraft that could easily conceal or disguise themselves until conducting a final maneuver to neutralize their targets. The victim would also be aware that, especially at distant GEO and HEO altitudes, SSA is not sufficiently comprehensive to detect and give warning of all suspicious or threatening movements as they happen. As suspicions abound, decision makers are faced with hard choices. Could this perhaps be the harbinger of a wider nuclear or nonnuclear first strike, along with which the attacker is seeking to eliminate the possibility of retaliation by degrading the defender’s capacity to command, control, and communicate with its forces? Should the defender react immediately before the remaining space-enabled NC3 elements are also compromised and its control over nuclear and nonnuclear forces degrades even further? In the absence of a clear-cut picture of what actually has happened, there is a risk that impending decisions will be made on the basis of insufficient and potentially erroneous information, and the climate will be ripe for unfounded presumptions and predispositions. The resulting ultimatums, responses, or counteractions could set off a dangerous cycle of escalation and tit-for-tat actions, whereby reactions and overreactions between adversaries lead to potentially catastrophic consequences. At a minimum, heightened tension in orbit would have the outcome of spilling down to Earth so as to further aggravate an already tense situation.

#### **Absent nuclear early warning satellites, mutually assured destruction falls apart as nuclear armed nations are operating in the dark, risking escalatory conflict, MAD keeps early strikes from happening now—if its falls apart nuclear war is guaranteed.**

Johnson 14 [Les, Baen science fiction author, popular science writer, and NASA technologist. “Living without satellites”. <https://www.baen.com/living_without_satellites>.] brett

Satellite imagery is used by the military and our political leaders to maintain the peace. When your potential adversaries can’t hide what they’re doing, where their armies are moving and what they are doing with their civilian and military infrastructure, then the danger of surprise attack is diminished. In our nuclear age with instant death only minutes away by missile attack, the doctrine of Mutual Assured Destruction (MAD) only works if both sides know whether or not they are being attacked. The launch of missiles or a bomber fleet can easily be seen from space far in advance of either reaching their potential targets halfway around the globe. The danger of surprise attack is therefore small, making an accidental war far less likely. So what does all this mean? And what do we do about it? First of all, it means that the advocates of space development, exploration and commercialization have succeeded far beyond their initial expectations and dreams. The economies and security of countries in the developed world are now dependent on space satellites. We space advocates should celebrate our success and be terrified of it at the same time.

Should we lose these fragile assets in space, our economy would experience a disruption like no other: ship, air and train travel would stop and only restart/operate in a much-reduced capacity for years (GPS loss). Many banking and retail transactions would cease (VSAT loss). Distribution of news and vital national information would be crippled (communications satellite loss). Lives would be put at risk and the productivity of our farming would dramatically decrease (weather satellite loss). The risk of war, including nuclear war, would increase (loss of spy satellites) and our military’s ability to react to crises would be significantly reduced (loss of military logistics and intelligence gathering satellites).

#### Nuclear war causes extinction.

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

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