# Starlink 1AC

### Plan

#### Plan: Megaconstellations in low-Earth Orbit by private entities, including but not limited to SpaceX’s Starlink, are unjust.

### Advantage

#### The Kessler syndrome is starting now but private megaconstellations make management impossible

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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

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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."

#### SpaceX does whatever it wants and refuses to listen to anybody

Silverman 21, Jacob Silverman is a staff writer at The New Republic and the author of Terms of Service: Social Media and the Price of Constant Connection. “Elon Musk Wants to Move Fast and Break Space”, April 19, 2021, <https://newrepublic.com/article/162096/spacex-starlink-satellite-internet-profit-space>, accessed 12/5/21, sb

Late last month, a pair of satellites operated by Starlink and OneWeb—two companies working to launch constellations of small, low-orbiting satellites that beam internet access all over Earth—almost collided, passing within nearly 200 feet of one another. As The Wall Street Journal reported on Monday, this was only the latest near miss: In late 2019, a Starlink satellite passed dangerously close to a European Union weather satellite. Apparently, the EU took the potential collision a lot more seriously than Starlink, which is part of SpaceX, the rocketry firm in Elon Musk’s growing business portfolio. “The agency said it was only able to contact Starlink via email, and the company told it they would take no action, so EU engineers had to initiate a collision avoidance maneuver,” according to the Journal. Space is getting crowded, and experts worry that we might one day face a catastrophic cascade of proliferating space debris, which could in turn knock out satellites, disable GPS service, and generally render space travel and global communications impossible for a generation. “In orbit, a one-centimetre bolt can have the explosive force of a hand grenade upon impact,” noted The New Yorker. While there’s blame to go around—along with a few nascent efforts by governments and NGOs to do something about the problematic buildup of space debris—the latest set of concerns revolves around constellations of low-orbiting satellites that companies like SpaceX are launching in order to provide global broadband internet access. The potential payoff, for customers in difficult-to-reach areas and the corporate tycoons managing these projects, is huge. By some estimates, up to 40 percent of the world’s population lacks internet access. Due to geography, conflict, disinvestment, or poverty, many people remain cut off from existing broadband and wireless networks; satellite internet access could potentially work anywhere—even in moving vehicles, claims Musk. SpaceX has said that satellite internet access is a potentially $1 trillion market. According to Morgan Stanley, if its satellite constellation succeeds, SpaceX’s value could soar to $175 billion. (Wide-eyed analysts speak of Amazon adding four billion customers through its own satellite network.) What we have here is, once again, a public good being distorted through the lens of private industry. And there’s real money to be made. But a growing list of skeptics—some, admittedly, from companies that seek to launch their own competing satellites—is worried that companies like SpaceX are putting up too many satellites too quickly. Other critics say that Starlink satellites risk blocking the view of telescopes, or that the company’s privatization of space-based communications will undermine public connectivity projects. The situation resembles a real estate grab, with competing firms racing to claim as much of space as they possibly can—before governments can apportion rights or coordinate with industry on how to keep an increasingly crowded sky full of functioning satellites. So far, no company has been as aggressive in colonizing space as SpaceX. Benefiting from its growing role as the U.S. government’s preferred rocketry firm, SpaceX exhibits a Zuckerbergian “move fast and break things” approach, brushing off the problem of exploding rockets and even tolerating an initial failure rate for its Starlink satellites as high as 5 percent. When a satellite doesn’t work, the company simply deorbits it, bringing it back toward Earth, where it burns up in the atmosphere. Starlink’s overall failure rate has more recently declined to somewhere in the realm of 3 percent—not bad by industry standards, but when thousands of satellites are deployed, that can add up to a lot of junk and a lot of systemic risk. As one industry observer told Forbes, with a large satellite constellation, “the goal should be a failure rate of … 1 percent or lower and even that will lead to dozens of dead satellites.” At the moment, the Starlink project has at least 1,350 satellites in orbit. There’s talk of building up to 12,000 small satellites for its broadband network (in six years, the company says, the number could be as high as 42,000). OneWeb, a British company, has fewer than 150 satellites in space right now, with its final network projected to cap out around 650. Reports about Jeff Bezos’s Project Kuiper anticipate that it will have more than 3,000 satellites. The Canadian operator Telesat has plans for 300. Russia and China may be working on their own satellite constellations, while an EU official told The Wall Street Journal that developing a ring of internet-beaming satellites was “a strategic priority.” It’s not clear, however, if all of this competition—both between profit-hungry corporations and power-hungry nation-states—will benefit the public, especially when there is potentially more to be gained by building out terrestrial internet infrastructure. Still, a monopoly managed by a global consortium, much like the internet itself, would guarantee more international cooperation, a less crowded sky, and likely a fairer deal for consumers. It would also help mitigate the costs of failure. Last year, three different satellite communications providers went bankrupt in three months. One of them was OneWeb, which received significant investment from SoftBank, a funder of WeWork, Uber, and other money-losing startups (OneWeb has since found new investors). One of the industry’s worst failures was Iridium, a $5 billion satellite network that filed for bankruptcy in 1999. It’s been resurrected in the meantime—SpaceX even launched some of its satellites—but remains unprofitable. In October, Starlink launched a test run of its internet service, calling it a “Better Than Nothing Beta.” While the negative consequences of patchy internet service may be mild for customers who sign up for this trial, this cavalier approach—with a blasé attitude toward safety and mechanical failure—can be found throughout Elon Musk’s empire. (SpaceX and Tesla did not respond to questions about their safety records before publication.) Just last week, a Tesla apparently engaged in self-driving mode—or autopilot, as the company has also called it—crashed with two passengers inside, killing them both in a horrific inferno that took four hours and 32,000 gallons of water to extinguish. (In an echo of the EU/Starlink near miss, firefighters had to call Tesla for help on putting out a lithium battery fire.) While the passengers were clearly acting irresponsibly—no one was behind the wheel to take over in an emergency, as Tesla advises—the mere fact that Tesla has made this feature widely available encourages customers to put their faith, and their lives, in an unproven, unregulated technology. Similarly, while managing the space-junk problem requires close coordination between private firms and a number of government agencies, SpaceX has once again followed Musk’s instinct to go it alone. Starlink has an automated AI avoidance system about which it’s released few details. Critics have said that an automated system isn’t useful when avoiding collisions requires different satellite owners or governments cooperating with one another. If your satellite is programmed to move automatically, how can I anticipate where to send mine without provoking a collision? From unpredictable self-driving vehicles to rockets strewing debris across Texas wetlands to the increasingly busy sky overhead, the world has become Elon Musk’s test lab. Whether you believe in Musk’s solar system–altering mission or not, people are experimenting with his products all around you. The risks apply to nearly all of us, while the rewards will accrue to Musk and his shareholders. Not all blame can be heaped at the fanboy-worshipped feet of Musk. A lack of government investment in new technologies and public infrastructure has rendered NASA and the space program a shadow of itself. The inclusion of broadband investment in the recent Biden stimulus package was long overdue. Self-driving car regulations vary by state. Absent meaningful federal action, there’s little to stop Musk from rolling out Tesla’s autonomous capabilities as a series of incremental patches and upgrades, rather than ensuring that the system is fully tested and secure. In the same way, with satellites becoming cheaper to launch and easily iterated upon, space is his to do with as he pleases. With SpaceX now launching U.S. government satellites and ferrying NASA astronauts—the company was recently chosen to return Americans to the moon—it seems as if the U.S. government has picked its winner. Like most of Elon Musk’s companies, SpaceX/Starlink has benefited enormously from government funding. Last year, the company received $885.5 million in subsidies from the Federal Communications Commission as part of a program to bring internet access to rural areas. Starlink received about 10 percent of all funding the FCC distributed this way; the rest of the $9.2 billion was apportioned among 179 other companies, indicating a strong degree of U.S. government support for Musk’s project. As a professor of aerospace engineering told The Wall Street Journal, “Musk is just doing what’s legal … but legal is not necessarily safe or sustainable.” But who’s going to stop him?

#### 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.

#### Specifically, space debris causes China miscalc.

Zenko ’14 Micah Zenko, Whitehead Senior Fellow on the US and Americas Programme at Chatham House, 4-16-2014, "Dangerous Space Incidents," Council on Foreign Relations, https://www.cfr.org/report/dangerous-space-incidents?sp\_mid=45655631&sp\_rid=emFjay5iZWF1Y2hhbXBAZ21haWwuY29tS0

A January 2007 direct ascent ASAT test carried out by China against its defunct Fengyun-1C weather satellite instantly increased the amount of space debris in low earth orbit (LEO) by 40 percent. Debris is especially problematic in LEO, where half of the world's 1,100 active satellites operate. Space objects—even flecks of paint—travel as fast as eighteen thousand miles per hour and can cause catastrophic damage to manned and unmanned spacecraft—creating even more debris in the process. The U.S. National Research Council estimates that portions of LEO have reached a "tipping point," with hundreds of thousands of space debris larger than one centimeter stuck in orbit that will collide with other pieces of debris or spacecraft, thus creating exponentially more debris. Significant growth in the quantity or density of space debris could render certain high-demand portions of outer space unnavigable and inutile. Currently, there are no legal or internationally accepted means for removing existing debris. China could also test co-orbital antisatellite systems in which an interceptor spacecraft destroys its target by exploding in close proximity, creating even more debris. For several years, Beijing has conducted a series of close proximity maneuvers with its satellites in LEO; the most recent occurred after a July 20, 2013, launch of three satellites on the same rocket, which have since conducted sudden maneuvers toward other Chinese satellites. Human or operating errors during these maneuvers could inadvertently result in a collision that produces harmful debris. While these maneuvers could eventually be used for civilian purposes, most U.S. officials believe these experiments are primarily intended to demonstrate latent ASAT capabilities. An ASAT test that causes unintended damage to U.S. and ally satellites or an accident in space caused by debris could trigger a major international crisis between the United States and China. The risk is heightened by the fact that both countries have no pre–space-launch notification arrangements, similar to the U.S.-Russia agreement on notifications of intercontinental ballistic missile (ICBM) and submarine-launched ballistic missile (SLBM) launches. Management of such a crisis could also be hindered by a lack of direct communication between U.S. authorities and the PLA agency that oversees Chinese military space launches.

#### That goes nuclear.

Kulacki ‘16 — Gregory Kulacki, China Project Manager in the Global Security Program at the Union of Concerned Scientists, former Associate Professor of Government at Green Mountain College, former Director of External Studies at Pitzer College, former Director of Academic Programs in China for the Council on International Educational Exchange, holds a Ph.D. in Political Theory from the University of Maryland-College Park, holds graduate certificates in Chinese Economic History and International Politics at Fudan University (Shanghai), 2016 (“The Risk of Nuclear War with China: A Troubling Lack of Urgency,” Union of Concerned Scientists, May, Available Online at <http://www.ucsusa.org/sites/default/files/attach/2016/05/Nuclear-War-with-China.pdf>, Accessed 06-28-2016)

No Technical Exit As long as both sides remain committed to pursuing technical solutions to their unique strategic problems, they are condemned to continue competing indefinitely. But stalemate is not a stable outcome; rather, it is a perpetual high-wire act. Twenty-four hours a day, 365 days a year, the governments of the United States and China are a few poor decisions away from starting a war that could escalate rapidly and end in a nuclear exchange. Lack of mutual trust and a growing sense that their differences may be irreconcilable incline both governments to continue looking for military solutions—for new means of coercion that help them feel more secure. Establishing the trust needed to have confidence in diplomatic resolutions to the disagreements, animosities, and suspicions that have troubled leaders of the United States and the PRC for almost 70 years is extremely difficult when both governments take every new effort to up the technological ante as an act of bad faith. The bilateral dialogues on strategic stability aim to manage the military competition, but they do not seek to end it. Although the two governments work very hard at avoiding conflict, they have yet to find a way out of what Graham Allison called their “Thucydides trap”—the risk of conflict between a rising power and an established power invested in the status quo (Allison 2015). Allison’s warning not to minimize the risks of war is sage advice, even if he does not say how the United States and China can escape the trap he describes. [end page 8] PRC leaders believe it is possible to prosecute a major war without risking a U.S. nuclear attack. The leaders of the United States believe stopping the PRC from prosecuting such a war may depend, in certain contingencies, on a credible threat to use nuclear weapons—a threat U.S. leaders state they are prepared to execute. These mismatched perceptions increase both the possibility of war and the likelihood it will result in the use of nuclear weapons. Well-informed U.S. officials tend to dismiss the possibility that the United States and the PRC could wander into a nuclear war. For example, Admiral Dennis Blair, a former Director of National Intelligence whose final military post was Commander in Chief of the U.S. Pacific Command, assured a large gathering of U.S. arms-control experts that “the chances of a nuclear exchange between the United States and China are somewhere between nil and zero.” J. Stapleton Roy, a former U.S. ambassador to the PRC, wholeheartedly agreed (Swaine, Blair, and Roy 2015). Similarly, PRC military strategists and arms control experts believe that the risk of nuclear war with the United States is not an urgent concern even if that risk may not be zero (Cunningham and Fravel 2015). This lack of urgency is troubling. For example, the United States reportedly told the PRC it would risk military escalation to prevent or stop a proposed PRC island reclamation project in the Scarborough Shoal (Cooper and Douglas 2016). The PRC reportedly responded by committing to move ahead with the project later in 2016 (Chan 2016). This particular contest of wills is part of a steadily increasing number of unresolved diplomatic spats that have escalated to the level of overt military posturing reminiscent of U.S.-Soviet jousting during the Cold War. The United States and the PRC are decades-old enemies, preparing for war and armed with nuclear weapons. Good faith efforts by the leaders of both nations have failed to stop accelerating preparations for war, including new investments in their nuclear forces. Miscommunication, misunderstanding, or poor judgment could spark a conflict that both governments may find difficult to stop. War between the United States and the People’s Republic of China is not inevitable, but failing to acknowledge the risks is certain to make it more likely. Both governments should confront these risks with a greater sense of purpose. Only then will they devote the same measure of creativity, effort, and resources to the diplomacy of reducing those risks as they now spend preparing for war.

#### Nuke war causes extinction AND outweighs other existential risks

PND 16. internally citing Zbigniew Brzezinski, Council of Foreign Relations and former national security adviser to President Carter, Toon and Robock’s 2012 study on nuclear winter in the Bulletin of Atomic Scientists, Gareth Evans’ International Commission on Nuclear Non-proliferation and Disarmament Report, Congressional EMP studies, studies on nuclear winter by Seth Baum of the Global Catastrophic Risk Institute and Martin Hellman of Stanford University, and U.S. and Russian former Defense Secretaries and former heads of nuclear missile forces, brief submitted to the United Nations General Assembly, Open-Ended Working Group on nuclear risks. A/AC.286/NGO/13. 05-03-2016. http://www.reachingcriticalwill.org/images/documents/Disarmament-fora/OEWG/2016/Documents/NGO13.pdf

Consequences human survival 12. Even if the 'other' side does NOT launch in response the smoke from 'their' burning cities (incinerated by 'us') will still make 'our' country (and the rest of the world) **uninhabitable**, potentially inducing global famine lasting up to **decades**. **Toon and Robock** note in ‘Self Assured Destruction’, in the Bulletin of Atomic Scientists 68/5, 2012, that: 13. “A nuclear war between Russia and the United States, even after the arsenal reductions planned under New START, could produce a nuclear winter. Hence, an attack by either side could be suicidal, resulting in **self assured destruction**. Even a 'small' nuclear war between **India** and **Pakistan**, with each country detonating 50 Hiroshima-size atom bombs--only about 0.03 percent of the global nuclear arsenal's explosive power--as air bursts in urban areas, could produce so much smoke that temperatures would fall below those of the Little Ice Age of the fourteenth to nineteenth centuries, shortening the growing season around the world and threatening the global food supply. Furthermore, there would be massive ozone depletion, allowing more **ultraviolet** radiation to reach Earth's surface. **Recent studies** predict that agricultural production in parts of the **U**nited **S**tates and **China** would decline by about 20 percent for four years, and by 10 percent for a decade.” 14. A conflagration involving USA/NATO forces and those of Russian federation would most likely cause the deaths of most/nearly all/**all humans** (and severely impact/extinguish **other species**) as well as destroying the delicate interwoven techno-structure on which latter-day 'civilization' has come to depend. Temperatures would drop to below those of the last ice-age for up to 30 years as a result of the lofting of up to 180 million tonnes of very black soot into the stratosphere where it would remain for decades. 15. Though human ingenuity and resilience shouldn't be underestimated, human survival itself is arguably problematic, to put it mildly, under a 2000+ warhead USA/Russian federation scenario. 16. The Joint Statement on Catastrophic Humanitarian Consequences signed October 2013 by 146 governments mentioned 'Human Survival' no less than 5 times. The most recent (December 2014) one gives it a highly prominent place. **Gareth Evans**’ ICNND (International Commission on Nuclear Non-proliferation and Disarmament) Report made it clear that it saw the threat posed by nuclear weapons use as one that at least threatens what we now call 'civilization' and that potentially **threatens human survival with an immediacy that even climate change does not**, though we can see the results of climate change here and now and of course the immediate post-nuclear results for Hiroshima and Nagasaki as well.

#### Collisions with nuclear powered spacecraft radiate the globe.

Zaitsev 9 Yuri Zaitsev, academic adviser with the Russian Academy of Engineering Sciences, ‘9, “Russia to develop nuclear-powered spacecraft for Mars mission” <http://en.rian.ru/analysis/20091111/156797969.html>

Soviet and U.S. nuclear spacecraft programs were marred by a number of accidents. In April 1964, a U.S. Navy Transit navigation satellite with a radio-isotopic generator onboard failed to reach orbit and disintegrated in the atmosphere, spewing out over 950 grams of plutonium-238. This was more than the total amount of plutonium released during all nuclear explosions by 1964. In January 1978, Kosmos-954, a Soviet Radar Ocean Reconnaissance Satellite (RORSAT) with a nuclear reactor onboard reentered the atmosphere, after the satellite's reactor core failed to separate and boost it into a nuclear-safe orbit, and fell in Canada, contaminating 100,000 sq. km. of its territory. In February 1983, the nuclear-powered Soviet satellite Kosmos-1402 went down in the South Atlantic. The most serious threat involved Cassini-Huygens, a joint NASA/European Space Agency/Italian Space Agency robotic spacecraft mission currently studying the planet Saturn and its many natural satellites, that was launched on October 15, 1997 and which made a gravitational-assist flyby of the Earth on August 18, 1999. The spacecraft, which had a nuclear reactor with 32.7 kg of plutonium-238, passed only 500 km above the Earth. Up to five billion people could have got radiation poisoning had the spacecraft plunged into the atmosphere. On February 10, 2009, the Iridium-33 telecommunications satellite owned by U.S. company Iridium Satellite LLC and its defunct Russian equivalent, the Kosmos-2251 with a nuclear propulsion unit, collided over northern Siberia. This resulted in potentially hazardous space debris. At present, 30 Russian and seven U.S. spacecraft with nuclear systems onboard are orbiting the earth at 800-1,100-km altitudes, where similar collisions can take place. This makes up for about 40 "potential nuclear explosions." If any of these satellites hits a fragment of space junk, it will slow down and eventually re-enter the atmosphere, spewing radiation above the Earth and on its surface.

#### That causes 5 billion deaths.

Grossman 15 Karl, “NASA's warning - SpaceX crash highlights dangers of nuclear power in space.” professor of journalism at the State University of New York/College of New York. #Dartmouth-JWL.

**That claim of no hazardous consequences *is not true***, as the late Dr. John Gofman, professor at the University of California at Berkeley, long maintained. **Of the three US space nuclear accidents, the most serious was the fall back to Earth in 1964 of a satellite with a SNAP-9A plutonium system onboard.** The satellite and plutonium system disintegrated in the fall, **the plutonium was dispersed worldwide and caused**, in Dr. Gofman's estimation, **an increase in the global lung cancer rate**. Dr. Gofman, an M.D. and Ph.D., co-discoverer of several radioisotopes, and was a pioneer in the earliest experiments with plutonium. A 10% failure rate in space nuclear power missions has also been the case for Russia and, before it, the Soviet Union. The worst Soviet space nuclear accident occurred in the fall in 1978 of Cosmos satellite 954, with an atomic reactor onboard, which disintegrated as it plummeted to Earth, spreading nuclear debris for hundreds of miles across the Northwest Territories of Canada. Despite the study's rosy history of space nuclear power, it also says "it may be prudent to build in more time in the development of schedule for the first launch of a new space reactor. Public interest would likely be large, and it is possible that opposition could be substantial." **The explosion after launch Sunday from the Kennedy Space Center in Florida of a SpaceX Falcon 9 rocket on a mission to deliver supplies to the International Space Station was an event again underlining the danger of using nuclear power on spacecraft**. Officials were warning that "**potentially hazardous debris could wash ashore." What if a radioisotope thermoelectric generator was onboard and plutonium was also dispersed? Or a nuclear reactor or atomic propulsion system, and an array of radioactive poisons rained down in the debris.** US Representative Donna Edwards of Maryland, a member of the House Science, Space & Technology Committee, announced that **"the launch failure this morning shows us once again that space is difficult - it requires near perfection." Inserting nuclear poisons into a danger-prone equation that "requires near perfection" - especially when it is unnecessary - is reckless, and the consequences are potentially devastating. Estimates** in NASA's Final Environmental Impact Statement, for instance, **of the cost of plutonium decontamination if there were an accident** when the Curiosity rover was launched in 2011 to Mars **were put at** $267 million for each square mile of farmland, $478 million for each square mile of forests and **$1.5 billion for each square mile of "mixed-use urban areas".** It was powered with a plutonium-energized RTG, although previously NASA Mars rovers were able to function well with solar power. When the Cassini space probe was sent off to Saturn in 1997 - with three RTGs containing 72.3 pounds of Plutonium-238, the most plutonium ever used on a spacecraft - NASA in its Final Environmental Impact Statement said that if an "**inadvertent reentry**" of Cassini **into the Earth's atmosphere** occurred **causing it to disintegrate and release its plutonium, "5 billion...of the world's population...could receive 99 percent or more of the radiation exposure."** Noting that "**technology frequently goes wrong**", Gagnon of the Global Network Against Weapons and Nuclear Power in Space, says: **"When you consider adding nuclear power into the mix it becomes an explosive combination. We've long been sounding the alarm that nuclear power in space is something the neither public nor the planet can afford to take a chance on."**

#### Megaconstellations like Starlink make astronomy during astronomical twilight impossible – that moots asteroid detection

Fish 20, Tom Fish is a science reporter at Express.co.uk. Tom started his career in the industry as a press photographer, before working as a picture desk editor. He then proceeded to manage a picture desk at Bancroft Media, before becoming a reporter at DailyStar.co.uk. “Asteroid shock: SpaceX Starlink to make spotting new city-killers 'very difficult'”, UPDATED: 15:07, Mon, Mar 16, 2020, <https://www.express.co.uk/news/science/1254549/asteroid-news-spacex-starlink-elon-musk-difficult-astronomy-detect-new-city-killer>, accessed 12/1/21, sb

Starlink is the Elon Musk-owned SpaceX satellite broadband project aiming to eventually launch tens of thousands of satellites to Earth orbit to deliver internet around the world. But although admirable idea, astronomers increasingly believe Starlink will affect humanity’s ability to save itself from annihilation from an asteroid collision. Dr Jonathan McDowell, an astronomer at the Harvard Smithsonian Center for Astrophysics believes the nascent Starlink has already adversely impacted the vital search for new asteroids able to inflict death from above. He told Express.co.uk: Although SpaceX Starlink is not yet posing a problem for spotting asteroids, it is a nuisance. “But Starlink is going to be a problem within a couple of years while they put up all these satellites. “There are 300 Starlink satellites up right now, with 60 more going up in a few days. “But SpaceX is planning for up to 12,000 satellites or even more. “So while a constellation of 300 is a pain in the neck, we can handle it – 12,000 is going to make it very difficult, especially for these asteroids.” Starlink poses a unique problem for astronomers due to both their eventual quantity and their relatively low orbiting distance. Most astronomers work in the middle of the night, when the sky is as dark as possible because they are looking at distant galaxies. However, asteroids on a possible collision course with Earth, are close in the sky to the Sun, meaning astronomers have to look as close to the Sun as possible. Unfortunately, this takes place as soon as the Sun sets – but this twilight period is exactly when most of the Starlink satellites are illuminated. Although the Sun is set on Earth, it hasn’t set 300 miles up, meaning Starlink satellites are still reflecting the Sun. At any given time, there could be hundreds of these satellites illuminated as astronomers attempt to observe the twilight sky, a period known as the astronomical twilight, which is the first few hours of the night. Dr McDowell said: “So early in the night, there’s going to be lots of these things, making it very difficult to take a picture without one of these things, leaving a bloody great streak across your image. “I think that will make this the science difficult. “If there’s 10 streaks on every astronomical image – which I don’t think we’re going to see but that’s the logical extreme – then you’re completely hosed as we say in America. “It’s unclear just how bad it’s going to be right now, but it’s not an order of magnitude away from the really bad case. “And even if Starlink ends up being not so bad, allowing astronomers to work around it without an extreme amount of effort, the next constellation might be worse. “It’s not out of bounds that someone could put up a constellation that would make this kind of astronomy completely impossible. “Therefore, I think there needs to be discussion about the night sky as a shared resource for humanity and who should regulate it and who should decide how it gets changed.”

#### Asteroids cause extinction and without top-notch detection technology, a hit is inevitable

Dreier 21, Casey Dreier is Senior Space Policy Adviser for The Planetary Society, an independent nonprofit organization based in California. “Why an Asteroid Strike Is Like a Pandemic”, July 25, 2021, <https://www.scientificamerican.com/article/why-an-asteroid-strike-is-like-a-pandemic/>, accessed 12/3/21, sb

Imagine the following scenario. Scientists identify a potential global threat, but initial data are spotty—not enough to spur drastic action. Rapidly, relentlessly, the threat grows. What once was preventable becomes inevitable. The world has no choice but to endure the disaster at the cost of trillions of dollars and millions of lives. This is the story of COVID pandemic—but it could equally well be the story of a catastrophic strike by a large asteroid. As we emerge from the worst of COVID-19, we should heed this lesson: low-probability, high-impact events do occur; but they can be mitigated if we prepare and act early enough. Asteroids are like viruses in a sense: they number in the tens of millions but only a few types pose a threat to humans. For asteroids, it’s the “near-Earth” variety—those with orbits that come close to our own—that we must worry about. Also as with viral outbreaks, the likelihood of a catastrophe is unlikely in any given year, but almost inevitable over time. And just as we can in principle develop vaccines against emerging viruses before they cause too much damage, creating immunity without making people sick, we can similarly use modern technology to develop a level of global immune response to asteroid collisions. But this requires ongoing investments in research and preparedness—and while the U.S. spent more than $6.5 billion dollars on pandemic preparedness over the past decade (with admittedly mixed results), the nation spent less than a tenth of that on the work of asteroid detection and deflection. This is far too low. In fact, impacts from space happen all the time, but they are generally small and harmless. The Earth is peppered with meteors throughout the year that are mere inches across or less, which burn up as shooting stars when they enter our atmosphere. The threat comes from the bigger ones, which are house-sized or larger. These strike less frequently, but they do happen. In 2013, a 60-foot-diameter meteor exploded over the city of Chelyabinsk, injuring thousands of people. The really big ones—miles across—are even rarer, occurring every few hundred million years or so. But the damage they do can be catastrophic. Think of the mass extinction 65 million years ago that wiped out most of the dinosaurs. The good news is that we’ve found most of those and, fortunately for us, Earth is not in their crosshairs. But there is a middle ground that demands our attention: “city killer” asteroids that are about around the size of a football field and could unleash 10,000 times the energy of the atomic bomb that leveled Hiroshima. They seem to hit us every few thousand years, on average. There are likely many tens of thousands of them with orbits near Earth’s, yet we’ve only found about one third of these. And finding them is hard. Even the big ones are tiny, cosmically speaking, and are camouflaged against the blackness of space by their charcoal-like dark surfaces. Ground-based telescopes, which measure reflected light, struggle to see these small, dim objects. Only a few hundred are discovered each year. To significantly improve the rate of detection we need to move off the Earth, to the realm of the asteroids. We need a telescope in space. The Near-Earth Object (NEO) Surveyor is a modest space telescope currently under consideration by NASA. Instead of looking at reflected light, it would seek out heat signatures of asteroids, which glow with infrared radiation against the cold background of space. And in space, where there’s no bad weather and daytime that limit observations, the NEO Surveyor could find more city-killer asteroids in the next 10 years than have been discovered by all the telescopes on Earth over the past three decades. The mathematics of orbital mechanics that characterizes asteroids can be as heartless as the exponential growth that goes with viral outbreaks. And as with broad testing regimes that have been used during COVID, a dedicated effort to discover potentially hazardous asteroids will be the key to preventing disaster. It’s possible to alter an incoming asteroid’s orbit to protect the Earth, but that becomes increasingly more difficult depending on how close we are to impact. It is far easier to act years (if not decades) in advance. After more than a decade in bureaucratic purgatory, where the NEO Surveyor has struggled to gain approval, the project appears ready to move forward. The Biden administration recently proposed to fund this mission in its latest NASA budget; Congress should support this request. It will take years to build and launch, but as early as 2026 we may see the start of the first dedicated effort to understand the scope of the asteroid threat. We also need to invest in deflection technology, the “vaccine” of the asteroid response. Fortunately, NASA is close to launching a mission called the Double Asteroid Redirection Test (DART). In 2022, the spacecraft will ram into the tiny “moon” that orbits the near-Earth asteroid Didymos, slightly changing its orbit. Scientists will compare the exact degree of change to their predictions, which will help them understand how to alter asteroid orbits more effectively in the future. This is only a test, but it could serve the same function as the years of basic research into the field of mRNA vaccines that ultimately paid off when applied to COVID. We must also continue to support sky surveys by ground telescopes, which can support the work of space-based missions. The Vera Rubin Observatory, for example, now under construction in Chile and especially good at finding fast-moving objects in the solar system, will greatly assist in asteroid detection. (The proposed “megaconstellations” of Earth-orbiting satellites by Amazon, SpaceX, OneWeb, and others threaten to overwhelm our view of these dim objects and make asteroid detections more difficult. There is no easy solution to this, beyond further confirming the need for space-based detectors located in quieter regions of the solar system.) The coronavirus pandemic has many humbling lessons for humanity. But let this be one of them: low-probability, high-impact disasters do occur; and there is no higher impact disaster than a large asteroid collision with the Earth. We know that early awareness enables early action. Big problems later on can be prevented by small investments now. Let’s not be caught off-guard again.

#### Hits are aperiodic, but certain – this means traditional probability scales drastically under-state risk. Treat our impact as if it could happen tomorrow

**Brownfield 4** (Roger, Gaishiled Project, “A Million Miles a Day”, Presentation at the Planetary Defense Conference: Protecting Earth From Asteroids, February 26th, [http://www.aiaa.org/content.cfm?pageid=406&gTable= Paper&g](http://www.airpower.maxwell.af.mil/airchronicles/cc/france2.html?pageid=406&gTable=%20Paper&g) ID=17092)

Once upon a time there was a Big Bang... Cause/Effect - Cause/Effect -Cause/Effect and fifteen billion years later we have this chunk of cosmos weighing in at a couple trillion tons, screaming around our solar system, somewhere, hair on fire at a million miles a day, on course to the subjective center of the universe. Left to its own fate -- on impact -- this Rock would release the kinetic energy equivalent of one Hiroshima bomb for every man, woman and child on the planet. Game Over... No Joy... Restart Darwin's clock… again. No happy ever after. There is simply no empirical logic or rational argument that this could not be the next asteroid to strike Earth or that the next impact event could not happen *tomorrow*. And as things stand we can only imagine a handful of dubious undeveloped and untested possibilities to defend ourselves with. There is nothing we have actually prepared to do in response to this event. From an empirical analysis of the dynamics and geometry of our solar system we have come to understand that the prospect of an Earth/asteroid collision is a primal and ongoing process: a solar systemic status quo that is unlikely to change in the lifetime of our species. And that the distribution of these impact events is completely aperiodic and random both their occasion and magnitude. From abstracted averaged relative frequency estimates we can project that over the course of the next 500 million years in the life of Earth we will be struck by approximately 100,000 asteroids that will warrant our consideration. Most will be relatively small, 100 to 1,000 meters in diameter, millions of tons: only major city to nation killers. 1,000 or so will be over 1,000 meters, billions of tons and large enough to do catastrophic and potentially irrecoverable damage to the entire planet: call them global civilization killers. Of those, 10 will be over 10,000 meters, trillions of tons and on impact massive enough to bring our species to extinction. All these asteroids are out there, orbiting the sun... now. Nothing more needs to happen for them to go on to eventually strike Earth. As individual and discrete impact events they are all, already, events in progress. By any definition this is an existential threat. Fortunately, our current technological potential has evolved to a point that if we choose to do so we can deflect all these impact events. Given a correspondingly evolved political will, we can effectively manage this threat to the survival of our species. But since these events are aperiodic and random we can not simply trust that any enlightened political consensus will someday develop spontaneously before we are faced with responding to this reality. If we would expect to deflect the next impact event a deliberate, rational punctuated equilibrium of our sociopolitical will is required now. The averaged relative frequency analysis described above or any derived random-chance statistical probabilistic assessment, in itself, would be strategically meaningless and irrelevant (just how many extinction level events can we afford?). However, they can be indirectly constructive in illuminating the existential and perpetual nature of the threat. Given that the most critically relevant strategic increment can be narrowly defined as the next “evergreen” 100 years, it would follow that the strategic expression of the existent risk of asteroid impact in its most likely rational postulate would be for one and only one large asteroid to be on course to strike Earth in the next 100 years... If we do eventually choose to respond to this threat, clearly there is no way we can address the dynamics or geometry of the Solar System so there is no systemic objective we can respond to here. We can not address 'The Threat of Asteroid Impact' as such. We can only respond to this threat as these objects present themselves as discrete impending impactors: one Rock at a time. This leaves us the only aspect of this threat we *can* respond to - a rationally manifest first-order and evergreen tactical definition of this threat Which unfortunately, as a product of random-chance, includes the prospect for our extinction. Asteroid impact is a randomly occurring existential condition. Therefore the next large asteroid impact event is inevitable and expectable, and that inevitable expectability begins... now. The Probability is Low: As a risk assessment: “The probability for large asteroid impact in the next century is low”... is irrelevant. Say the daily random-chance probability for large asteroid impact is one in a billion. And because in any given increment of time the chance that an impact will not happen is far greater than it will, the chance that it will happen can be characterized as low. However, if we look out the window and see a large asteroid 10 seconds away from impact the daily random-chance probability for large asteroid impact will still be one in a billion... and we must therefore still characterize the chance of impact as low... When the characterization of the probability can be seen to be tested to be in contradiction with the manifest empirical fact of the assessed event it then must also then be seen to be empirically false. Worse: true only in the abstract and as such, misleading. If we are going to *respond* to these events, when it counts the most, this method of assessment will not be relevant. If information can be seen to be irrelevant ex post it must also be seen to be irrelevant ex ante. This assessment is meaningless. Consider the current threat of the asteroid Apophis. With its discovery we abandon the average relative frequency derived annual random-chance probability for a rational conditional-empiric probabilistic threat assessment derived from observing its speed, vector and position relative to Earth. The collective result is expressed in probabilistic terms due only to our inability to meter these characteristics accurately enough to be precise to the point of potential impact. As Apophis approaches this point the observations and resulting metrics become increasingly accurate and the conditional-empiric probability will process to resolve into a certainty of either zero or one. Whereas the random-chance probability is unaffected by whether Apophis strikes Earth or not. These two probabilistic perceptions are inherently incompatible and unique, discrete and nonconstructive to each other. The only thing these two methodologies have in common is a nomenclature: probability/likelihood/chance, which has unfortunately served only to obfuscate their semantic value making one seem rational and relevant when it can never be so. However, merely because they are non rational does not make averaged relative frequency derived random-chance probabilities worthless. They do have some psychological merit and enable some intuitive 'old lady' wisdom. When we consider the occasion of some unpredictable event that may cause us harm and there is nothing tangible we can do to deflect or forestall or stop it from happening, we still want to know just how much we should worry about it. We need to quantify chance not only in in case we can prepare or safeguard or insure against potentially recoverable consequences after the fact, but to also meter how much hope we should invest against the occasion of such events. Hope mitigates fear. And when there is nothing else we can do about it only then is it wise to mitigate fear... “The probability for large asteroid impact in the next century is low” does serve that purpose. It is a metric for hope. Fifty years ago, before we began to master space and tangibly responding this threat of asteroid impact became a real course of action, hope was all we could do. Today we can do much more. Today we can hold our hope for when the time comes to successfully deflect. And then, after we have done everything we can possibly do to deflect it, there will still be of room for hope... and good luck. Until then, when anyone says that the probability for large asteroid impact or Extinction by NEO is low they are offering nothing more than a metric for hope -- not rational information constructive to metering a response or making a decision to do so or not. Here, the probability is in service to illusion... slight-of-mind... and is nothing more than comfort-food-for-thought. We still need such probabilistic comfort-food-for-thought for things like Rogue Black Holes and Gamma Bursts where we are still imaginably defenseless. But if we expect to punctuate the political equilibrium and develop the capability to effectively respond to the existential threat of asteroid impact, we must allow a rational and warranted fear of extinction by asteroid impact to drive a rational and warranted response to this threat forward. Forward into the hands and minds of those who have the aptitude and training and experience in *using* fear to handle fearful things. Fear focuses the mind... Fear reminds us that there are dire negative consequences if we fail. If we are going to concern ourselves with mounting a response and deflecting these objects and no longer tolerate and suffer this threat, would it not be far more relevant to know in which century the probability for large asteroid impact was *high* and far more effective to orient our thinking from when it *will not* to when it *will* occur? But this probabilistic perspective can not even pretend to approach providing us with that kind of information. As such, it can never be strategically relevant: contribute to the conduct of implementing a response. The same can be said when such abstract reasoning is used to forward the notion that the next asteroid to strike Earth will likely be small... This leads us to little more than a hope based Planetary Defense. If we are ever to respond to this threat well then we must begin thinking about this threat better. Large Asteroid Impacts Are Random Events. Expect the next one to occur at any time. Strategically speaking, this means being at DefCon 3: lock-cocked and ready to rock, prepared to defend the planet and mankind from the worst case scenario, 24/7/52... forever. Doing anything less by design, would be like planning to bring a knife to a gunfight. If we expect our technological abilities to develop and continue to shape our nascent and still politically tacit will to respond to this threat: if we are to build an effective Planetary Defense, we must abandon the debilitating sophistry of “The probability for large asteroid impact in the next century is low” in favor of rational random inevitable expectation... and its attendant fear.

#### The risk of asteroids supersedes every impact - human cognitive reluctance prevents acknowledging its propensity for extinction

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Astronomers are fond of observing that the real question is not "whether" Earth will again be struck by a large asteroid, but "when." We can detect around the planet the remnants of scores of impact craters of diverse size and age left by previous NEOs, and the pockmarks are even more obvious on the Moon and other celestial bodies, where erosion has not degraded their silhouettes. As asteroids pinball around the Solar System, it is only a matter of time before the next jarring impact-time that might be measured in months or in millions of years. The potential consequences of such a collision beggar belief Prehistoric experience demonstrates that all of human civilization, as well as most or all other forms of life on Earth, may hang in the balance. Even a more moderately sized asteroid could devastate a community or a country in an instant. As Igor Ashurbeyli assesses the stakes, developing countermeasures to this apocalyptic threat "must become the most important task that humanity must solve in the 2 1st century. "211 But the time frame matters, too. If we knew, hypothetically, that an extinction-level event was not going to occur for thousands or millions of years, why would we devote time, attention, and money to it now? A known risk of extermination, eons into the future, would pose profound philosophical and psychological conundrums, but preemptively responding to it would not be on anyone's active "to-do list" for generations. Still, timing matters in another way, too. With our present state of astronomical intelligence, we cannot be certain about our planet's prolonged safety, and we must exhibit appropriate modesty about our confidence in the completeness of the inventory of known NEOs. Accordingly, the planet may not have much advance notice about the next Chicxulub, and we may be no more able than the dinosaurs to immediately invent our way out of an unanticipated fatal space specter. Frances Lyall and Paul B. Larsen summarize the issue this way: "Time might be too short adequately to deal with the crisis-missile or other technology has to be prepared." 2 12 It is difficult for humans to think rationally about this sort of problem-it is hard to get our collective minds around such enormous consequences and such tiny probabilities simultaneously-especially when people have so little first-hand experience with the causal phenomenon. A 2010 study by the National Academy of Sciences referred to this as a classic "zero times infinity" problem that thwarts human cognitive processing.213 Cass Sunstein and Richard Zeckhauser label the resulting bias in decision-making as "probability neglect"-a propensity to misunderstand the fearsome risks that are so difficult to conceptualize.2 14 Behavioral economics literature abounds with examinations of the collective non-rationality in our species' approach to high-severity/low-probability events, leading to extreme discounting of remote future catastrophes, to the detriment of individuals and society.2 15 The underdeveloped state of international law on trans-border disasters reflects this cognitive deficit. Perhaps this should not be surprising-the tasks of preventing, responding to, and rebuilding after global catastrophes are daunting. These are topics that sovereign states, as well as individual human beings, shy away from addressing-they are uncomfortable to think about; they can involve sharing resources, as well as sympathy, with foreigners; and they seem to call for spending immense sums of money on vanishingly remote contingencies. It will never be easy to marshal political support for developing, improving, and sustaining planetary defense capabilities that in all likelihood will never be exercised during any government official's term in office or even lifetime.216 Nevertheless, planetary defense represents one of the occasions in which these psychological barriers must be overcome. The extended time frame in dealing with asteroids places special burdens on the effort to think rationally about very-low-probability dangers, because the people at risk are (likely) not ourselves but our far-distant progeny, generations so remote that the emotional connection to them is strained. We can appreciate that the good work of IAWN and SMPAG today may help increase the odds of our species' survival, but we must also be aware that the counter-asteroid technology available to earthlings a century or two from now will surely surpass today's puny capabilities in ways we cannot imagine.2 17 Collision with a body of 3-5 km diameter) could kill, say, half the world's population (soon to reach eight billion people) sometime in the next million years. On an actuarial basis, that works out to 4,000 statistical deaths annually. That is surely a significant fatality rate-enough to warrant substantial financial investment-even though the incidents would be extraordinarily "lumpy," in the sense that for almost all of those one million years, there would be no deaths at all due to asteroids, but in one year there would be an unprecedented catastrophe. At this rate, asteroids would rank above many other natural and bizarre phenomena that people fear (and that societies attempt to do something about), such as floods, tornados, airplane crashes, terrorism, or choking. Asteroids, however, would still fall far below other leading causes of death, such as automobile accidents, communicable diseases, and tobacco use. 2 18 This weird combination of probabilities and consequences promotes what many call the "giggle factor": humans' seemingly congenital reluctance to discuss planetary defense seriously without retreating to the silliest tropes about alien attacks or sci-fi thrillers. The topic seems to be ripped from kitschy movie trailers, not news headlines. 2 19 An additional fear factor here is the danger of surprise. If a significant asteroid were to arrive without warning-as in the Chelyabinsk incident-the afflicted country might perceive that it had been attacked by a hostile neighbor, rather than by a fickle Mother Nature. If, by further malign luck, the event happened to occur during a period of heightened international tensions, the propensity to misinterpret, and to respond precipitously, would rise. The unforeseen space object could thus catalyze a larger human-caused tragedy.2 20 The easiest part of the policy prescription is to recommend that more should be done to gather and disseminate the relevant data about NEOs. NASA, IAWN, and other actors should press forward zealously to enhance the inventory of known asteroids and should expand their efforts to track and characterize those that might plausibly pose a threat. This survey may get expensive: space-based telescopes may be necessary in order to detect space objects that canbe obscured by the Sun, and long-distance space missions may be required in order to collect more information about the structure, composition, and flight characteristics of asteroids of interest.

#### Starlink generates aluminum oxide upon entry and reentry – that causes a new hole in the ozone and runaway geoengineered warming

Delbert 21, Caroline Delbert is a writer, book editor, researcher, and avid reader. “All the Satellites in Space Could Crack Open the Ozone Layer”, https://www.popularmechanics.com/space/satellites/a36651845/satellite-pollution-starlink-ozone/, JUN 17, 2021, accessed 12/1/21, sb

The hole in the ozone layer, Earth’s protective chemical shield that absorbs most of the sun’s ultraviolet rays, has slowly healed over the last few decades since the global ban of chlorofluorocarbons (CFCs). But scientists are now raising the alarm about puncturing a new hole in the ozone layer—this time without any noticeable CGCs in sight. Instead, the surprising cause is deterioration of the aluminum in megaconstellation satellites like SpaceX’s Starlink network. For our purposes, a satellite is a human-made object put into low-Earth orbit (LEO) for a planned lifespan. There are about 5,000 active and defunct satellite sin LEO, with over 40,000 Starlink sats planned in the future, plus satellite projects from national space agencies and private companies around the world, researchers from the University of British Columbia say in their new Scientific Reports study. The human-made distinction may seem obvious, but it hasn’t always been. That’s because, as Space.com reports, scientists spent decades favorably comparing satellite “junk” to the amount of material deposited and burned up in our atmosphere by meteorites. As long as meteorites were so much more of the material by volume while doing almost no harm to the planet, how bad could human-made satellites be? Well, as it turns out, it’s a matter of quality rather than quantity. That’s because meteorites are made of a different constellation of minerals and elements than our custom-manufactured sky robots. “We have 54 tonnes (60 tons) of meteoroid material coming in every day,” lead study author Aaron Boley told Space.com. “With the first generation of Starlink, we can expect about 2 tonnes (2.2 tons) of dead satellites reentering Earth’s atmosphere daily. But meteoroids are mostly rock, which is made of oxygen, magnesium and silicon. These satellites are mostly aluminum, which the meteoroids contain only in a very small amount, about 1 [percent].” Aluminum is key to everything at stake here. First, it burns into reflective aluminum oxide, or alumina, which could turn into an unwitting geoengineering experiment that could alter Earth’s climate. And second, aluminum oxide could damage and even rip a new hole in the ozone layer. Let’s look at each threat separately and try to figure it out. Misadventures in Geoengineering Geoengineering is the umbrella term for technologies that seek to alter the climate or other physical realities about the planet. The major meaning that most people associate with the word is solar geoengineering, an experimental idea to fight climate change. Yes, this includes launching reflective aerosols that will “block the sun” back into space and ostensibly cool the planet, which is what Bill Gates eventually wants to try. But we just don’t know how large-scale geoengineering could affect the planet’s climate. (In the sci-fi flick Snowpiercer, geoengineering has turned Earth into a lifeless iceball whose only survivors must crowd aboard an unceasing train. That’s probably our worst-case scenario.) Aluminum oxide scatters more light than glass, with a refractive index of about 1.76 compared with just 1.52 for glass and about 1.37 for plain aluminum. The researchers write: “Anthropogenic deposition of aluminum in the atmosphere has long been proposed in the context of geoengineering as a way to alter Earth’s albedo. These proposals have been scientifically controversial and controlled experiments encountered substantial opposition. Mega-constellations [of satellites] will begin this process as an uncontrolled experiment.” Another Hole in the Ozone? What, then, of the ozone layer? Once again, aluminum oxide comes to the forefront. As aluminum burns, it can chemically react with ozone in the air to form aluminum oxide, thereby depleting the naturally protective supply of ozone in the atmosphere. The atmosphere can absorb a small amount of these chemicals without ill effect, but with tens of thousands of satellites in play, the quantities will naturally go up. That’s in addition to the ozone damage done by each rocket launch to put satellites into LEO. “Rockets threaten the ozone layer by depositing radicals directly into the stratosphere, with solid-fueled rockets causing the most damage because of the hydrogen chloride and alumina they contain,” the researchers write. While satellites typically dissolve above the stratosphere where most ozone is contained, the particulate can drift down into the stratosphere in order to react there with ozone, scientist Gerhard Drolshagen, an expert on meteoroid material, told Space.com. Aluminum oxide will sink to that level and subsequently cause losses.

#### Ozone depletion causes extinction

Voosen 20, Paul Voosen is a staff writer who covers Earth and planetary science. “No asteroids needed: ancient mass extinction tied to ozone loss, warming climate”, 27 MAY 2020, <https://www.science.org/content/article/no-asteroids-or-volcanoes-needed-ancient-mass-extinction-tied-ozone-loss-warming>, accessed 12/5/21, sb

The end of the Devonian period, 359 million years ago, was an eventful time: Fish were inching out of the ocean, and fernlike forests were advancing on land. The world was recovering from a mass extinction 12 million years earlier, but the climate was still chaotic, swinging between hothouse conditions and freezes so deep that glaciers formed in the tropics. And then, just as the planet was warming from one of these ice ages, another extinction struck, seemingly without reason. Now, spores from fernlike plants, preserved in ancient lake sediments from eastern Greenland, suggest a culprit: The planet's protective ozone layer was suddenly stripped away, exposing surface life to a blast of mutation-causing ultraviolet (UV) radiation. Just as the extinction set in, the spores became misshapen and dark, indicating DNA damage, John Marshall, a palynologist at the University of Southampton, and his co-authors say in a paper published today in Science Advances. It's evidence, he says, that "all of the ozone protection is gone." Scientists have long believed—at least before humanity became a force for extinction—that there were just two ways to wipe out life on Earth: an asteroid strike or massive volcanic eruptions. But 2 years ago, researchers found evidence that in Earth's worst extinction—the end-Permian, 252 million years ago—volcanoes lofted Siberian salt deposits into the stratosphere, where they might have fed chemical reactions that obliterated the ozone layer and sterilized whole forests. Now, spores from the end-Devonian make a compelling case that, even without eruptions, a warming climate can deplete the ozone layer, says Lauren Sallan, a paleobiologist at the University of Pennsylvania. "Because the evidence is so strong, it will make people rethink other mass extinction events." The end-Devonian die-off has long sat in the shadow of the Late Devonian extinction 12 million years earlier, one of the planet's largest. Likely driven by volcanoes that emitted gases that drastically cooled and warmed the planet, it killed most corals and many shelled sea creatures. But 10 years ago, work by Sallan and others revealed the end-Devonian was mighty in its own right, wiping out many plants and vertebrates, including most tetrapods, the four-limbed fish that had begun to evolve fingers and toes. Only the five-toed tetrapods survived. "It resets our own evolution," Marshall says. "All these archaic lineages, it kicked them out of the frame." What the end-Devonian lacked was a cause. There was no evidence for volcanism or a giant impact, but one alluring clue was seen in the rapid formation and disappearance of rock deposits associated with glaciers, Sallan says. "Something was really screwed up with climate at that time." Over the past 3 decades, Marshall has explored rocks surviving from this time in eastern Greenland. At the time, this terrain lay far from the arctic, at lower latitudes, locked in the arid interior of a landmass called the Old Red Sandstone Continent. As the climate warmed after the Devonian's last ice age, lakes formed and filled with sediment that slowly turned to mudstone, recording conditions before and during the extinction. In 2017, Marshall exhumed the perfect mudstone in a 6-meter-long drilled core. It captures a startling transformation: Healthy fossilized spores, coated in distinctive symmetrical spikes, suddenly grow misshapen, their spikes dilapidated and uneven. Spores are a common fossil because of their armored coat, but they are vulnerable to UV radiation, much like humans; spores can even develop a "tan" in response to UV. The damage Marshall saw is consistent with such exposure, says Jeffrey Benca, an experimental paleobotanist who has linked such damage to the end-Permian extinction. "What they propose seems quite plausible," he says. Marshall argues that the warming climate drove more powerful summer thunderstorms, which could have injected an ozone-depleting mix of water and salts into the stratosphere. As UV rays killed off forests, nutrient runoff into the sea could have caused blooms of plankton and algae, which would have produced more ozone-destroying salts in a runaway feedback. "It looks like it might be a perfect storm," he says. Marshall's scenario could explain not just the extinction, but also the many natural gas deposits dating from the period, says Sarah Carmichael, a geochemist at Appalachian State University. They formed from decaying organic matter, but no one has explained the needed surge in plankton growth. Nutrient runoff from dead forests could have fertilized the marine life.

### Framing

#### The standard is maximizing expected well-being.

#### 1] Death is bad and outweighs

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Contrary to those accounts, I would argue that it is death per se that is really the objective evil for us, not because it deprives us of a prospective future of overall good judged better than the alter- native of non-being. It cannot be about harm to a former person who has ceased to exist, for no person actually suffers from the sub-sequent non-participation. Rather, death in itself is an evil to us because it ontologically destroys the current existent subject — it is the ultimate in metaphysical lightening strikes.80 The evil of death is truly an ontological evil borne by the person who already exists, independently of calculations about better or worse possible lives. Such an evil need not be consciously experienced in order to be an evil for the kind of being a human person is. Death is an evil because of the change in kind it brings about, a change that is destructive of the type of entity that we essentially are. Anything, whether caused naturally or caused by human intervention (intentional or unintentional) that drastically interferes in the process of maintaining the person in existence is an objective evil for the person. What is crucially at stake here, and is dialectically supportive of the self-evidency of the basic good of human life, is that death is a radical interference with the current life process of the kind of being that we are. In consequence, death itself can be credibly thought of as a ‘primitive evil’ for all persons, regardless of the extent to which they are currently or prospectively capable of participating in a full array of the goods of life.81  In conclusion, concerning willed human actions, it is justifiable to state that any intentional rejection of human life itself cannot therefore be warranted since it is an expression of an ultimate disvalue for the subject, namely, the destruction of the present person; a radical ontological good that we cannot begin to weigh objectively against the travails of life in a rational manner. To deal with the sources of disvalue (pain, suffering, etc.) we should not seek to irrationally destroy the person, the very source and condition of all human possibility.82

#### 2] Pleasure and pain are the starting point for moral reasoning—they’re our most baseline desires and the only things that explain the intrinsic value of objects or actions

Moen 16, Ole Martin (PhD, Research Fellow in Philosophy at University of Oslo). "An Argument for Hedonism." Journal of Value Inquiry 50.2 (2016): 267.

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**. Although **pleasure and pain thus seem to be good candidates for intrinsic value and disvalue**, several objections have been raised against this suggestion: (1) that pleasure and pain have instrumental but not intrinsic value/disvalue; (2) that pleasure and pain gain their value/disvalue derivatively, in virtue of satisfying/frustrating our desires; (3) that there is a subset of pleasures that are not intrinsically valuable (so-called “evil pleasures”) and a subset of pains that are not intrinsically disvaluable (so-called “noble pains”), and (4) that pain asymbolia, masochism, and practices such as wiggling a loose tooth render it implausible that pain is intrinsically disvaluable. I shall argue that these objections fail. Though it is, of course, an open question whether other objections to P1 might be more successful, I shall assume that if (1)–(4) fail, we are justified in believing that P1 is true itself a paragon of freedom—there will always be some agents able to interfere substantially with one’s choices. The effective level of protection one enjoys, and hence one’s actual degree of freedom, will vary according to multiple factors: how powerful one is, how powerful individuals in one’s vicinity are, how frequent police patrols are, and so on. Now, we saw above that what makes a slave unfree on Pettit’s view is the fact that his master has the power to interfere arbitrarily with his choices; in other words, what makes the slave unfree is the power relation that obtains between his master and him. The difﬁculty is that, in light of the facts I just mentioned, there is no reason to think that this power relation will be unique. A similar relation could obtain between the master and someone other than the slave: absent perfect state control, the master may very well have enough power to interfere in the lives of countless individuals. Yet it would be wrong to infer that these individuals lack freedom in the way the slave does; if they lack anything, it seems to be security. A problematic power relation can also obtain between the slave and someone other than the master, since there may be citizens who are more powerful than the master and who can therefore interfere with the slave’s choices at their discretion. Once again, it would be wrong to infer that these individuals make the slave unfree in the same way that the master does. Something appears to be missing from Pettit’s view. If I live in a particularly nasty part of town, then it may turn out that, when all the relevant factors are taken into account, I am just as vulnerable to outside interference as are the slaves in the royal palace, yet it does not follow that our conditions are equivalent from the point of view of freedom. As a matter of fact, we may be equally vulnerable to outside interference, but as a matter of right, our standings could not be more different. I have legal recourse against anyone who interferes with my freedom; the recourse may not be very effective—presumably it is not, if my overall vulnerability to outside interference is comparable to that of a slave— but I still have full legal standing.68 By contrast, the slave lacks legal recourse against the interventions of one speciﬁc individual: his master. It is that fact, on a Kantian view—a fact about the legal relation in which a slave stands to his master—that sets slaves apart from freemen. The point may appear trivial, but it does get something right: whereas one cannot identify a power relation that obtains uniquely between a slave and his master, the legal relation between them is undeniably unique. A master’s right to interfere with respect to his slave does not extend to freemen, regardless of how vulnerable they might be as a matter of fact, and citizens other than the master do not have the right to order the slave around, regardless of how powerful they might be. This suggests that Kant is correct in thinking that the ideal of freedom is essentially linked to a person’s having full legal standing. More speciﬁcally, he is correct in holding that the importance of rights is not exhausted by their contribution to the level of protection that an individual enjoys, as it must be on an instrumental view like Pettit’s. Although it does matter that rights be enforced with reasonable effectiveness, the sheer fact that one has adequate legal rights is essential to one’s standing as a free citizen. In this respect, Kant stays faithful to the idea that freedom is primarily a matter of standing—a standing that the freeman has and that the slave lacks. Pettit himself frequently insists on the idea, but he fails to do it justice when he claims that freedom is simply a matter of being adequately (and reliably) shielded against the strength of others. As Kant recognizes, the standing of a free citizen is a more complex matter than that. One could perhaps worry that the idea of legal standing is something of a red herring here—that it must ultimately be reducible to a complex network of power relations and, hence, that the position I attribute to Kant differs only nominally from Pettit’s. That seems to me doubtful. Viewing legal standing as essential to freedom makes sense only if our conception of the former includes conceptions of what constitutes a fully adequate scheme of legal rights, appropriate legal recourse, justiﬁed punishment, and so on. Only if one believes that these notions all boil down to power relations will Kant’s position appear similar to Pettit’s. On any other view—and certainly that includes most views recently defended by philosophers—the notion of legal standing will outstrip the power relations that ground Pettit’s theory.

**3] Moral uncertainty means preventing extinction should be our highest priority.  
Bostrom 12** [Nick Bostrom. Faculty of Philosophy & Oxford Martin School University of Oxford. “Existential Risk Prevention as Global Priority.” Global Policy (2012)]  
These reflections on **moral uncertainty suggest** an alternative, complementary way of looking at existential risk; they also suggest a new way of thinking about the ideal of sustainability. Let me elaborate.¶ **Our present understanding of axiology might** well **be confused. We may not** nowknow — at least not in concrete detail — what outcomes would count as a big win for humanity; we might not even yet **be able to imagine the best ends** of our journey. **If we are** indeedprofoundly **uncertain** about our ultimate aims,then we should recognize that **there is a great** option **value in preserving** — and ideally improving — **our ability to recognize value and** to **steer the future accordingly. Ensuring** that **there will be a future** version of **humanity** with great powers and a propensity to use them wisely **is** plausibly **the best way** available to us **to increase the probability that the future will contain** a lot of **value.** To do this, we must prevent any existential catastrophe.