### Plan

#### Resolved: States ought to prohibit the appropriation of Low Earth Orbit by private entities.

#### The plan clarifies customary law to ban private satellite mega-constellations that appropriate Low Earth Orbit and solves otherwise detrimental space debris.

Johnson 20 [Chris, Space Law Advisor for Secure World Foundation, 9 years of professional experience in international space law and policy. J.D. from New York Law School; 2020; “The Legal Status of MegaLEO Constellations and Concerns About Appropriation of Large Swaths of Earth Orbit,” <https://swfound.org/media/206951/johnson2020_referenceworkentry_thelegalstatusofmegaleoconstel.pdf>] brett

Yes, This Is Impermissible Appropriation

Article II of the Outer Space Treaty, discussed above, is clear on the point that the appropriation of outer space, including the appropriation of either void space or of celestial bodies, is an impermissible and prohibited action under international law. No means or methods of possession of outer space will legitimize the appropriation or ownership of outer space, or subsections thereof.

Excludes Others

The constellations above, because they seem to so overwhelmingly possess particular orbits through the use of multiple satellites to occupy orbital planes, and in a manner that precludes other actors from using those exact planes, constitute an appropriation of those orbits. While the access to outer space is nonrivalrous – in the sense that anyone with the technological capacity to launch space objects can therefore explore space – it is also true that orbits closer to Earth are unique, and when any actor utilizes that orbit to such an extent to these proposed constellations will, it means that other actors simply cannot go there.

To allow SpaceX, for example, to so overwhelmingly occupy a number of altitudes with so many of their spacecraft, essentially means that SpaceX will henceforth be the sole owner and user of that orbit (at least until their satellites are removed). No other actors can realistically expect to operate there until that time. No other operator would dare run the risk of possible collision with so many other spacecraft in that orbit. Consequently, the sole occupant will be SpaceX, and if “possession is 9/10th of the law,” then SpaceX appears to be the owner of that orbit.

Done Without Coordination

Additionally, SpaceX and other operators of megaconstellations are doing so without any real international conversation or agreement, which is especially egregious and transgressive of the norms of outer space. Compared to the regime for GSO, as administered by the ITU and national frequency administrators, Low Earth Orbit is essentially ungoverned, and SpaceX and others are attempting to seize this lack of authority to claim entire portions of LEO for itself; and before any international agreement, consensus, or even discussion is had. They are operating on a purely “first come, first served” basis that smacks of unilateralism, if not colonialism.

Governments Are Ultimately Implicated

As we know, under international space law, what a nongovernmental entity does, a State is responsible for. Article VI of the Outer Space Treaty requires that at least one State authorize and supervise its nongovernmental entities and assure their continuing compliance with international law. As such, the prohibition on nonappropriation imposed upon States under Article II of the Outer Space Treaty applies equally to nongovernmental private entities such as SpaceX.

Nevertheless, through the launching and bringing into use of the Starlink constellation, SpaceX will be the sole occupant, and thereby, possessor, both fact and in law, of 550 km, 1100 km, 1130 km, 1275 km, and 1325 km above our planet (or whatever orbits they finally come to occupy). The same is true for the other operators of these large constellations which will be solely occupying entire orbits.

Long-Term Occupation Constitutes Appropriation

These altitudes are additionally significant, as nonfunctional spacecraft in orbits lower than around 500 km will re-enter the Earth’s atmosphere in months or a few years, but the altitudes selected for the Starlink constellation, while technologically desirable for their purposes, also mean that any spacecraft which are not de-orbited from these regions may be there for decades, or possibly even hundreds of years. By comparison, the granting of rights for orbital slots at GSO is in 15-year increments, a length of time much less than what the altitudes of the megaconstellations threaten. Such long spans of time at these altitudes by these megaconstellations further bolster the contention that this occupation rises to the level of appropriation of these orbits.

Prevents Others from Using Space

Article I of the Outer Space Treaty establishes that the exploration and use of outer space is “the province of all mankind.” It further requires that this exploration and use shall be by all States “without discrimination of any kind, on a basis of equality and in accordance with international law...” However, when one private corporation so overwhelmingly possesses entire portions of outer space, their use is discriminatory to other potential users and interferes with their freedom to access, explore, and use outer space. So long as these actors are so dominantly possessing and occupying those orbits, their actions exclude others from using them. What other operator would dare use orbits where there are already hundreds of satellites operating as part of a constellation? It would be an extremely unwise and risky decision to try to share these orbits with a mega constellation, so they will likely choose other altitudes and orbits. This massive occupation of particular orbits effectively defeats others from enjoying the use of outer space. While a State can issue permits for one of its corporations allowing them to launch and operate satellites to this extent, that does not automatically mean that their activities in outer space, an area beyond national sovereignty, are therefore in perfect accordance with the strictures of international law. Indeed, national permissions offer no such guarantee.

No Due Regard for Others

That these megaconstellations violate the prohibition on appropriation in Article II is additionally supported by Article IX of the Outer Space Treaty. Article IX requires that in the exploration and use of outer space, States “shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space... with due regard to the corresponding interests of other States...” There is hardly any way to view this deployment of megaconstellations as showing any type of due regard to the corresponding interests of others. This lack of regard further supports the notion of their unilateral transgressive violations of the purposes of space law norms.

Harmful Contamination

The impacts of the spacecraft on the pressing issue of space debris need not be gone into detail here. Suffice it to say, megaconstellations threaten mega-debris. The failure rate of these comparatively cheap satellites should give pause, because if 5% of a constellation of 100 satellites fails, this is 5 guaranteed new pieces of debris intentionally introduced to the fragile space domain. Article IX of the Outer Space Treaty warns of harmful contamination of the space environment and requires States to take appropriate measures to prevent this harmful contamination. A responsible government could not, in all seriousness, permit the intentional release of such amounts of space debris, especially in the already fraught orbits that many megaconstellations are headed towards. While the threat of space debris is not directly relevant to the accusation of appropriation of outer space, it goes towards the argument that these actors are conducting activities in a manner lacking in regard to others, and in fact, amounts to excluding others from using the space domain. By excluding others, this has the effect of taking orbits for themselves, which IS occupation.

If This Isn’t Appropriation, Then What Is?

Arguing in the alternative, if these megaconstellations — in their dominant occupation of entire orbits in orbital planes with numerous satellites — could be considered (merely for the sake of argument) to not be appropriation, we must therefore ask: what would be appropriation? What use of void space, including orbits of the Earth, would constitute actual appropriation? What further, additional fact of these uses of space, if added to the scenario, would cause that constellation to cross over the line into clearly prohibited appropriation? Perhaps the exact same scenario, but supplemented with an actual, formal claim of sovereignty, issued by a government, is the only element which could be added to megaconstellations which would then cross the threshold into appropriation. However, a formal claim of sovereignty would be merely an act occurring on Earth and would not change any actual facts in the space domain. Consequently, the lack of a formal claim of sovereignty should not be the deciding criteria in arriving at the conclusion that megaconstellations constitute appropriation of orbits.

Conclusion

In conclusion, these megaconstellations effectively occupy entire orbital regions with their vast fleet of spacecraft and in so doing effectively preclude other actors from sharing those domains. They have done so, or are attempting to do so, without any international consensus or discussion, which is most egregious for a domain outside of State sovereignty and which no State can own. Governments will ultimately be responsible for this appropriation, and both are prohibited from appropriating space. In distinction to GSO, their permission to go there means that they could occupy these regions for incredibly long periods — which again shows their appropriation. These constellations significantly prevent others from using those regions, which therefore interferes with others’ right to explore and use space. And ultimately, this reckless ambition shows absolutely no due regard (as per Article IX) for the corresponding rights of others. As such, these megaconstellations constitute an impermissible appropriation of particular regions of outer space, regardless of any formal, official claim of such by a responsible, authorizing government.

#### No circumvention. Authorization, supervision, and liability ensure compliance -- potential for liability causes self-regulation.

Johnson 20 [Chris, Space Law Advisor for Secure World Foundation, 9 years of professional experience in international space law and policy. J.D. from New York Law School; 2020; “The Legal Status of MegaLEO Constellations and Concerns About Appropriation of Large Swaths of Earth Orbit,” <https://swfound.org/media/206951/johnson2020_referenceworkentry_thelegalstatusofmegaleoconstel.pdf>] brett

Authorization and Continuing Supervision

The second sentence of Article VI then gives States a positive obligation to undertake authorization and continuing supervision of nongovernmental entities.

The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.

Consequently, it is not merely sufficient that governments allow private actors to access and explore space. States have a duty to authorize and supervise them. Looking again at the first sentence of Article VI, above, gives some indication as to what standard this supervision must meet. The first sentence of Article VI ends with “... and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty.” Consequently, States must authorize and supervise private entities to make sure that these private entities conform with the Outer Space Treaty.

Additionally, Article III of the Outer Space Treaty creates a link between the treaty and the rest of international law, including the UN Charter. Therefore, and to the extent that other sources of international law create norms applicable for private entities in outer space, all national activities – including private, nongovernmental activities – must conform with said laws. Some of these other sources include the other UN treaties on outer space, such as the 1968 Astronaut Rescue and Return Agreement, the 1972 Liability Convention, and the 1975 Registration Convention. Other specialized treaties on outer space, like the international telecommunications regime of the International Telecommunications Union Convention and Constitution, international enviromental law, international humanitiarian law, and other special regimes also form the rest of the normative order for outer space.

Potential Liability

Supplemental to international responsibility for acts in space committed by private entities is the potential for liability for damage resulting from their activities. Article VIII of the Outer Space Treaty establishes a liability provision, and the 1972 Liability Convention expands the mechanisms for dealing with liability claims. Liability is a requirement to pay compensation to an injured party for the damage or suffering that has been caused to them. In space law, liability is for physical damage to a space object by another space object. These provisions on liability have not yet been enforced relating to any actual claims of damage in space. However, and just like the obligation to be internationally responsible for private actors mentioned in Article VI, the potential for liability serves as a strong motivator and incentive for States to oversee, monitor, and regulate what private actors are doing in space.

#### Space debris and the potential for collisions dooms LEO spaceflight.

Moltz, 14 [James Clay; chairman of the Department of National Security Affairs at the Naval Postgraduate School, where he also holds a joint faculty appointment in the Space Systems Academic Group., “Crowded orbits Conflict and Cooperation in Space,” Columbia University Press, <https://www.jstor.org/stable/10.7312/molt15912>] brett

As noted above, space tourism will become a much more robust industry by 2020 and especially in the decade after that, when such services might become accessible to those who fall below the top one percent of earners in the developed world. Indeed, much like air travel after World War II, it is foreseeable that suborbital flight will become affordable to tens of thousands of people in upper-income brackets by 2030, with a range of new services available as technology develops further. Hundreds may be able to visit orbital hotels or stations within ten years, and a growing number of people will be working in space, tending tourist facilities as well as various industrial and manufacturing enterprises. Another factor that might change the direction of current activities in Earth orbit is the expansion of national military programs in space. To date, only three countries carry out significant military activities beyond reconnaissance: the United States, Russia, and China. But this group will likely expand further in the coming two decades. The list of militaries that might decide they have a strategic interest in testing kinetic, laser, or other active space defenses includes India, Pakistan, Japan, Iran, Israel, France, Brazil, and North Korea. Additional types of weapons that might be developed and tested against space objects in the coming two decades by various militaries—assuming new arms control mechanisms are not developed—include microwave systems, particle beams, space mines, and Earth-, sea-, air-, and space-based electronic jammers. At present, no treaty forbids these technologies, and there are strong military-industrial lobbies in a number of countries supporting space-based weapons, despite their possibly disruptive effects on space commerce, science, and passive military operations in the same regions of space. In all likelihood, the growing population in the lower reaches of space will force some sort of decision regarding priorities: either to allow countries to test and deploy large-scale orbital defenses or to strictly limit destructive weapons and emphasize commercial development of low-Earth orbit, including expanded human spaceflight. Active defenses and commerce probably will not be compatible in crowded orbits because of the linkage between space weapons and harmful debris, particularly since such military tests and related onorbit deployments—once begun by one country for missile defense, ASAT, or space-to-ground attack options—are likely to be met with countermeasures by other militaries. Under such conditions, the development of commercial human spaceflight in low-Earth orbit will become too unsafe to continue. In this regard, successful space traffic management will be essential to the ability of people, companies, and countries to enjoy future services. This improved policing must include preventing orbital collisions with debris and other spacecraft as well as avoiding radio frequency conflicts. To date, success has arguably been possible less because of effective international management and more because of the lack of crowding in space. These conditions will no longer hold in the future. Given these challenges, it seems unlikely that current space governance mechanisms will be adequate to the task of managing foreseeable space risks across the range of new actors and activities. For this reason, we next look at three alternative mechanisms for managing space over the next two decades: military hegemony, piecemeal global engagement, and enhanced international institutions.

### 1AC---Debris

#### Incoming mega-constellations of satellites ensure unmanageable space debris, triggering the Kessler Syndrome. No alt causes---current debris is being managed but constellations push Kessler over the brink.

Boley & Byers 21 [Aaron C., Department of Physics and Astronomy @ The University of British Columbia\*, and Michael, Department of Political Science @ The University of British Columbia; Published: 20 May 2021; Scientific Reports; “Satellite mega-constellations create risks in Low Earth Orbit, the atmosphere and on Earth,” <https://www.nature.com/articles/s41598-021-89909-7>] brett

Companies are placing satellites into orbit at an unprecedented frequency to build ‘mega-constellations’ of communications satellites in Low Earth Orbit (LEO). In two years, the number of active and defunct satellites in LEO has increased by over 50%, to about 5000 (as of 30 March 2021). SpaceX alone is on track to add 11,000 more as it builds its Starlink mega-constellation and has already filed for permission for another 30,000 satellites with the Federal Communications Commission (FCC)1. Others have similar plans, including OneWeb, Amazon, Telesat, and GW, which is a Chinese state-owned company2. The current governance system for LEO, while slowly changing, is ill-equipped to handle large satellite systems. Here, we outline how applying the consumer electronic model to satellites could lead to multiple tragedies of the commons. Some of these are well known, such as impediments to astronomy and an increased risk of space debris, while others have received insufficient attention, including changes to the chemistry of Earth’s upper atmosphere and increased dangers on Earth’s surface from re-entered debris. The heavy use of certain orbital regions might also result in a de facto exclusion of other actors from them, violating the 1967 Outer Space Treaty. All of these challenges could be addressed in a coordinated manner through multilateral law-making, whether in the United Nations, the Inter-Agency Debris Committee (IADC), or an ad hoc process, rather than in an uncoordinated manner through different national laws. Regardless of the law-making forum, mega-constellations require a shift in perspectives and policies: from looking at single satellites, to evaluating systems of thousands of satellites, and doing so within an understanding of the limitations of Earth’s environment, including its orbits.

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.

Figure 1

[Figure 1 omitted]

Cumulative on-orbit distribution functions (all orbits). Deorbited objects are not included. The 2007 and 2009 spikes are a Chinese anti-satellite test and the Iridium 33-Kosmos 2251 collision, respectively. The recent, rapid rise of the orange curve represents NewSpace (see "Methods").

Full size image

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.

Figure 2

[Figure 2 omitted]

Orbital distribution and density information for objects in Low Earth Orbit (LEO). (Left) Distribution of payloads (active and defunct satellites), binned to the nearest 1 km in altitude and 1° in orbital inclination. The centre of each circle represents the position on the diagram, and the size of the circle is proportional to the number of satellites within the given parameter space. (Right) Number density of different space resident objects (SROs) based on 1 km radial bins, averaged over the entire sky. Because SRO objects are on elliptical orbits, the contribution of a given object to an orbital shell is weighted by the time that object spends in the shell. Despite significant parameter space, satellites are clustered in their orbits due to mission requirements. The emerging Starlink cluster at 550 km and 55° inclination is already evident in both plots (Left and Right).

Full size image

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.

Figure 3

[Figure 3 omitted]

Satellite density distribution in LEO with the Starlink and OneWeb mega-constellations as filed (and amended) with the FCC. Provided that the orbits are nearly circular, the number densities in those shells will exceed 10–6 km−3. Because the collisional cross-section in those shells is also high, they represent regions that have a high collision risk whenever debris is too small to be tracked or collision avoidance manoeuvres are impossible for other reasons.

Full size image

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.

#### No alt causes or thumpers---absent megaconstellations, LEO debris would increase slowly for decades, eventually stabilizing after 200 years. Prefer NASA studies that assume our plan.

---1 collision a decade is hardly enough to trigger Kessler syndrome.

Liou et al. 18 [Dr. J.-C. Liou is the NASA Chief Scientist for Orbital Debris; Matney M., NASA Johnson Space Center; Vavrin A., GeoControl Systems – Jacobs JETS Contract; Manis A., HX5 – Jacobs JETS Contract, NASA Johnson Space Center; Gates D., Jacobs Technology, NASA Johnson Space Center, Orbital Debris Quarterly News, 2018; “NASA ODPO's Large Constellation Study,” <https://www.orbitaldebris.jsc.nasa.gov/quarterly-news/pdfs/odqnv22i3.pdf>] brett

In recent years, several commercial companies have proposed telecommunications constellations consisting of hundreds to thousands of 100-to-300-kg class spacecraft in low Earth orbit (LEO, the region below 2000-km altitude). If deployed, such large constellations (LCs) will dramatically change the landscape of satellite operations in LEO. Fig. 1 shows the current mass distribution in LEO. The top blue histogram shows the total and the three curves below show a breakdown by object type (spacecraft, rocket bodies, or other). The mass distribution is dominated by spacecraft and upper stages (i.e., rocket bodies). The yellow bars from 1100 km to 1300 km altitudes show the notional mass distribution from 8000 150 kg LC spacecraft or, equivalently, 4000 300 kg LC spacecraft. From the large amount of mass involved, it is clear that the deployment, operations, and frequent de-orbit and replenishment of the proposed LCs could significantly contribute to the existing orbital debris problem.

To better understand the nature of the problem, the NASA Orbital Debris Program Office (ODPO) recently completed a parametric study on LCs. The objective was to quantify the potential negative debris-generation effects from LCs to the LEO environment and provide recommendations for mitigation measures. The tool used for the LC study was the ODPO’s LEO-to-GEO Environment Debris (LEGEND) numerical simulation model, which has been used for various mitigation and remediation studies in the past [1, 2]. For the LC study, more than 300 scenarios based on different user-specified assumptions and parameters were defined. Selected results from key scenarios are summarized in this article.

The LEO Environment without Large Constellations

To establish a benchmark to assess the effects from LCs, several baseline scenarios were completed first. Fig. 2 shows the environment projection without LCs. The historical curve reflects the documented launches and breakup events between 1957 and 2015. The antisatellite test conducted by China and the accidental collision between Iridium 33 and Cosmos 2251 were the reasons for the jump in 2007 and 2009, respectively. Future launch traffic is a repeat of the launches over the last 8 years of the historical space activities (2008-2015). The environment is projected 200 years into the future, through the year 2215.

Each future projection curve is the average of 100 LEGEND Monte Carlo (MC) simulation runs. The top red curve is the result of a non-mitigation scenario where LEO-crossing upper stages and spacecraft are left at mission altitudes at the end of mission operations rather than conducting postmission disposal (PMD) maneuvers to lower their orbits to follow the 25-year decay rule. Upper stages and spacecraft are also assumed to explode in the future with accidental explosion probabilities derived from the historical explosion events. The middle black-dashed curve is the result of a scenario where LEO-crossing upper stages and spacecraft are assumed to follow the 25-year decay rule at the end of their missions with a PMD reliability of 90%. The bottom blue-dotted curve is the result of a scenario where, in addition to the 90% PMD success rate, no explosions occur in the future.

As expected, the non-mitigation scenario leads to a rapid LEO population increase over time, with an approximately 330% increase in 200 years, i.e., from the beginning of 2016 to the end of 2215. The non-linear increase is also an indication of the collision feedback effect in the environment. With a global 90% PMD implementation of the 25-year decay rule, however, the debris population growth is reduced to about a 110% linear increase in 200 years. If explosions can be eliminated, the population growth is further reduced to 40% in 200 years.

Fig. 3 shows the cumulative numbers of catastrophic collisions involving 10 cm and larger objects over time. A catastrophic collision occurs when the ratio of impact kinetic energy to target mass exceeds 40 J/g. The outcome of a catastrophic [FIGURES OMITTED] collision is the total fragmentation of the target, whereas a non-catastrophic collision only results in minor damage to the target and generates a small amount of debris that should have negligible contribution to the long-term debris population increase. Again, the non-mitigation scenario leads to a non-linear increase of catastrophic collisions, a total of 61 in 200 years, whereas the effective implementation of PMD and additionally, elimination of future explosions can reduce the numbers of catastrophic collisions to 27 and 21, respectively, in 200 years. The increases in effective number of objects and catastrophic collisions for the 90% PMD scenarios, with future explosions, are used to benchmark the effects when LCs are added to the simulated environment as described in the sections below.

#### Increasing debris triggers miscalculated war. The internal link is linear---any reduction in debris reduces the risk.

Dockrill 16 [Peter; 2016; Award-winning science & technology journalist. “Space Junk Accidents Could Trigger Armed Conflict, Study Finds.” <https://www.sciencealert.com/space-junk-accidents-could-trigger-armed-conflict-expert-warns>] brett

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

#### **It goes nuclear.**

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

Satellite imagery is used by the military and our political leaders to maintain the peace. When your potential adversaries can’t hide what they’re doing, where their armies are moving and what they are doing with their civilian and military infrastructure, then the danger of surprise attack is diminished. In our nuclear age with instant death only minutes away by missile attack, the doctrine of Mutual Assured Destruction (MAD) only works if both sides know whether or not they are being attacked. The launch of missiles or a bomber fleet can easily be seen from space far in advance of either reaching their potential targets halfway around the globe. The danger of surprise attack is therefore small, making an accidental war far less likely. So what does all this mean? And what do we do about it? First of all, it means that the advocates of space development, exploration and commercialization have succeeded far beyond their initial expectations and dreams. The economies and security of countries in the developed world are now dependent on space satellites. We space advocates should celebrate our success and be terrified of it at the same time. Should we lose these fragile assets in space, our economy would experience a disruption like no other: ship, air and train travel would stop and only restart/operate in a much-reduced capacity for years (GPS loss). Many banking and retail transactions would cease (VSAT loss). Distribution of news and vital national information would be crippled (communications satellite loss). Lives would be put at risk and the productivity of our farming would dramatically decrease (weather satellite loss). The risk of war, including nuclear war, would increase (loss of spy satellites) and our military’s ability to react to crises would be significantly reduced (loss of military logistics and intelligence gathering satellites).

#### Nuclear war causes extinction.

Trevithick and Rogoway ’19 [Joseph and Tyler; February 27; Military Analyst, M.A. in Conflict Resolution from Georgetown University, B.A. in the History and Policy of International Relations at Carnegie-Mellon University; Defense Journalist; The Drive, “Yes, India And Pakistan Could End The World As We Know It Through A Nuclear Exchange,” <https://www.thedrive.com/the-war-zone/26674/yes-india-and-pakistan-could-end-the-world-as-we-know-it-through-a-nuclear-exchange>] brett

A global threat

India and Pakistan's nuclear arsenals are tiny compared to those of the [United States and Russia](http://thedrive.com/the-war-zone/26013/russia-says-its-own-new-weapons-are-exempt-after-accusing-u-s-of-violating-nuclear-arms-deal), and these weapons are focused primarily on deterring each other, but that does not mean they're purely regional threats. Unlike conventional weapons, nuclear weapons create lasting and far-reaching effects that scientists have posited could upend life on Earth if warring parties were to use them in sufficient numbers.

[In 2012](http://climate.envsci.rutgers.edu/pdf/RobockToonSAD.pdf), Alan Robock, a distinguished professor in the Department of Environmental  Sciences and Associate Director of the Center for Environmental Prediction at Rutgers University, and Owen Brian Toon, a professor in the Department of Atmospheric and Oceanic Sciences and a research associate at  the Laboratory for Atmospheric and Space Physics at the University of Colorado, Boulder, argued that it might not take a large amount of nuclear weapons to create a scenario commonly known as "[Nuclear Winter](https://en.wikipedia.org/wiki/Nuclear_winter)."

In general, this hypothesized event occurs when smoke and soot from nuclear explosions block significant amounts of sunlight from reaching the earth's surface, leading to a precipitous drop in temperatures that results in mass crop failure and widespread famine.

Robcock and Toon summarized their findings, which were based in part on their previous work, in an article in the Bulletin of The Atomic Scientists, [writing](http://climate.envsci.rutgers.edu/pdf/RobockToonSAD.pdf):

"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 airbursts in urban areas, could produce so much smoke that temperatures would fall below those of the [Little Ice Age](https://en.wikipedia.org/wiki/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 United States and China would decline by about 20 percent for four years, and by 10 percent for a decade.

The bomb the United States dropped on Hiroshima Japan, known as [Little Boy](https://en.wikipedia.org/wiki/Little_Boy), was an inefficient and essentially experimental design with a yield of around 15 kilotons. The reported results from [Indian](https://en.wikipedia.org/wiki/List_of_nuclear_weapons_tests_of_India) and Pakistani nuclear testing indicate that both countries can meet this threshold and both countries' weapons programs have almost certainly matured in the decades since.

In previous studies, Robcock, working with others, postulated that temperature changes could begin within 10 days of a limited nuclear exchange and the effects from the detonations of 100 nuclear weapons in the 15-kiloton class would directly result in the deaths of [at least 20 million people](http://www.nucleardarkness.org/warconsequences/fivemilliontonsofsmoke/). The second order impacts would be even worse in the years that followed.

In 2014, Michael Mills and Julia Lee-Taylor, both then working at the federally-funded National Center for Atmospheric Research's (NCAR) Earth System Laboratory, authored another paper with Robcock and Toon. This [study concluded](https://web.archive.org/web/20140308191334/http:/acd.ucar.edu/~mmills/pubs/2014_EarthsFuture_Mills_et_al.pdf) again that detonation of 100 15-kiloton yield bombs in a purely regional conflict would result in "multi-decadal global cooling" and "would put significant pressures on global food supplies and could trigger a global nuclear famine."

It is important to note that[critics have questioned](https://en.wikipedia.org/wiki/Nuclear_winter#Critical_response_to_the_more_modern_papers) whether the Nuclear Winter concept relies on too many assumptions and would ever actually occur. At the center of many of these rebuttals are debates about whether the nuclear explosions would truly create the amount of smoke and soot necessary for major climate change, as well as the specific conditions for those particles to remain in the atmosphere for a prolonged period of time.

The studies here do indicate significant impacts based on a relatively limited number of nuclear detonations of smaller yield devices, though. But even if the impacts are less pronounced than projected in this particular scenario, they could be far more severe if India and Pakistan were to use a larger number weapons and/or ones of higher yields, which both belligerents readily have.

In addition, Nuclear Winter is just one of the potential things that might happen following a nuclear exchange between the longtime foes. A detonation of dozens of nuclear weapons, even small ones, would throw hazardous nuclear fallout [into the air](http://thedrive.com/the-war-zone/19450/u-s-training-for-arctic-nuclear-satellite-disaster-amid-russian-weapons-developments) that, depending on the weather pattern, could carry that material [far and wide](https://futureoflife.org/background/us-nuclear-targets/?cn-reloaded=1#nukemap), causing both near- and short-term health impacts. The various [ground zeroes](https://nuclearsecrecy.com/nukemap/) themselves would be irritated and potentially hazardous for many years to come.

Depending on where the detonations occur, a nuclear exchange could potentially cut people off from critical water and food supplies, putting increased and potentially unsustainable strains on uncontaminated areas.  After the Chernobyl nuclear power plant, situated in Ukraine, [melted down and exploded](https://en.wikipedia.org/wiki/Chernobyl_disaster) in 1986, authorities established a 1,000 square mile restricted access "[exclusion zone](https://en.wikipedia.org/wiki/Chernobyl_Exclusion_Zone)" that remains in place today.

There would also be a major danger of second-order "spillover" effects, as individuals fled affected areas, putting economic and political strains on neighboring regions. This could inflame existing tensions not directly related to the inter-state conflict between India or Pakistan or lead to all new and potentially violent competition for what might already be limited resources. India has already threatened to [weaponize water access](https://www.nytimes.com/2019/02/21/world/asia/india-pakistan-water-kashmir.html) in its latest spat with the Pakistanis.

Any serious impacts on food and water supplies, or other economic upheavals as a direct or indirect result of the conflict, would have cascading impact across South Asia and beyond, as well. The very threat of a potential India-Pakistan war of any kind already caused [some negative reactions](https://www.cnbc.com/2019/02/27/indian-air-force-plane-crashes-in-kashmir-says-indian-police-official.html) in regional financial markets. Those markets would certainly collapse after an unprecedented nuclear exchange actually occurred, and that is before the long-term physical impacts of such an event would even manifest themselves.

Overall, we are talking about a sudden and dramatic geopolitical, financial, and environmental shift that would change our reality in a matter of hours. Even then, the darkness, both figuratively and literally, that could propagate over the weeks, months, and years would be far more damaging.

How great is the risk?

So far, India and Pakistan have not made any clear indications that the fighting is close to crossing their nuclear thresholds. Pakistan's warnings about the [risks of escalation](http://thedrive.com/the-war-zone/26642/pakistan-promises-retaliation-makes-nuclear-threats-after-indian-jets-bomb-its-territory) seem more calculated to try and prompt India to back down.

India itself has a so-called "no first use" policy, which means it has publicly pledged to use its nuclear weapons only in retaliation to a nuclear strike. However, experts have increasingly called into question whether this is truly the case and whether India might be developing delivery systems more suited to a first strike should there be a need to shift policies.

Pakistan, however, does not have a no first use policy and has insisted on its right to employ nuclear weapons to defend itself even in the face of purely conventional threat. Pakistani officials have, in the past, [specifically cited this policy](https://www.cfr.org/event/promoting-us-pakistan-relations-future-challenges-and-opportunities) as way of deterring India, which has a much larger and in some cases more advanced conventional force, and preventing larger wars.

The concern, then, is that this policy appears to have failed, at least to some degree, with India's strike on undisputed Pakistani territory on Feb. 26, 2019. India, however, did not target Pakistani forces in that instance and exchanges between the two countries have been limited, at least so far, to the disputed Jammu and Kashmir region, where violent skirmishes occur semi-regularly without precipitating a larger confrontation.

We can only hope that the two countries will find a diplomatic solution to this latest conflict and avoid any further escalation. If things were to spiral out of control and lead to the use of nuclear weapons, it would be something that would threaten all of humanity.

### 1AC---Ozone

#### Ozone is recovering now, breakdown causes existential environmental disaster.

WMO 21 [World Meteorological Organization; 9-15-2021; “Ozone layer recovery is an environmental success story,” <https://public.wmo.int/en/media/news/ozone-layer-recovery-environmental-success-story>] brett

The ozone layer in the upper atmosphere blocks ultraviolet (UV) radiation that harms living tissue, including humans and plants. The ozone “hole,” which was discovered in 1985 is the result of human emited chlorofluorocarbons (CFCs), which are ozone-depleting chemicals and greenhouse gases used as coolants in refrigerators and in aerosol spray. Nearly 200 countries signed the Montreal Protocol in 1987, which phased out the production and consumption of CFCs.

A new study in Nature demonstrates that by protecting the ozone layer, which blocks harmful UV radiation, the Montreal Protocol also protects plants and their ability to pull carbon from the atmosphere.

“The Montreal Protocol began life as a mechanism to protect and heal the ozone layer. It has done its job well over the past three decades. The ozone layer is on the road to recovery. The cooperation we have seen under the Montreal Protocol is exactly what is needed now to take on climate change, an equally existential threat to our societies,” said UN Secretary-General Antonio Guterres in a message.

The most recent WMO /UN Environment Programme Scientific Assessment of Ozone Depletion, issued in 2018, concluded that the measures under the protocol will lead to the ozone layer on the path of recovery and to potential return of the ozone in the Arctic and Northern Hemisphere mid-latitude ozone before the middle of the century (~2035) followed by the Southern Hemisphere mid-latitude around mid-century, and Antarctic region by 2060 .

Although the use of halons and chlorofluorocarbons has been discontinued, they will remain in the atmosphere for many decades. Even if there were no new emissions, there is still more than enough chlorine and bromine present in the atmosphere to destroy ozone at certain altitudes over Antarctica from August to December. The formation of the ozone hole is still expected to be an annual spring event. Its size and depth are governed to a large degree by the meteorological conditions particular for the year.

As of the first week of August 2021, the ozone hole reappeared and is rapidly growing and has extended to 23 million square kilometers on 13 September which is above the average since the mid 1980s. The lowest ozone value in the during this seasons was around 140 DU. The hole fluctuates in size annually and it usually reaches its largest area during the coldest months in the southern hemisphere, from late September to early October.

Its evolution is monitored by satellites and ground-based observing stations of WMO’s Global Atmosphere Watch Programme. Those observations are being combined with numerical modelling by different organizations and institutions (NASA, the Copernicus Atmospheric Monitoring Service implemented by ECMWF, ECCC, KNMI and others) to provide near -real time information and analyses on the ozone levels at different parts of the stratosphere, the location and dimensions of the ozone depleted area.

In 2020, there were exceptionally large ozone holes over the Antarctic and Arctic, reflecting extreme meteorological conditions. Specific dynamic conditions in the stratosphere in 2019 led to the smallest Antarctic ozone hole since its discovery. This shows the need for continued vigilance and observations.

Ozone and climate

The theme for this year is Montreal Protocol – keeping us, our food and vaccines cool.

Ozone depleting substances (ODS) are also greenhouse gases (GHG) and their abundance in atmosphere over the years has made an important contribution to the radiative forcing of climate.

While ODS concentrations are expected to keep decreasing, the concentrations of long-lived greenhouse gases have been increasing.

The distribution and amount of stratospheric ozone depends on temperature and circulation, so that changes in climate will affect the distribution of ozone. Long-lived greenhouse gases warm the troposphere, but cool the stratosphere, leading to changes of the global circulation, affecting the stability of the polar winter vortices, and changing weather patterns.

Therefore, the future evolution of the ozone layer will be influenced by the concentrations of these long-lived greenhouse gases, and by climate change.

The Montreal Protocol has led to very significant avoided warming and the Kigali amendment which regulates the hydrofluorocarbons (HFCs), CFCs and hydrochlorofluorocarbons (HCFCs) replacement gases, adds a further layer of important climate protection. The avoided ultraviolet radiation and climate change also have co-benefits for plants and their capacity to store carbon through photosynthesis.

Some recent scientific findings point that the ozone depletion in the Arctic polar vortex could intensify by the end of the century unless global greenhouse gases are rapidly and systematically reduced. In the future, this could also mean more UV radiation exposure in Europe, North America and Asia when parts of the polar vortex drift south.

Scientists are monitoring the extent to which climate change is leading to stratospheric cooling, which enhances the possibilities for observing temperatures under -78°C especially in the Arctic where there is evidence that the coldest stratospheric winters are becoming colder. Those temperatures are needed for the polar stratospheric cloud formation where the destruction of the ozone takes place.

UV Radiation

Several feedbacks to climate change occur from the effects of UV radiation on the biosphere. For example, the breakdown or photodegradation of dead plant material releases carbon to the atmosphere, increasing the amount of carbon dioxide and other greenhouse gases.

Increased thawing or melting of snow, ice and permafrost in the Arctic also releases GHGs and has a negative effect on the exposed ecosystems.

Studies are showing that temperature, UV radiation and frequency of rainfall are key factors that determine the availability or range of suitable habitats for certain plant species to survive. UV-B radiation and factors associated with climate change affect plant growth, pathogen and pest defence, and food crop quality.

For human health, UV radiation can have significant negative effects, for example, in causing skin cancers and certain eye diseases, such as cataract. However, the Montreal Protocol has played a major role in avoiding large numbers of cases and deaths.

With regard to pollution, UV radiation can have a substantial impact on the composition and quality of the atmosphere; on human, terrestrial and aquatic environment health. It drives the breakdown of plastic pollutants with implications for human health and the environment.

#### Megaconstellations of satellites and frequent re-entry causes Ozone Hole 2.0

Tereza 21 [Tereza; June 07, 2021; Bachelor's in Journalism and Master's in Cultural Anthropology from Prague's Charles University, Master's in Science from the International Space University. Space.com, “Air pollution from reentering megaconstellation satellites could cause ozone hole 2.0,” <https://www.space.com/starlink-satellite-reentry-ozone-depletion-atmosphere>] brett

Chemicals released as defunct satellites burn in the atmosphere could damage Earth’s protective ozone layer if plans to build megaconstellations of tens of thousands of satellites, such as SpaceX's Starlink, go ahead as foreseen, scientists warn.

Researchers also caution that the poorly understood atmospheric processes triggered by those chemicals could lead to an uncontrolled geoengineering experiment, the consequences of which are unknown.

For years, the space community was content with the fact that the amount of material that burns in the atmosphere as a result of Earth's encounters with meteoroids far exceeds the mass of defunct satellites meeting the same fate. Even the rise of megaconstellations won't change that. The problem, however, is in the different chemical composition of natural meteoroids compared to artificial satellites, according to Aaron Boley, an associate professor of astronomy and astrophysics at the University of British Columbia, Canada.

"We have 54 tonnes (60 tons) of meteoroid material coming in every day," Boley, one of the authors of a paper published May 20 in the journal Scientific Reports, 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%."

Related: SpaceX's Starlink satellite megaconstellation launches in photos

Uncontrolled geoengineering

The scientists realised that megaconstellations have a significant potential to change the chemistry of the upper atmosphere compared to its natural state. But not only that. The burning of aluminum is known to produce aluminum oxide, also known as alumina, which can trigger further unexplored side effects.

"Alumina reflects light at certain wavelengths and if you dump enough alumina into the atmosphere, you are going to create scattering and eventually change the albedo of the planet," Boley said.

Albedo is the measure of the amount of light that is reflected by a material. In fact, increasing Earth's albedo by pumping certain types of chemicals into the higher layers of the atmosphere has been proposed as a possible geoengineering solution that could slow down global warming. However, Boley said, the scientific community has rejected such experiments because not enough is known about their possible side effects.

"Now it looks like we are going to run this experiment without any oversight or regulation," Boley said. "We don't know what the thresholds are, and how that will change the upper atmosphere."

The Cygnus re-supply vehicle, which delivers cargo to the International Space Station, burning up in the atmosphere during its reentry. (Image credit: ESA/Alexander Gerst)

Ozone hole 2.0

The aluminum from re-entering satellites also has a potential to damage the ozone layer, a problem well known to humanity, which has been successfully solved by widespread bans on the use of chlorofluorocarbons, chemicals used in the past in aerosol sprays and refrigerators.

In their paper, Boley and his colleague Michael Byers cite research by their counterparts from the Aerospace Corporation, a U.S. non-profit research organization, which identified local damage to the planet's ozone layer triggered by the passage of polluting rockets through the atmosphere.

"We know that alumina does deplete ozone just from rocket launches themselves because a lot of solid-fuel rockets use, or have, alumina as a byproduct," Boley said. "That creates these little temporary holes in the stratospheric ozone layer. That's one of the biggest concerns about compositional changes to the atmosphere that spaceflight can cause."

The ozone layer protects life on Earth from harmful UV radiation. The depletion of ozone in the stratosphere, the second lowest layer of the atmosphere extending between altitudes of approximately 7 to 40 miles (10 to 60 kilometers), led to an increased risk of cancer and eye damage for humans on Earth.

Gerhard Drolshagen, of the University of Oldenburg, Germany, who has published papers about the effects of meteoroid material on Earth, told Space.com that reentering satellites usually evaporate at altitudes between 55 and 30 miles (90 and 50 km), just above the ozone-rich stratosphere. However, he added, the particles created as a result of the satellites' burning will eventually sink to the lower layers.

Boley said that as the alumina sinks into the stratosphere, it will cause chemical reactions, which, based on existing knowledge, will likely trigger ozone destruction.

Drolshagen, who wasn't involved in the recent study, agreed that because "satellites are mostly made of aluminum, the amount of aluminum deposited in the atmosphere will certainly increase."

Concerns about the effects of aluminium oxides on the atmosphere have been cited by U.S. telecommunications operator Viasat in its request to the US Federal Communications Commision to suspend launches of SpaceX's Starlink megaconstellation until a proper environmental review of its possible impacts is conducted.

Spectacular stratospheric clouds are linked to ozone destruction. (Image credit: NASA/Lamont Poole)

Learning from past mistakes

In their study, Boley and his colleagues looked only at the effects of the first generation of the Starlink megaconstellation, which is expected to consist of 12,000 satellites. More than 1,700 of these have already been launched. As a result of SpaceX's activities (and to a lesser extent those of other constellation operators), the number of active and defunct satellites in low Earth orbit, the region of space below the altitude of 620 miles (1,000 km), has increased by 50% over the past two years, according to the paper.

"The problem is that there are now plans to launch about 55,000 satellites," Boley said. "Starlink second generation could consist of up to 30,000 satellites, then you have Starnet, which is China's response to Starlink, Amazon's Kuiper, OneWeb. That could lead to unprecedented changes to the Earth’s upper atmosphere."

Megaconstellation operators, inspired by the consumer technology model, expect fast development of new satellites and frequent replacement, thus the high amount of satellites expected to be burning in the atmosphere on a daily basis.

#### Extinction.

Skudlarek 16 [Cooper, pollution writer for L2P, 12-13-2016, “The Ozone Layer,” <https://letters2president.org/letters/24312>] brett

We have a problem- a big problem (a 518,000,000 square kilometer problem to be exact). The ozone layer is a belt of naturally occurring gas that protects us from harmful radiation and it is at risk. We need to regulate the amount of air pollution produced and fossil fuels burned to prevent the formation of ozone holes which allow radiation to seep into the troposphere.

The Earth’s stratosphere is a part of our atmosphere that houses the earth’s ozone layer. The ozone layer is a belt of naturally occurring gas called ozone (hence the name ozone layer) that sits 15 kilometers above earth’s surface and shields us from a form of a form of radiation produced by the sun known as ultraviolet B radiation. Over the next 14 years the levels of carbon dioxide seeping into our atmosphere will have increased by nearly 40 percent. According to the website Conserve Energy Future, “An essential property of ozone molecule is its ability to block solar radiations of wavelengths less than 290 nanometers from reaching Earth’s surface. In this process, it also absorbs ultraviolet radiations that are dangerous for most living beings. UV radiation could injure or kill life on Earth. Though the absorption of UV radiations warms the stratosphere but it is important for life to flourish on planet Earth. Research scientists have anticipated disruption of susceptible terrestrial and aquatic ecosystems due to depletion of ozone layer.” This means that although it is necessary to keep our planet habitable it is only helpful if we have the right amount and we have far too much.

This is a major issue because the excess radiation caused by holes in the ozone layer is allowing immense amounts of solar radiation to seep into the troposphere (where we live). If humans (or any species for that matter) are exposed to too much of this radiation, then we can develop serious skin diseases including cancer. In addition, to that if the plants at the bottom of the food chain receive too much solar radiation, then they will die out causing waves of distortion to ripple up the food chain and the catastrophic extinction of many species that are vital to our survival. Finally, the constant decay of our ozone layer is exponentially accelerating climate change. This leads to things such as: global warming, Arctic Circle thawing, stronger hurricanes, sea level rising, and more.

### 1AC--- Framing

### Framing

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

#### Extinction must outweigh – moral uncertainty demands we preserve the conditions for life, even a tiny risk outweighs, and future gains in quality of life ensure it’s a prior question

Todd 17 [Ben has a 1st from Oxford in Physics and Philosophy, has published in Climate Physics, once kick-boxed for Oxford, and speaks Chinese, badly. "The case for reducing extinction risk." <https://80000hours.org/articles/extinction-risk/>] brett

In this new age, what should be our biggest priority as a civilisation? Improving technology? Helping the poor? Changing the political system? Here’s a suggestion that’s not so often discussed: our first priority should be to survive. So long as civilisation continues to exist, we’ll have the chance to solve all our other problems, and have a far better future. But if we go extinct, that’s it. Why isn’t this priority more discussed? Here’s one reason: many people don’t yet appreciate the change in situation, and so don’t think our future is at risk. Social science researcher Spencer Greenberg surveyed Americans on their estimate of the chances of human extinction within 50 years. The results found that many think the chances are extremely low, with over 30% guessing they’re under one in ten million.3 We used to think the risks were extremely low as well, but when we looked into it, we changed our minds. As we’ll see, researchers who study these issues think the risks are over one thousand times higher, and are probably increasing. These concerns have started a new movement working to safeguard civilisation, which has been joined by Stephen Hawking, Max Tegmark, and new institutes founded by researchers at Cambridge, MIT, Oxford, and elsewhere. In the rest of this article, we cover the greatest risks to civilisation, including some that might be bigger than nuclear war and climate change. We then make the case that reducing these risks could be the most important thing you do with your life, and explain exactly what you can do to help. If you would like to use your career to work on these issues, we can also give one-on-one support. Reading time: 25 minutes How likely are you to be killed by an asteroid? An overview of naturally occurring existential risks A one in ten million chance of extinction in the next 50 years — what many people think the risk is — must be an underestimate. Naturally occurring existential risks can be estimated pretty accurately from history, and are much higher. If Earth was hit by a 1km-wide asteroid, there’s a chance that civilisation would be destroyed. By looking at the historical record, and tracking the objects in the sky, astronomers can estimate the risk of an asteroid this size hitting Earth as about 1 in 5000 per century.4 That’s higher than most people’s chances of being in a plane crash (about one in five million per flight), and already about 1000-times higher than the one in ten million risk that some people estimated.5 Some argue that although a 1km-sized object would be a disaster, it wouldn’t be enough to cause extinction, so this is a high estimate of the risk. But on the other hand, there are other naturally occurring risks, such as supervolcanoes.6 All this said, natural risks are still quite small in absolute terms. An upcoming paper by Dr. Toby Ord estimated that if we sum all the natural risks together, they’re very unlikely to add up to more than a 1 in 300 chance of extinction per century.7 Unfortunately, as we’ll now show, the natural risks are dwarfed by the human-caused ones. And this is why the risk of extinction has become an especially urgent issue. A history of progress, leading to the start of the most dangerous epoch in human history If you look at history over millennia, the basic message is that for a long-time almost everyone was poor, and then in the 18th century, that changed.8 Large economic growth created the conditions in which now face anthropogenic existential risks This was caused by the industrial revolution — perhaps the most important event in history. It wasn’t just wealth that grew. The following chart shows that over the long-term, life expectancy, energy use and democracy have all grown rapidly, while the percentage living in poverty has dramatically decreased.9 Chart prepared by Luke Muehlhauser in 2017. Literacy and education levels have also dramatically increased: Image source. People also seem to become happier as they get wealthier. In The Better Angels of Our Nature, Steven Pinker argues that violence is going down.10 Individual freedom has increased, while racism, sexism and homophobia have decreased. Many people think the world is getting worse,11 and it’s true that modern civilisation does some terrible things, such as factory farming. But as you can see in the data, many important measures of progress have improved dramatically. More to the point, no matter what you think has happened in the past, if we look forward, improving technology, political organisation and freedom gives our descendants the potential to solve our current problems, and have vastly better lives.12 It is possible to end poverty, prevent climate change, alleviate suffering, and more. But also notice the purple line on the second chart: war-making capacity. It’s based on estimates of global military power by the historian Ian Morris, and it has also increased dramatically. Here’s the issue: improving technology holds the possibility of enormous gains, but also enormous risks. Each time we discover a new technology, most of the time it yields huge benefits. But there’s also a chance we discover a technology with more destructive power than we have the ability to wisely use. And so, although the present generation lives in the most prosperous period in human history, it’s plausibly also the most dangerous. The first destructive technology of this kind was nuclear weapons. Nuclear weapons: a history of near-misses Today we all have North Korea’s nuclear programme on our minds, but current events are just one chapter in a long saga of near misses. We came near to nuclear war several times during the Cuban Missile crisis alone.13 In one incident, the Americans resolved that if one of their spy planes were shot down, they would immediately invade Cuba without a further War Council meeting. The next day, a spy plane was shot down. JFK called the council anyway, and decided against invading. An invasion of Cuba might well have triggered nuclear war; it later emerged that Castro was in favour of nuclear retaliation even if “it would’ve led to the complete annihilation of Cuba”. Some of the launch commanders in Cuba also had independent authority to target American forces with tactical nuclear weapons in the event of an invasion. In another incident, a Russian nuclear submarine was trying to smuggle materials into Cuba when they were discovered by the American fleet. The fleet began to drop dummy depth charges to force the submarine to surface. The Russian captain thought they were real depth charges and that, while out of radio communication, the third world war had started. He ordered a nuclear strike on the American fleet with one of their nuclear torpedoes. Fortunately, he needed the approval of other senior officers. One, Vasili Arkhipov, disagreed, preventing war. Thanks to Vasili Arkhipov, we narrowly averted a global catastrophic risk from nuclear weapons Thank you Vasili Arkhipov. Putting all these events together, JFK later estimated that the chances of nuclear war were “between one in three and even”.14 There have been plenty of other close calls with Russia, even after the Cold War, as listed on this nice Wikipedia page. And those are just the ones we know about. Nuclear experts today are just as concerned about tensions between India and Pakistan, which both possess nuclear weapons, as North Korea.15 The key problem is that several countries maintain large nuclear arsenals that are ready to be deployed in minutes. This means that a false alarm or accident can rapidly escalate into a full-blown nuclear war, especially in times of tense foreign relations. Would a nuclear war end civilisation? It was initially thought that a nuclear blast might be so hot that it would ignite the atmosphere and make the Earth uninhabitable. Scientists estimated this was sufficiently unlikely that the weapons could be “safely” tested, and we now know this won’t happen. In the 1980s, the concern was that ash from burning buildings would plunge the Earth into a long-term winter that would make it impossible to grow crops for decades.16 Modern climate models suggest that a nuclear winter severe enough to kill everyone is very unlikely, though it’s hard to be confident due to model uncertainty.17 Even a “mild” nuclear winter, however, could still cause mass starvation.18 For this and other reasons, a nuclear war would be extremely destabilising, and it’s unclear whether civilisation could recover. How likely is a nuclear war to permanently end civilisation? It’s very hard to estimate, but it seems hard to conclude that the chance of a civilisation-ending nuclear war in the next century isn’t over 0.3%. That would mean the risks from nuclear weapons are greater than all the natural risks put together. (Read more about nuclear risks.) This is why the 1950s marked the start of a new age for humanity. For the first time in history, it became possible for a small number of decision-makers to wreak havoc on the whole world. We now pose the greatest threat to our own survival — that makes today the most dangerous point in human history. And nuclear weapons aren’t the only way we could end civilisation. How big is the risk of run-away climate change? In 2015, President Obama said in his State of the Union address that:19 “No challenge  poses a greater threat to future generations than climate change” Climate change is certainly a major risk to civilisation. The graph below shows estimates of climate sensitivity. Climate sensitivity is how much warming to expect in the long-term if CO2 concentrations double, which is roughly what’s expected within the century. Does climate change pose an existential risk? Wagner and Weitzman predict a greater than 10% chance of greater than 6 degrees celsius of warming. Image source The most likely outcome is 2-4 degrees of warming, which would be bad, but survivable. However, these estimates give a 10% chance of warming over 6 degrees, and perhaps a 1% chance of warming of 9 degrees. That would render large fractions of the Earth functionally uninhabitable, requiring at least a massive reorganisation of society. It would also probably increase conflict, and make us more vulnerable to other risks. (If you’re sceptical of climate models, then you should increase your uncertainty, which makes the situation more worrying.) So, it seems like the chance of a massive climate disaster created by CO2 is perhaps similar to the chance of a nuclear war. Researchers who study these issues think nuclear war seems more likely to result in outright extinction, due to the possibility of nuclear winter, which is why we think nuclear weapons pose an even greater risk than climate change. That said, climate change is certainly a major problem, which should raise our estimate of the risks even higher. (Read more about run-away climate change.) What new technologies might be as dangerous as nuclear weapons? The invention of nuclear weapons led to the anti-nuclear movement just a decade later in the 1960s, and the environmentalist movement soon adopted the cause of fighting climate change. What’s less appreciated is that new technologies will present further catastrophic risks. This is why we need a movement that is concerned with safeguarding civilisation in general. Predicting the future of technology is difficult, but because we only have one civilisation, we need to try our best. Here are some candidates for the next technology that’s as dangerous as nuclear weapons. In 1918-1919, over 3% of the world’s population died of the Spanish Flu.20 If such a pandemic arose today, it might be even harder to contain due to rapid global transport. What’s more concerning, though, is that it may soon be possible to genetically engineer a virus that’s as contagious as the Spanish Flu, but also deadlier, and which could spread for years undetected. That would be a weapon with the destructive power of nuclear weapons, but far harder to prevent from being used. Nuclear weapons require huge factories and rare materials to make, which makes them relatively easy to control. Designer viruses might be possible to create in a lab with a couple of biology PhDs. In fact, in 2006, The Guardian was able to receive segments of the extinct smallpox virus by mail order.21 Some terrorist groups have expressed interest in using indiscriminate weapons like these. (Read more about pandemic risks.) In fact, in 2006, The Guardian was able to receive segments of the extinct smallpox virus by mail order. Relevant experts suggest synthetic pathogens could potentially pose a global catastrophic risk. Who ordered the smallpox? Credit: The Guardian Another new technology with huge potential power is artificial intelligence. The reason that humans are in charge and not chimps is purely a matter of intelligence. Our large and powerful brains give us incredible control of the world, despite the fact that we are so much physically weaker than chimpanzees. So then what would happen if one day we created something much more intelligent than ourselves? In 2017, 350 researchers who have published peer-reviewed research into artificial intelligence at top conferences were polled about when they believe that we will develop computers with human-level intelligence: that is, a machine that is capable of carrying out all work tasks better than humans. The median estimate was that there is a 50% chance we will develop high-level machine intelligence in 45 years, and 75% by the end of the century.22 Graph of expert prediction from Grace et al: The median estimate was that there is a 50% chance we will develop high-level machine intelligence in 45 years These probabilities are hard to estimate, and the researchers gave very different figures depending on precisely how you ask the question.23 Nevertheless, it seems there is at least a reasonable chance that some kind of transformative machine intelligence is invented in the next century. Moreover, greater uncertainty means that it might come sooner than people think rather than later. What risks might this development pose? The original pioneers in computing, like Alan Turing and Marvin Minsky, raised concerns about the risks of powerful computer systems,24 and these risks are still around today. We’re not talking about computers “turning evil”. Rather, one concern is that a powerful AI system could be used by one group to gain control of the world, or otherwise be mis-used. If the USSR had developed nuclear weapons 10 years before the USA, the USSR might have become the dominant global power. Powerful computer technology might pose similar risks. Another concern is that deploying the system could have unintended consequences, since it would be difficult to predict what something smarter than us would do. A sufficiently powerful system might also be difficult to control, and so be hard to reverse once implemented. These concerns have been documented by Oxford Professor Nick Bostrom in Superintelligence and by AI pioneer Stuart Russell. Most experts think that better AI will be a hugely positive development, but they also agree there are risks. In the survey we just mentioned, AI experts estimated that the development of high-level machine intelligence has a 10% chance of a “bad outcome” and a 5% chance of an “extremely bad” outcome, such as human extinction.22 And we should probably expect this group to be positively biased, since, after all, they make their living from the technology. Putting the estimates together, if there’s a 75% chance that high-level machine intelligence is developed in the next century, then this means that the chance of a major AI disaster is 5% of 75%, which is about 4%. (Read more about risks from artificial intelligence.) People have raised concern about other new technologies, such as other forms of geo-engineering and atomic manufacturing, but they seem significantly less imminent, so are widely seen as less dangerous than the other technologies we’ve covered. You can see a longer list of existential risks here. What’s probably more concerning is the risks we haven’t thought of yet. If you had asked people in 1900 what the greatest risks to civilisation were, they probably wouldn’t have suggested nuclear weapons, genetic engineering or artificial intelligence, since none of these were yet invented. It’s possible we’re in the same situation looking forward to the next century. Future “unknown unknowns” might pose a greater risk than the risks we know today. Each time we discover a new technology, it’s a little like betting against a single number on a roulette wheel. Most of the time we win, and the technology is overall good. But each time there’s also a small chance the technology gives us more destructive power than we can handle, and we lose everything. Each new technology we develop has both unprecedented potential and perils. Image source. What’s the total risk of human extinction if we add everything together? Many experts who study these issues estimate that the total chance of human extinction in the next century is between 1 and 20%. For instance, an informal poll in 2008 at a conference on catastrophic risks found they believe it’s pretty likely we’ll face a catastrophe that kills over a billion people, and estimate a 19% chance of extinction before 2100.25 Risk At least 1 billion dead Human extinction Number killed by molecular nanotech weapons. 10% 5% Total killed by superintelligent AI. 5% 5% Total killed in all wars (including civil wars). 30% 4% Number killed in the single biggest engineered pandemic. 10% 2% Total killed in all nuclear wars. 10% 1% Number killed in the single biggest nanotech accident. 1% 0.5% Number killed in the single biggest natural pandemic. 5% 0.05% Total killed in all acts of nuclear terrorism. 1% 0.03% Overall risk of extinction prior to 2100 n/a 19% These figures are about one million times higher than what people normally think. In our podcast episode with Will MacAskill we discuss why he puts the risk of extinction this century at around 1%. In his his book The Precipice: Existential Risk and the Future of Humanity, Dr Toby Ord gives his guess at our total existential risk this century as 1 in 6 — a roll of the dice. Listen to our episode with Toby. What should we make of these estimates? Presumably, the researchers only work on these issues because they think they’re so important, so we should expect their estimates to be high (“selection bias”). But does that mean we can dismiss their concerns entirely? Given this, what’s our personal best guess? It’s very hard to say, but we find it hard to confidently ignore the risks. Overall, we guess the risk is likely over 3%. Why helping to safeguard the future could be the most important thing you can do with your life How much should we prioritise working to reduce these risks compared to other issues, like global poverty, ending cancer or political change? At 80,000 Hours, we do research to help people find careers with positive social impact. As part of this, we try to find the most urgent problems in the world to work on. We evaluate different global problems using our problem framework, which compares problems in terms of: Scale – how many are affected by the problem Neglectedness -how many people are working on it already Solvability – how easy it is to make progress If you apply this framework, we think that safeguarding the future comes out as the world’s biggest priority. And so, if you want to have a big positive impact with your career, this is the top area to focus on. In the next few sections, we’ll evaluate this issue on scale, neglectedness and solvability, drawing heavily on Existential Risk Prevention as a Global Priority by Nick Bostrom and unpublished work by Toby Ord, as well as our own research. First, let’s start with the scale of the issue. We’ve argued there’s likely over a 3% chance of extinction in the next century. How big an issue is this? One figure we can look at is how many people might die in such a catastrophe. The population of the Earth in the middle of the century will be about 10 billion, so a 3% chance of everyone dying means the expected number of deaths is about 300 million. This is probably more deaths than we can expect over the next century due to the diseases of poverty, like malaria.26 Many of the risks we’ve covered could also cause a “medium” catastrophe rather than one that ends civilisation, and this is presumably significantly more likely. The survey we covered earlier suggested over a 10% chance of a catastrophe that kills over 1 billion people in the next century, which would be at least another 100 million deaths in expectation, along with far more suffering among those who survive. So, even if we only focus on the impact on the present generation, these catastrophic risks are one of the most serious issues facing humanity. But this is a huge underestimate of the scale of the problem, because if civilisation ends, then we give up our entire future too. Most people want to leave a better world for their grandchildren, and most also think we should have some concern for future generations more broadly. There could be many more people having great lives in the future than there are people alive today, and we should have some concern for their interests. There’s a possibility that human civilization could last for millions of years, so when we consider the impact of the risks on future generations, the stakes are millions of times higher — for good or evil. As Carl Sagan wrote on the costs of nuclear war in Foreign Affairs: A nuclear war imperils all of our descendants, for as long as there will be humans. Even if the population remains static, with an average lifetime of the order of 100 years, over a typical time period for the biological evolution of a successful species (roughly ten million years), we are talking about some 500 trillion people yet to come. By this criterion, the stakes are one million times greater for extinction than for the more modest nuclear wars that kill “only” hundreds of millions of people. There are many other possible measures of the potential loss–including culture and science, the evolutionary history of the planet, and the significance of the lives of all of our ancestors who contributed to the future of their descendants. Extinction is the undoing of the human enterprise. We’re glad the Romans didn’t let humanity go extinct, since it means that all of modern civilisation has been able to exist. We think we owe a similar responsibility to the people who will come after us, assuming (as we believe) that they are likely to lead fulfilling lives. It would be reckless and unjust to endanger their existence just to make ourselves better off in the short-term. It’s not just that there might be more people in the future. As Sagan also pointed out, no matter what you think is of value, there is potentially a lot more of it in the future. Future civilisation could create a world without need or want, and make mindblowing intellectual and artistic achievements. We could build a far more just and virtuous society. And there’s no in-principle reason why civilisation couldn’t reach other planets, of which there are some 100 billion in our galaxy.27 If we let civilisation end, then none of this can ever happen. We’re unsure whether this great future will really happen, but that’s all the more reason to keep civilisation going so we have a chance to find out. Failing to pass on the torch to the next generation might be the worst thing we could ever do. So, a couple of percent risk that civilisation ends seems likely to be the biggest issue facing the world today. What’s also striking is just how neglected these risks are. Why these risks are some of the most neglected global issues Here is how much money per year goes into some important causes:28 Cause Annual targeted spending from all sources (highly approximate) Global R&D $1.5 trillion Luxury goods $1.3 trillion US social welfare $900 billion Climate change >$300 billion To the global poor >$250 billion Nuclear security $1-10 billion Extreme pandemic prevention $1 billion AI safety research $10 million As you can see, we spend a vast amount of resources on R&D to develop even more powerful technology. We also expend a lot in a (possibly misguided) attempt to improve our lives by buying luxury goods. Far less is spent mitigating catastrophic risks from climate change. Welfare spending in the US alone dwarfs global spending on climate change. But climate change still receives enormous amounts of money compared to some of these other risks we’ve covered. We roughly estimate that the prevention of extreme global pandemics receives under 300 times less, even though the size of the risk seems about the same. Research to avoid accidents from AI systems is the most neglected of all, perhaps receiving 100-times fewer resources again, at around only $10m per year. You’d find a similar picture if you looked at the number of people working on these risks rather than money spent, but it’s easier to get figures for money. If we look at scientific attention instead, we see a similar picture of neglect (though, some of the individual risks receive significant attention, such as climate change): Existential risk research receives less funding than dung beetle research. Credit: Nick Bostrom Our impression is that if you look at political attention, you’d find a similar picture to the funding figures. An overwhelming amount of political attention goes on concrete issues that help the present generation in the short-term, since that’s what gets votes. Catastrophic risks are far more neglected. Then, among the catastrophic risks, climate change gets the most attention, while issues like pandemics and AI are the most neglected. This neglect in resources, scientific study and political attention is exactly what you’d expect to happen from the underlying economics, and are why the area presents an opportunity for people who want to make the world a better place. First, these risks aren’t the responsibility of any single nation. Suppose the US invested heavily to prevent climate change. This benefits everyone in the world, but only about 5% of the world’s population lives in the US, so US citizens would only receive 5% of the benefits of this spending. This means the US will dramatically underinvest in these efforts compared to how much they’re worth to the world. And the same is true of every other country. This could be solved if we could all coordinate — if every nation agreed to contribute its fair share to reducing climate change, then all nations would benefit by avoiding its worst effects. Unfortunately, from the perspective of each individual nation, it’s better if every other country reduces their emissions, while leaving their own economy unhampered. So, there’s an incentive for each nation to defect from climate agreements, and this is why so little progress gets made (it’s a prisoner’s dilemma). And in fact, this dramatically understates the problem. The greatest beneficiaries of efforts to reduce catastrophic risks are future generations. They have no way to stand up for their interests, whether economically or politically. If future generations could vote in our elections, then they’d vote overwhelmingly in favour of safer policies. Likewise, if future generations could send money back in time, they’d be willing to pay us huge amounts of money to reduce these risks. (Technically, reducing these risks creates a trans-generational, global public good, which should make them among the most neglected ways to do good.) Our current system does a poor job of protecting future generations. We know people who have spoken to top government officials in the UK, and many want to do something about these risks, but they say the pressures of the news and election cycle make it hard to focus on them. In most countries, there is no government agency that naturally has mitigation of these risks in its remit. This is a depressing situation, but it’s also an opportunity. For people who do want to make the world a better place, this lack of attention means there are lots high-impact ways to help. What can be done about these risks? We’ve covered the scale and neglectedness of these issues, but what about the third element of our framework, solvability? It’s less certain that we can make progress on these issues than more conventional areas like global health. It’s much easier to measure our impact on health (at least in the short-run) and we have decades of evidence on what works. This means working to reduce catastrophic risks looks worse on solvability. However, there is still much we can do, and given the huge scale and neglectedness of these risks, they still seem like the most urgent issues. We’ll sketch out some ways to reduce these risks, divided into three broad categories: 1. Targeted efforts to reduce specific risks One approach is to address each risk directly. There are many concrete proposals for dealing with each, such as the following: Many experts agree that better disease surveillance would reduce the risk of pandemics. This could involve improved technology or better collection and aggregation of existing data, to help us spot new pandemics faster. And the faster you can spot a new pandemic, the easier it is to manage. There are many ways to reduce climate change, such as helping to develop better solar panels, or introducing a carbon tax. With AI, we can do research into the “control problem” within computer science, to reduce the chance of unintended damage from powerful AI systems. A recent paper, Concrete problems in AI safety, outlines some specific topics, but only about 20 people work full-time on similar research today. In nuclear security, many experts think that the deterrence benefits of nuclear weapons could be maintained with far smaller stockpiles. But, lower stockpiles would also reduce the risks of accidents, as well as the chance that a nuclear war, if it occurred, would end civilisation. We go into more depth on what you can do to tackle each risk within our problem profiles: AI safety Pandemic prevention Nuclear security Run-away climate change We don’t focus on naturally caused risks in this section, because they’re much less likely and we’re already doing a lot to deal with some of them. Improved wealth and technology makes us more resilient to natural risks, and a huge amount of effort already goes into getting more of these. 2. Broad efforts to reduce risks Rather than try to reduce each risk individually, we can try to make civilisation generally better at managing them. The “broad” efforts help to reduce all the threats at once, even those we haven’t thought of yet. For instance, there are key decision-makers, often in government, who will need to manage these risks as they arise. If we could improve the decision-making ability of these people and institutions, then it would help to make society in general more resilient, and solve many other problems. Recent research has uncovered lots of ways to improve decision-making, but most of it hasn’t yet been implemented. At the same time, few people are working on the issue. We go into more depth in our write-up of improving institutional decision-making. Another example is that we could try to make it easier for civilisation to rebound from a catastrophe. The Global Seed Vault is a frozen vault in the Arctic, which contains the seeds of many important crop varieties, reducing the chance we lose an important species. Melting water recently entered the tunnel leading to the vault due, ironically, to climate change, so could probably use more funding. There are lots of other projects like this we could do to preserve knowledge. Similarly, we could create better disaster shelters, which would reduce the chance of extinction from pandemics, nuclear winter and asteroids (though not AI), while also increasing the chance of a recovery after a disaster. Right now, these measures don’t seem as effective as reducing the risks in the first place, but they still help. A more neglected, and perhaps much cheaper option is to create alternative food sources, such as those that be produced without light, and could be quickly scaled up in a prolonged winter. Since broad efforts help even if we’re not sure about the details of the risks, they’re more attractive the more uncertain you are. As you get closer to the risks, you should gradually reallocate resources from broad to targeted efforts (read more). We expect there are many more promising broad interventions, but it’s an area where little research has been done. For instance, another approach could involve improving international coordination. Since these risks are caused by humanity, they can be prevented by humanity, but what stops us is the difficulty of coordination. For instance, Russia doesn’t want to disarm because it would put it at a disadvantage compared to the US, and vice versa, even though both countries would be better off if there were no possibility of nuclear war. However, it might be possible to improve our ability to coordinate as a civilisation, such as by improving foreign relations or developing better international institutions. We’re keen to see more research into these kinds of proposals. Mainstream efforts to do good like improving education and international development can also help to make society more resilient and wise, and so also contribute to reducing catastrophic risks. For instance, a better educated population would probably elect more enlightened leaders (cough), and richer countries are, all else equal, better able to prevent pandemics — it’s no accident that Ebola took hold in some of the poorest parts of West Africa. But, we don’t see education and health as the best areas to focus on for two reasons. First, these areas are far less neglected than the more unconventional approaches we’ve covered. In fact, improving education is perhaps the most popular cause for people who want to do good, and in the US alone, receives 800 billion dollars of government funding, and another trillion dollars of private funding. Second, these approaches have much more diffuse effects on reducing these risks — you’d have to improve education on a very large scale to have any noticeable effect. We prefer to focus on more targeted and neglected solutions.

#### Anticipating nuclear extinction breeds empathy and entangled care. Distancing ourselves from considering extinction reifies detached elitism.

Offord, 17—Faculty of Humanities, School of Humanities Research and Graduate Studies, Bentley Campus (Baden, “BEYOND OUR NUCLEAR ENTANGLEMENT,” Angelaki, 22:3, 17-25, dml) [ableist language modifications denoted by brackets]

You are steered towards overwhelming and inexplicable pain when you consider the nuclear entanglement that the species Homo sapiens finds itself in. This is because the fact of living in the nuclear age presents an existential, aesthetic, ethical and psychological challenge that defines human consciousness. Although an immanent threat and ever-present danger to the very existence of the human species, living with the possibility of nuclear war has infiltrated the matrix of modernity so profoundly as to paralyse [shut down] our mind-set to respond adequately. We have chosen to ignore the facts at the heart of the nuclear program with its dangerous algorithm; we have chosen to live with the capacity and possibility of a collective, pervasive and even planetary-scale suicide; and the techno-industrial-national powers that claim there is “no immediate danger” ad infinitum.8

This has led to one of the key logics of modernity's insanity. As Harari writes: “Nuclear weapons have turned war between superpowers into a mad act of collective suicide, and therefore forced the most powerful nations on earth to find alternative and peaceful ways to resolve conflicts.”9 This is the nuclear algorithm at work, a methodology of madness. In revisiting Jacques Derrida in “No Apocalypse, Not Now (Full Speed Ahead, Seven Missiles, Seven Missives),”10 who described nuclear war as a “non-event,” it is clear that the pathology of the “non-event” remains as active as ever even in the time of Donald Trump and Kim Jong-un with their stichomythic nuclear posturing.

The question of our times is whether we have an equal or more compelling capacity and willingness to end this impoverished but ever-present logic of pain and uncertainty. How not simply to bring about disarmament, but to go beyond this politically charged, as well as mythological and psychological nuclear algorithm? How to find love amidst the nuclear entanglement; the antidote to this entanglement? Is it possible to end the pathology of power that exists with nuclear capacity? Sadly, the last lines of Nitin Sawhney's “Broken Skin” underscore this entanglement:

Just 5 miles from India's nuclear test site

Children play in the shade of the village water tank

Here in the Rajasthan desert people say

They're proud their country showed their nuclear capability.11

As an activist scholar working in the fields of human rights and cultural studies, responding to the nuclear algorithm is an imperative. Your politics, ethics and scholarship are indivisible in this cause. An acute sense of care for the world, informed by pacifist and non-violent, de-colonialist approaches to knowledge and practice, pervades your concern. You are aware that there are other ways of knowing than those you are familiar and credentialed with. You are aware that you are complicit in the prisons that you choose to live inside,12 and that there is no such thing as an innocent bystander. You use your scholarship to shake up the world from its paralysis, abjection and amnesia; to unsettle the epistemic and structural violence that is ubiquitous to neoliberalism and its machinery; to create dialogic and learning spaces for the work of critical human rights and critical justice to take place. All this, and to enable an ethics of intervention through understanding what is at the very heart of the critical human rights impulse, creating a “dialogue for being, because I am not without the other.”13

Furthermore, as a critical human rights advocate living in a nuclear armed world, your challenge is to reconceptualise the human community as Ashis Nandy has argued, to see how we can learn to co-exist with others in conviviality and also learn to co-survive with the non-human, even to flourish. A dialogue for being requires a leap into a human rights frame that includes a deep ecological dimension, where the planet itself is inherently involved as a participant in its future. This requires scholarship that “thinks like a mountain.”14 A critical human rights approach understands that it cannot be simply human-centric. It requires a nuanced and arresting clarity to present perspectives on co-existence and co-survival that are from human and non-human viewpoints.15

Ultimately, you realise that your struggle is not confined to declarations, treaties, legislation, and law, though they have their role. It must go further to produce “creative intellectual exchange that might release new ethical energies for mutually assured survival.”16 Taking an anti-nuclear stance and enabling a post-nuclear activism demands a revolution within the field of human rights work. Recognising the entanglement of nuclearism with the Anthropocene, for one thing, requires a profound shift in focus from the human-centric to a more-than-human co-survival. It also requires a fundamental shift in understanding our human culture, in which the very epistemic and rational acts of sundering from co-survival with the planet and environment takes place. In the end, you realise, as Raimon Panikkar has articulated, “it is not realistic to toil for peace if we do not proceed to a disarmament of the bellicose culture in which we live.”17 Or, as Geshe Lhakdor suggests, there must be “inner disarmament for external disarmament.”18 In this sense, it is within the cultural arena, our human society, where the entanglement of subjective meaning making, nature and politics occurs, that we need to disarm.

It is 1982, and you are reading Jonathan Schell's The Fate of the Earth on a Sydney bus. Sleeping has not been easy over the past few nights as you reluctantly but compulsively read about the consequences of nuclear war. For some critics, Schell's account is high polemic, but for you it is more like Rabindranath Tagore: it expresses the suffering we make for ourselves. What you find noteworthy is that although Schell's scenario of widespread destruction of the planet through nuclear weaponry, of immeasurable harm to the bio-sphere through radiation, is powerfully laid out, the horror and scale of nuclear obliteration also seems surreal and far away as the bus makes its way through the suburban streets.

A few years later, you read a statement from an interview with Paul Tibbets, the pilot of “Enola Gay,” the plane that bombed Hiroshima. He says, “The morality of dropping that bomb was not my business.”19 This abstraction from moral responsibility – the denial of the implications on human life and the consequences of engagement through the machinery of war – together with the sweeping amnesia that came afterwards from thinking about the bombing of Hiroshima, are what make you become an environmental and human rights activist. You realise that what makes the nuclear algorithm work involves a politically engineered and deeply embedded insecurity-based recipe to elide the nuclear threat from everyday life. The spectre of nuclear obliteration, like the idea of human rights, can appear abstract and distant, not our everyday business. You realise that within this recipe is the creation of a moral tyranny of distance, an abnegation of myself with the other. One of modernity's greatest and earliest achievements was the mediation of the self with the world. How this became a project assisted and shaped through the military-industrial-technological-capitalist complex is fraught and hard to untangle. But as a critical human rights scholar you have come to see through that complex, and you put energies into challenging that tyranny of distance, to activate a politics, ethics and scholarship that recognises the other as integral to yourself. Ultimately, even, to see that the other is also within.20

#### Foreign policy experts are good – take in more information and clash to create self-correcting outcomes

**Brands** et. al **20** [HAL BRANDS, the Henry A. Kissinger Distinguished Professor of Global Affairs at the Johns Hopkins School of Advanced International Studies and a scholar at the American Enterprise Institute, served as Special Assistant to the Secretary of Defense in 2015-2016. PETER FEAVER, Professor of Political Science and Public Policy at Duke University, served as special adviser for strategic planning and institutional reform at the National Security Council staff in 2005-2007 and as director for defense policy and arms control in 1993-1994. WILLIAM INBODEN, William Powers, Jr., Executive Director of the Clements Center for National Security and an Associate Professor at the LBJ School of Public Affairs at the University of Texas at Austin, served at the State Department in 2002-2005 and as senior director for strategic planning on the National Security Council staff in 2005-2007, “In Defense of the Blob”, April 29th, <https://www.foreignaffairs.com/articles/united-states/2020-04-29/defense-blob>]

* Any offense they win is solved by doubling down and committing to status quo foreign policy – rejecting foreign policy expertise makes everything worse so any offense they win against primacy is offense against the alt because expertise solves and rejection makes it worse
* Turns interventions – they’re politically toxic which discourages them, but lack of expertise makes them more common
* Answers general foreign policy Ks --- american foreign policy is not monolithic or closed off to alternative perspectives --- your perspective is just wrong
* Assume the K is wrong because a century of foreign policy expertise has concluded the LIO is best

Blob theorists view the establishment as a club of like-minded elite insiders who control everything, take care of one another, and brush off challenges to conventional wisdom. In reality, the United States actually has a healthy marketplace of foreign policy ideas. Discussion over American foreign policy is loud, contentious, diverse, and generally pragmatic—and as a result, the nation gets the opportunity to learn from its mistakes, build on its successes, and improve its performance over time.

In both absolute and relative terms, the expert community dealing with foreign policy and national security in the United States is remarkably large and heterogeneous. Inside government, cadres of professionals make vast amounts of technocratic knowledge and institutional memory available to policymakers. Every department and agency with an international role has distinctive regional or functional expertise it can bring to bear. This in-house knowledge is complemented by an even larger and more diverse network of experts in the many hundreds of think tanks and contract research institutions that surround the government and offer views ranging from right to left, hawk to dove, free trader to protectionist, technocratic to ideological. Pick any policy issue and you can put together a lively debate with ease. Should the United States engage with China or contain it? Negotiate with Iran or squeeze it? Withdraw from the Middle East or redouble its efforts? Reasoned arguments on all sides are widely available, in any form you want—all supplied from within the supposedly monolithic establishment.

Moreover, unlike such communities in other leading powers, the American foreign policy establishment is connected to society rather than cut off from it, because the top several layers of U.S. national security bureaucracies are staffed by political appointees rather than civil servants. The Blob comprises government officials, outside experts, and many people who go back and forth between the two. Insiders know how government works and what is practical. Outsiders think independently. And in-and-outers bridge the gaps. Other countries simply do not have comparably large, diverse, permeable, expert communities that encourage vigorous debate over national policy—which is why, say, the caliber of U.S. debate about nuclear policy is more nuanced and better informed than in other nuclear powers, and which is why other countries would love to have such a Blob of their own.

The American foreign policy establishment, finally, is generally more pragmatic than ideological. It values prudence and security over novelty and creativity. It knows that thinking outside the box may be useful in testing policy assumptions, but the box is usually there for a reason, and so reflexively embracing the far-out option is dangerous. Its members have made many mistakes, individually and collectively, but several features of the system enforce accountability over time. Foreign policy failures, for example, are politically toxic and often spur positive change. The monumental intelligence failures that allowed the September 11 attacks to happen were followed by policy and institutional reforms that have helped prevent other mass-casualty terrorist attacks on U.S. targets for almost two decades. Early misjudgments in the Iraq war led to the adoption of a new counterinsurgency strategy that restored stability

#### Only constructive policy debates nurture information literacy necessary for every model of politics – the process of sifting through evidence and subjecting positions to researched scrutiny is essential to managing emerging crises and information overload

Leek 16 [Danielle R. Leek, professor of communications at Grand Valley State University, “Policy debate pedagogy: a complementary strategy for civic and political engagement through service-learning,” Communication Education, 65:4, 399-405]

Through policy debate, students can develop information literacy and learn how to make critical arguments of fact. This experience is politically empowering for students who will also build confidence for political engagement. Information literacy While there are many definitions of information literacy, the term generally is understood to mean that a student is “able to recognize when information is needed , and have the ability to locate, evaluate, and use effectively the information needed” for problem- solving and decision-making (Spitzer, Eisenberg, & Lowe, 1998, p. 19). Information exists in a variety of forms, in visual data, computer graphics, sound-recordings, film, and photographs. Information is also constructed and disseminated through a wide range of sources and mediums. Therefore, “information literacy” functions as a blanket term which covers a wide range of more specific literacies. Critiques of service-learning’s knowl- edge-building power, such as those articulated by Eby (1998) and Colby (2008), are chal- lenging both the emphasis the pedagogy places on information gained through experience and the limited scope of political information students are exposed to in the process. Policy debate can augment a student’s civic and political learning by fostering extended information literacies. Snider and Schnurer (2002) identify policy debate as an especially research intensive form of oral discussion which requires extensive time and commitment to learn the dimensions of a topic. Understanding policy issues calls for contemplating a range of materials, from traditional news media publications to court proceedings, research data, and institutional propaganda. Moreover, the nature of policy debate, which involves public presentation of arguments on two competing sides of a question, motivates students to go beyond basic information to achieve a more advanced level of expertise and credibility on a topic (Dybvig & Iverson, n.d.). This type of work differs from traditional research projects where students gather only the materials needed to support their argument while neglecting contrary evidence. Instead, the “debate research process encourages a kind of holistic approach, where students need to pay attention to the critics of their argument because they will have to respond to those attacks” (Snider & Schnurer, 2002, p. 32). In today’s attention economy, cultivating a sensibility for well- rounded information gathering can also aid students in recognizing when and how the knowledge produced in their social environments can be effectively translated

### 1AC – Underview

#### 1] 1AR theory is legit – anything else means infinite abuse – drop the debater – 1AR is too short to make up for the time trade-off – no RVIs – 6 min 2NR means they can brute force me every time – competing interps – otherwise the 2NR could drown the aff in arguments while playing defense

#### 2] Reasonability on NC shells – the 1AR is too short to line by line every argument, make a counter interpretation, and go for substance – key to check arbitrary interps.