# **Cursor Parking Lot**

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# **Jan/Feb 22 Aff**

#### **It is because I believe that outer space ought to remain the common heritage of all mankind that I affirm the resolution resolved: The appropriation of outer space by private entities is unjust. In this speech I will provide a framing system to weigh the round and present 3 arguments for the affirmative.**

#### **Given that the resolution asks us what is just, the value of this round must answer to some form of Justice. Thus, I value Distributive Justice which refers to the perceived fairness of distributing resources.**

#### **The criterion that best supports this value is consistency with the difference principle. Philosopher John Rawls explains the difference principle as follows: Social and economic inequalities are to be arranged so that they are to the greatest benefit of the least advantaged members of society.**

#### **Rawls, John (1999). *A Theory of Justice: Revised Edition*. p. 266.** [**ISBN**](https://en.wikipedia.org/wiki/ISBN_(identifier))[**0674000781**](https://en.wikipedia.org/wiki/Special:BookSources/0674000781)**.**

Social and economic inequalities are to be arranged so that they are (a) to the greatest benefit of the least advantaged members of society, consistent with the just savings principle (2a).

**The difference principle asks us how a rational actor would want society to function if they were placed behind a veil with complete ignorance about their societal standing. In this position, a rational person would advocate a society where every disadvantaged group is protected to ensure that they themselves would always be safe. Such a society would clearly uphold justice because it would maximize fairness and protect those who need justice most.**

**Before moving onto contentions, an observation: Appropriation is defined by Collins Dictionary as the act of taking something without having the right to do so.**

**This means that the negative must defend the morality of allowing corporations to take any land or resource in outer space without property rights granted by a governing body.**

**"Appropriation definition and meaning | Collins English Dictionary". 2022 https://www.collinsdictionary.com/us/dictionary/en glish/appropriation. Accessed 12 January 2022.**

Appropriation of something that belongs to someone else is the act of taking it, usually without having the right to do so.

**The thesis of the affirmative is that because the appropriation of outer space by private entities violates the difference principle, it is unjust.**

### **Contention 1 is the Environment**

**The private appropriation of outer space will destroy the planet we call home, leaving those without the money to leave scrambling to pick up the pieces. Pultarova 21 explains that while spaceflight currently burns less than 1% of the fuel burned by aviation, annual commercial space launches are expected to increase by the hundreds or the thousands.**

**Verbeek and Fouqet 17 quantify that one large rocket launch can emit as much carbon dioxide in a few minutes that a car would under constant use for 200 years. The risk of such activities is higher because the emissions are sent into the highest layers of the atmosphere: the stratosphere and the mesosphere, where its impact is dangerously under-researched. On top of emissions, rocket launches release soot into the stratosphere, creating an umbrella effect exacerbating global warming. Because private companies are motivated by money, harmful fuels that cost less will continue to be used.**

**The impact is climate change worsening public health. The World Health Organization in 2021 warns that Climate Change is the single biggest threat to public health. It will cause an additional 5 million deaths over a 20 year period from malnutrition, disease, heat stroke, and more. And those hurt the worst will be the least well off—the uninsured and impoverished. Thus, because the appropriation of outer space by private entities will worsen climate change and thus violate the difference principle, it is unjust.**

## **C2 is Safety**

#### **Leaving outer space completely unregulated will threaten the stability of our satellite systems. Private companies are launching rockets and mega-constellations of satellites. Professor in Physics and Astronomy Aaron Boley explains in 2021 that SpaceX alone wants to add 41,000 more satellites into the atmosphere. This is an issue because it will trigger Kessler Syndrome, the phenomenon where the destruction of one satellite will cause every other satellite in orbit to also be destroyed. They explain that this syndrome happens because orbital gravity makes debris travel at up to 30,000 kilometers an hour giving it so much energy that it shatters opposing satellites on collision, which in turn makes thousands more pieces of debris and results in more collisions, spreading to every satellite. The professor furthers that we are only narrowly avoiding a catastrophe at the moment, and the addition of mega constellations puts every satellite in orbit at major risk.**

#### **The stability of the world's satellite systems is crucial. Heba Soffar explains in 2015 that satellites provide necessary features of modern society like communication, weather forecasting, navigation, climate change monitoring, and military surveillance which is key to stability.**

#### **However, perhaps the most important impact of Kessler Syndrome is that it could prevent space travel from ever happening again. Harry Petit explains in 2020 that scientists suggest that the continued build up of debris will make rocket launches too risky, as debris would destroy rockets trying to escape, causing us to be trapped on earth forever because of a greedy few. Thus, because the appropriation of outer space by private entities would prevent the rest of humanity from exploring the stars violating the difference principle, it is unjust.**

## **C3 is Human Rights**

#### **Private ownership of outer space both allows and incentivises for human rights violations in places where no one can hear you scream.**

**The vast amounts of resources within space will create a distinct class division. Those who can go to space, and those who can’t. George Zarkadias explains in 2021 that the winner-take-all space race by private conglomerates will result in the creation of an elite super class which threatens democracy and humanity as a whole, as their power will be completely unchecked and unmatched.**

**Kramer et al in 2021 explain that it will be near impossible to fight for rights in privately owned space facilities because the employers will have complete control over basic biological functions such as air and water. It's hard to stage a “walk out” when “out” is the vacuum of space. They describe a “company town” scenario where a corporation wields immense leverage over workers by controlling every aspect of their existence. A society set up by a mega-corporation will run like a mega-corporation. It will not facilitate freedom and equality, it will maximize profit by any means necessary.**

**The only possible justification for this ruthless treatment of workers is that it will facilitate the growth of space exploration. However this is a false compromise. Science Journalist Bryan Dyne explains in 2021 that mass space exploration will not be possible with the mere wealth that corporations and individuals have, the big projects like terraforming other planets and colonization will only be possible with international cooperation.**

**The resources from space can also just as easily be distributed fairly. Nick Levine explains in 2015 that as the space economy grows to a similar size like that of the earth economy, resources could be equitably distributed to all earth dwellers."**

**Because private ownership of outer space allows for the poor to be oppressed and enslaved, it necessarily violates the difference principle and thus fails to uphold justice.**

**1AR opener: It is because I still believe that outer space ought to be the common heritage of all mankind, that I affirm.**

Sources

C1:

Contention 1

#### **Card #1**

#### **Card #2**

Tereza **Pultarova**, 7-26-20**21**, "The rise of space tourism could affect Earth's climate in unforeseen ways, scientists worry," Space, https://www.space.com/environmental-impact-space-tourism-flights

Too little is known For Karen Rosenlof, senior scientist at the Chemical Sciences Laboratory at the U.S. National Oceanic and Atmospheric Administration (NOAA), the biggest problem is that rockets pollute the higher layers of the atmosphere — the stratosphere, which starts at an altitude of about 6.2 miles (10 kilometers), and the mesosphere, which goes upward from 31 miles (50 km). "You are emitting pollutants in places where you don't normally emit it," Rosenlof told Space.com. "We really need to understand. If we increase these things, what is the potential damage?" So far, the impact of rocket launches on the atmosphere has been negligible, according to Martin Ross, an atmospheric scientist at the Aerospace Corporation who often works with Rosenlof. But that's simply because there have not been that many launches. "The amount of fuel currently burned by the space industry is less than 1% of the fuel burned by aviation," Ross told Space.com. "So there has not been a lot of research, and that makes sense. But things are changing in a way that suggests that we should learn about this in more detail." Northern Sky Research predicts that the number of space tourism flights will skyrocket over the next decade, from maybe 10 a year in the near future to 360 a year by 2030, Kasaboski said. This estimate is still far below the growth rate that space tourism companies like Virgin Galactic and Blue Origin envision for themselves. "Demand for suborbital tourism is extremely high," Kasaboski said. "These companies virtually have customers waiting in a line, and therefore they want to scale up. Ultimately, they would want to fly multiple times a day, just like short-haul aircraft do." The rate of rocket launches delivering satellites into orbit is expected to grow as well. But Kasaboski sees bigger potential for growth in space tourism. "It's like the difference between a cargo flight and a passenger flight," Kasaboski said. "There's a lot more passengers that are looking to fly." The problem is, according to Ross, that the scientific community has no idea and not enough data to tell at what point rocket launches will start having a measurable effect on the planet's climate. At the same time, the stratosphere is already changing as the number of rocket launches sneakily grows. "The impacts of these [rocket-generated] particles are not well understood even to an order of magnitude, the factor of 10," Ross said. "The uncertainty is large, and we need to narrow that down and predict how space might be impacting the atmosphere."

#### **Card #3**

David Verbeek and Helene Fouquet, 7-14-2017, "Can we get to space without damaging the Earth through huge carbon emissions?," Los Angeles Times, https://www.latimes.com/business/story/2020-01-30/space-launch-carbon-emissions

When a SpaceX Falcon Heavy rocket blasts off on a plume of white smoke, hot gases shoot out of its 27 engines, creating a thrust equal to 18 Boeing 747 aircraft. Upon reaching orbit, the world’s heaviest operational rocket will have burned about 400 metric tons of kerosene and emitted more carbon dioxide in a few minutes than an average car would in more than two centuries. That kind of shock to the atmosphere is stoking concerns about the effect that launching into orbit has on Earth, and it’s about to get worse. Fueled by surging data transmissions and the race for commercial space flights between Elon Musk’s Space Exploration Technologies Corp., Jeff Bezos’ Blue Origin and Richard Branson’s Virgin Galactic Holdings Inc., the number of launches — including giants such as the Falcon Heavy and new mini-rockets — is expected to increase tenfold to roughly 1,000 annually in the coming years. Although there are no regulations on rocket emissions, new space pioneers are taking it upon themselves to develop launchers that make leaving the atmosphere less damaging to the planet. It’s less space cowboy and more space boy scout. “Climate change is real, and we don’t want to make it worse,” said Chris Larmour, chief executive of British rocket maker Orbex. The start-up, founded in 2015 and which has a contract with U.S. launch integrator TriSept Corp., uses bio-propane that it says can cut CO2 emissions by 90% compared with traditional launch fuel. Besides greenhouse gas pollution, kerosene-fueled rockets transport large amounts of black carbon, also known as soot, into the upper layers of the atmosphere. There, it remains for a long time, creating an umbrella that may add to global warming. The fuel is widely used because it’s easier to handle than fuels such as hydrogen. “So far the only criteria for everyone to build rockets was performance and cost,” said Jean-Marc Astorg, director for launch vehicles at French space agency CNES.

#### **Card #4**

World Health Organization, 10-30-2021, "Climate change and health," WHO, https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health

Key facts Climate change affects the social and environmental determinants of health – clean air, safe drinking water, sufficient food and secure shelter. Between 2030 and 2050, climate change is expected to cause approximately 250 000 additional deaths per year, from malnutrition, malaria, diarrhoea and heat stress. The direct damage costs to health (i.e. excluding costs in health-determining sectors such as agriculture and water and sanitation), is estimated to be between USD 2-4 billion/year by 2030. Areas with weak health infrastructure – mostly in developing countries – will be the least able to cope without assistance to prepare and respond. Reducing emissions of greenhouse gases through better transport, food and energy-use choices can result in improved health, particularly through reduced air pollution. Climate change - the biggest health threat facing humanity Climate change is the single biggest health threat facing humanity, and health professionals worldwide are already responding to the health harms caused by this unfolding crisis. The Intergovernmental Panel on Climate Change (IPCC) has concluded that to avert catastrophic health impacts and prevent millions of climate change-related deaths, the world must limit temperature rise to 1.5°C. Past emissions have already made a certain level of global temperature rise and other changes to the climate inevitable. Global heating of even 1.5°C is not considered safe, however; every additional tenth of a degree of warming will take a serious toll on people’s lives and health. While no one is safe from these risks, the people whose health is being harmed first and worst by the climate crisis are the people who contribute least to its causes, and who are least able to protect themselves and their families against it - people in low-income and disadvantaged countries and communities. The climate crisis threatens to undo the last fifty years of progress in development, global health, and poverty reduction, and to further widen existing health inequalities between and within populations. It severely jeopardizes the realization of universal health coverage (UHC) in various ways – including by compounding the existing burden of disease and by exacerbating existing barriers to accessing health services, often at the times when they are most needed. Over 930 million people - around 12% of the world’s population - spend at least 10% of their household budget to pay for health care. With the poorest people largely uninsured, health shocks and stresses already currently push around 100 million people into poverty every year, with the impacts of climate change worsening this trend. Climate-sensitive health risks Climate change is already impacting health in a myriad of ways, including by leading to death and illness from increasingly frequent extreme weather events, such as heatwaves, storms and floods, the disruption of food systems, increases in zoonoses and food-, water- and vector-borne diseases, and mental health issues. Furthermore, climate change is undermining many of the social determinants for good health, such as livelihoods, equality and access to health care and social support structures. These climate-sensitive health risks are disproportionately felt by the most vulnerable and disadvantaged, including women, children, ethnic minorities, poor communities, migrants or displaced persons, older populations, and those with underlying health conditions. Although it is unequivocal that climate change affects human health, it remains challenging to accurately estimate the scale and impact of many climate-sensitive health risks. However, scientific advances progressively allow us to attribute an increase in morbidity and mortality to human-induced warming, and more accurately determine the risks and scale of these health threats. In the short- to medium-term, the health impacts of climate change will be determined mainly by the vulnerability of populations, their resilience to the current rate of climate change and the extent and pace of adaptation. In the longer-term, the effects will increasingly depend on the extent to which transformational action is taken now to reduce emissions and avoid the breaching of dangerous temperature thresholds and potential irreversible tipping points.

Card 1

C3

Card 1

George Zarkadakis, 8-21-2021, "The risks of privatising space – George Zarkadakis," No Publication, https://www.georgezarkadakis.com/the-risks-of-privatising-space/

Finally, there is the socio-political risk that space privatization may leave most humans behind. The “Last Frontier”, if left to become a “winner-takes-all” race between powerful private conglomerates, may result in humanity splitting in a “space-abled” minority who would be travelling in space and enjoying massive financial and scientific dividends, and a “space-disabled” majority stuck on Earth. Such a divide would be detrimental to the survival of democracies and, indeed, to humanity itself. We need to democratize space exploration and exploitation so that many more people, and their descendants, can participate in what is likely to become the most important industry of the 21st century. Replacing subsidies with US-backed private bonds may be a good way towards achieving such a goal. Pension funds, trade unions, professional associations, cooperatives, and individual citizens, could purchase these bonds and hold them in their investment portfolios. These bonds could include options to convert to equity after a few years, something that could improve the future governance of space companies. And they may also include lottery tickets that would enable winners to travel to space at no cost, so that not only the very rich but also everyone would have the possibility to experience the majesty of space travel.

Card 2

#### **Card 2**

#### **Miriam Kramer, Bryan Walsh, 4-13-2021, "The push to define workers' rights in space," Axios, https://www.axios.com/workers-rights-space-private-companies-4c5605e1-ddd8-480f-a60d-793f2343cb79.html**

As humanity stretches into orbit and beyond, experts are still grappling with how rights afforded to workers on Earth apply to those living in space. Why it matters: In order to create businesses and perhaps societies in space — where the biological necessities for sustaining human life, like air and water, aren't readily available — there will need to be fundamental rights agreements to guarantee laborers aren't exploited. Translating human rights to professional astronauts and other spaceflyers isn't necessarily straightforward. Experts say the international community needs to start grappling with that now, decades before we have a city on Mars. How would the right to free expression work practically for a mistreated worker aboard a private space station where a company supplies air and life support? "In space, we have an opportunity to create a new, holistic system from the very beginning and that includes labor protections, that includes political protections... that includes protections for accessibility to resources and oxygen and water," AJ Link, a research director with Jus Ad Astra, an organization focused on human rights in space, told Axios. What's happening: The UN's Outer Space Treaty classifies astronauts as a protected group that should be considered emissaries of humanity with rights and protections. But rules around the rights of private astronauts in space aren't clearly defined in the treaty, and that could complicate things as more companies work to send private citizens to space. In theory, nations licensing the launches of companies like SpaceX are responsible for what those businesses do in space, meaning that people sent to orbit and beyond will be protected by those nations, but that hasn't been put to the test on a wide scale yet. The intrigue: While defining what rights a laborer has off-Earth may seem premature today, experts say that decisions made now will influence what rights look like in orbit for decades to come. Jeff Bezos has detailed his vision of large, private space stations in orbit that will serve as manufacturing hubs for industry, keeping that kind of polluting work off of the planet. Elon Musk's SpaceX has already made the broad (and unsupported) claim that Mars is a "free planet and that no Earth-based government has authority or sovereignty over Martian activities" as part of its Starlink beta test agreement. "It’s not hard to imagine a 'company town' scenario where employers can wield incredible leverage over workers by controlling almost every aspect of their existence," Ed Finn, founding director at the Center for Science and the Imagination at Arizona State University, told Axios. "Staging a walk-out is tricky when the only place to go is the pitiless void on the other side of the airlock." The big picture: "One challenge I see facing private space exploration is that the leaders of space exploration companies will set the objectives, rules, and sanctions that govern space habitations and missions, likely with profit maximization as the goal," David Colby Reed, graduate researcher in the Space Enabled research group at the MIT Media Lab, told Axios. "This is business-as-usual on Earth, but, in space, such private government becomes totalizing." That control over both everyday life and work could create a situation where "it's difficult for a free society of equals to take root," Reed added. The bottom line: Sending people to space for the long haul will require tough conversations today about what rights they'll have in space and how they will be enforced hundreds to millions of miles from Earth.

Card 3

Bryan **Dyne**, science writer, July 14, **2021**

"Richard Branson’s flight and the privatization of space travel," World Socialist Web Site, https://www.wsws.org/en/articles/2021/07/15/spac-j15.html (accessed 12/12/21)

Along with the many scientific lessons learned from such missions—Voyager, Curiosity, Cassini, New Horizons, to name a few—there is also a social lesson: space exploration will always be constricted when it is bound to the resources of one nation or even small groups of nations. The development of genuine planetary exploration, with thousands of robotic missions studying the multitudes of mysteries that still need to be uncovered and the resumption of manned missions beyond Earth’s orbit, requires a coordinated global effort. The scale cannot be reduced to the whims of a single capitalist, no matter how rich. If a manned space program could only be propelled to the Moon by the competition between the United States and Soviet Union, it will go virtually nowhere driven by competition between Branson and Bezos. They are, moreover, wholly dependent on drawing from the successes of past and present social endeavors, from the rocket science developed by NASA’s army of researchers in the 1960s to the spaceport Branson operates in New Mexico, which the state built for the billionaire at a cost of $220 million. There is a further and genuinely criminal aspect to the declarations of a “new normal”: hundreds of millions of people live in extreme poverty around the world, and billions have little to no regular income, while 4.06 million lives have been lost in the past nineteen months from the coronavirus pandemic.

Levine, Nick. “Democratize The Universe.” Jacobin. March 21, 2015. Web. December 11, 2021.

<https://jacobinmag.com/2015/03/space-industry-extraction-levine>.

The history of the Moon Treaty serves as a reminder that outer space is not just a screen onto which we project techno-utopian fantasies or existential anxieties about the infinite void. It has been, and will continue to be, a site of concrete struggle over economic power. The politics of the present are undoubtedly different from those of the 1970s. The egalitarian project of the Group of 77 has given way to BRICS-style market liberalism. Global capital has gained power where international labor efforts have stagnated. Domestic inequalities have skyrocketed. The rapid proliferation of information technologies has temporarily masked the reality that the future, to paraphrase William Gibson, is not being very evenly distributed. Without international political organization to challenge galactic market fundamentalism, a twenty-first century space odyssey could mean the concentration of even more wealth and income in the hands of a few powerful corporations and the most technologically advanced countries. At the same time, and for the same reasons, the prospect of preserving the final frontier as a celestial commons presents an opportunity to fight for a more democratic political economy. Sharing the benefits of the celestial commons is key to expanding democracy to a galactic scale. One time-tested means of distributing the benefits of natural-resource extraction universally is the sovereign wealth fund, which Alaska uses to deliver oil revenue to its residents. As an international commons, outer space offers an opportunity to experiment with such redistributive mechanisms beyond the traditional confines of the nation-state. Organizing around an issue of such scale may seem utopian, but it’s also necessary. From regulating capital to mitigating climate change, the problems that confront us are inherently global in scope and require commensurate strategies. At the very least, the global left ought to demand the creation of an independent Galactic Wealth Fund to manage the proceeds of outer space resources on behalf of all human beings. At first, it would amount to little, divided up among all of us. But as the space economy grows relative to the terrestrial one, social dividends from the Galactic Wealth Fund could provide the basis for a truly universal basic income. This is just one component of a broader platform for galactic democracy that must be developed collectively. Extraterrestrial economic justice — not just shiny technological advances — will be central to any truly egalitarian politics in the twenty-first century. It’s time to start building a democratic futurism.

C2:

Card 1

#### **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**](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 **O**uter **S**pace **T**reaty. 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 Syndrome**3. 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 **a**ctive **d**ebris **r**emoval4. The addition of satellite **mega-constellations** and the general proliferation of low-cost satellites in LEO **stresses the environment further**5,6,7,8.

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 debris**6, 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.

Card 2:

**Les Johnson 13, Deputy Manager for NASA's Advanced Concepts Office at the Marshall Space Flight Center, Co-Investigator for the JAXA T-Rex Space Tether Experiment and PI of NASA's ProSEDS Experiment, Master's Degree in Physics from Vanderbilt University, Popular Science Writer, and NASA Technologist, Frequent Contributor to the Journal of the British Interplanetary Society and Member of the American Institute of Aeronautics and Astronautics, National Space Society, the World Future Society, and MENSA, Sky Alert!: When Satellites Fail, p. 5 [language modified]**

Chapter 10: Remote Sensing: Environmental Monitoring and Science For over 30 years, we've been able to monitor global climate patterns and changes using satellite remote sensing. Much of what we've learned about the cycles that drive our climate and our technological civilization's impact on the global ecosystem has come from satellite observations. Without updated information from space, we would be [**ruined**] ~~crippled~~ in our ability to monitor atmospheric changes, global rainfall patterns, and other climatological indicators - leaving policy makers to make decisions without the most significant part of their data in hand. Satellite systems make regional and **global resource monitoring** possible. This is because it is **very difficult** and **costly** to conduct ground and aerial surveys over large areas and then to coordinate the individual surveys by joining them together. To collect data on a **global scale**, one **must** use the **unique vantage point** provided by **space** systems. One of the **most successful** applications of space imaging is monitoring the world's **agricultural production**, including identifying and differentiating most of the major crop types: wheat, barley, millet, oats, corn, soybeans, rice, and others. **Feeding the world** is **only possible** because of our ability to **monitor** food production and **rapidly adapt** to changes in the distribution system - and, in our modem world, both of these **require** space satellite systems. Satellite remote sensing has also been successfully used in identifying mineral resources, particularly when the data from various types of space-based sensors are combined and compared. Locating future sources of raw materials suddenly becomes **much more difficult** and **costly** without satellite data.

Card 3:

**Les Johnson 13, Deputy Manager for NASA's Advanced Concepts Office at the Marshall Space Flight Center, Co-Investigator for the JAXA T-Rex Space Tether Experiment and PI of NASA's ProSEDS Experiment, Master's Degree in Physics from Vanderbilt University, Popular Science Writer, and NASA Technologist, Frequent Contributor to the Journal of the British Interplanetary Sodety and Member of the American Institute of Aeronautics and Astronautics, National Space Society, the World Future Society, and MENSA, Sky Alert!: When Satellites Fail, p. 5 [language modified]**

Chapter 10: Remote Sensing: Environmental Monitoring and Science For over 30 years, we've been able to monitor global climate patterns and changes using satellite remote sensing. Much of what we've learned about the cycles that drive our climate and our technological civilization's impact on the global ecosystem has come from satellite observations. Without updated information from space, we would be [**ruined**] ~~crippled~~ in our ability to monitor atmospheric changes, global rainfall patterns, and other climatological indicators - leaving policy makers to make decisions without the most significant part of their data in hand. Satellite systems make regional and **global resource monitoring** possible. This is because it is **very difficult** and **costly** to conduct ground and aerial surveys over large areas and then to coordinate the individual surveys by joining them together. To collect data on a **global scale**, one **must** use the **unique vantage point** provided by **space** systems. One of the **most successful** applications of space imaging is monitoring the world's **agricultural production**, including identifying and differentiating most of the major crop types: wheat, barley, millet, oats, corn, soybeans, rice, and others. **Feeding the world** is **only possible** because of our ability to **monitor** food production and **rapidly adapt** to changes in the distribution system - and, in our modem world, both of these **require** space satellite systems. Satellite remote sensing has also been successfully used in identifying mineral resources, particularly when the data from various types of space-based sensors are combined and compared. Locating future sources of raw materials suddenly becomes **much more difficult** and **costly** without satellite data.

Card 4:

**Heba Soffar, 6-5-2015, "What are the importance and uses of Satellites in our life?," Science online,** [**https://www.online-sciences.com/technology/what-are-the-importance-and-uses-of-satellites-in-our-life**](https://www.online-sciences.com/technology/what-are-the-importance-and-uses-of-satellites-in-our-life)

Satellites send television signals directly to homes, They send the signals from a central station that generates programming to smaller stations that send the signals locally via the cables or the airwaves, The news broadcasts are sent from the field to the studio via the satellite. Satellites offer the flight phone communications on the airplanes, They are the main conduit of voice communication for the rural areas and the areas where the phone lines are damaged after a disaster, And they provide the primary timing source for the cell phones and the pagers. Communications satellites have the ability to rapidly communicate between a number of widely dispersed locations, They help the big manufacturing companies and the department stores to perform inventory management, They provide the instant credit card authorization and automated teller banking services to even small towns, They pay at the pump gas at the freeway gas stations, and video conferencing for the international corporations. Satellites provide the meteorologists with the ability to see the weather on a global scale, They allow them to follow the effects of phenomena like the volcanic eruptions and the burning gas and the oil fields to the development of large systems like the hurricanes.Astronomy satellites are the new technology that is mounted on earth-orbiting satellites or on the deep space probes, and they can give us an unobstructed view without the earth’s atmosphere interfering, They carry the detectors to record the electromagnetic radiation at wavelengths shorter than visible light. Satellite-based navigation systems like Navstar Global Positioning Systems enable anyone with a handheld receiver to determine his location to within a few meters, They are known colloquially as GPS. GPS locators are increasingly included in the car direction services, GPS based systems are used by the civilians and the military for navigation on land, the sea, and the air, and they are crucial in the situations like a ship making a difficult course in a harbor in the bad weather or the troops lost in unknown regions. There are surveillance or spy satellites, There are four kinds of major satellites (White 100) which is the most commonly used, The reconnaissance use cameras to take the pictures of a particular place from up above, and they also have radar and infrared detectors, so, they can detect the things in the dark of the things that are covered by something or camouflage. Reconnaissance satellites are used to spy on other countries, They provide intelligence information on the military activities of foreign countries, They can detect the missile launches or the nuclear explosions in space. Reconnaissance satellites can pick up and record the radio and radar transmissions while passing over a country and they can be used as an orbital weapon by placing the warheads on a low orbit satellite to be launched at a ground target. Ocean surveillance satellites are used to search for the ships or the submarines, They can spot the nuclear vessels, and new advancements may allow them to scan the depths of the ocean, Early warning and Elint satellites are primarily used by the armed forces, These basically protect the countries from the sneak attacks, and they can be used to detect if other countries are building or storing the nuclear warheads. Elint is the basic spy satellite that picks up the radio transmissions, and the maps location of countries defense bases, It is the most important military satellite because it does not let another country to put together an attack without another country knowing. Satellites provide the meteorologists with the ability to see the weather on a global scale, They allow them to follow the effects of phenomena like the volcanic eruptions and the burning gas and the oil fields to the development of large systems like the hurricanes. Satellites are used in the field of oceanography, Now the marine scientists and marine biologists can detect everything that goes on in the ocean, They use satellites to detect oceans effect on the environment, they can analyze the wave patterns. They can monitor the marine surface life, they can analyze the ocean tendencies and the currents, and they can get a complete synoptic view of the ocean, These things help them tell you what the water will be like, and help them find out about the ocean life. Satellites are the best sources of data for the climate change research, They monitor the ocean temperatures and the prevailing currents, The data acquired by the satellite-borne radars were able to show the sea levels have been rising by three mm a year over the last decade. Imaging satellites can measure the changing sizes of the glaciers which is difficult to do from the ground due to the remoteness and darkness of the polar regions, The satellites can determine the long term patterns of the rainfall, the vegetation cover, and the emissions of the greenhouse gases. Earth observation satellites can monitor the ocean and the wind currents, the extent of the forest fires, the oil spills, and the airborne pollution, This information helps organize the emergency responders and the environmental cleanup. Satellites can take the search out of search and rescue for the people in the distress in the remote regions, Distress radio beacons directly linked to a search and rescue satellite can lead the rescuers quickly and accurately to the land, the sea, or the air emergency location. Remote sensing is observing and measuring our environment from a distance, They are put into the space to monitor the resources that are important for humans, They may track the animal migration, They locate the mineral deposits, they watch the agricultural crops for the weather damage. These satellites can take photographs and observe the areas all over the globe, they can monitor the areas in which the climate is very harsh, or which are nearly impossible to reach by land. Satellites can detect the underground water and the mineral sources, They can monitor the transfer of the nutrients and the contaminants from the land into the waterways, and they can measure the land and the water temperatures, the growth of the algae in the seas, and the erosion of the topsoil from the land. Imaging satellites produce high-resolution data of the entire landmass on earth which are used in the closely guarded military capability, but now anyone with an internet connection can find his house using Google Earth.

Card 5:

#### **Harry Pettit, 11-15-2020, "Space junk set to TRAP humanity on Earth and set off 'chain of destruction'," US Sun, https://www.the-sun.com/lifestyle/tech-old/1802341/space-debris-trap-humanity-earth-destruction/**

Millions of bits of junk circling our planet threaten to trigger a catastrophic cascade of collisions that could knock out working satellites, one scientist tells The Sun. If this were to continue unchecked, it could take down communication systems and render parts of space inaccessible. Some experts have even suggested a further build up of debris could trap humanity on Earth because rocket launches would become too dangerous. The solution? Send up giant nets that can snatch debris out of orbit, while ensuring future satellites have self-destruct systems. "We've basically been launching things since 1957, and in the early decades, there wasn't any sense that this might become a major environmental problem," Dr Alice Gorman, of Finders University in Australia, told The Sun

### **A2: Starlink Will Solve Its Own Problems lol**

**1. Space X is not solving the problem. Sissi Cao explains in 2020 that many of the Space X satellites have already failed, and will take years to burn up. In addition, Cao explains that the ESA has already have to avoid a deadly collision with a starlink satellite.**

**Sissi Cao, 10-17-2020, "Will Starlink Satellites Become Space Junk One Day? SpaceX Has an (Imperfect) Plan.," Observer, <span class="skimlinks-unlinked">https://observer.com/2020/10/spacex-starlink-satellite-collision-risk-space-debris</span>/**

So far, SpaceX has launched a total of 775 Starlink satellites. According to satellite-moving data collected by the astronomer Jonathan McDowell, of the Harvard-Smithsonian Center for Astrophysics, about 3 percent of the ion engines have already failed, leaving some 23 satellites wondering in Earth’s orbit. (The number excludes 47 prototypes that SpaceX intentionally de-orbited.) That malfunction rate isn’t too bad per aerospace standards, McDowell said. The problem, though, is that they could add up quickly as SpaceX launches hundreds of satellites every month over the next few years. SpaceX has the Federal Communications Commission’s permission to launch 12,000 Starlink satellites. And to enhance internet service, the company plans to launch 30,000 more and has applied for priority spectrum rights to these additional satellites with the FCC. If SpaceX ends up deploying all 42,000 satellites, a 3 percent failure rate would mean more than 1,200 dead satellites orbiting in low altitude for years. That alone is equivalent to a third of the total number of retired satellites in Earth’s orbit right now, according to the European Space Agency (ESA). Space debris created by past rocket launches, dead satellites and other space missions is a burning concern for scientists and aerospace companies globally. Just this week, a defunct Soviet satellite almost smashed into a Chinese rocket body in space. Last September, the ESA had to move a satellite at the last minute to avoid a 1-1,000 chance collision with a Starlink satellite. The ESA said it had to maneuver the spacecraft because SpaceX had “no plan to take action.” SpaceX later said it missed the ESA’s communication due to a tech glitch in the company’s computer system.

### **A2 Profit motive lol**

#### **Space companies have no incentives to self regulate. Ethan Siegel explains in 2021 that any recommendations that will result in more costs in the short term or even long term will be ignored because companies have the need for constant growth.**

**Siegel, Ethan. “How Can Astronomers Overcome The Damage Being Done By Satellite Mega-**

**Constellations?.” Forbes. July 08, 2021. Web. December 12, 2021.**

**<https://www.forbes.com/sites/startswithabang/2021/07/08/how-can-astronomers-**

**overcome-the-damage-being-done-by-satellite-mega-constellations/>.**

Despite the widespread sentiment that the night sky is a natural resource that belongs to no person, corporation, or nation, the actions of a few companies and individuals are dramatically changing the skies for the foreseeable future for all 7+ billion of us here on Earth. As Ian Ayres and John Braithwaite wrote in Responsive Regulation back in 1992, “We have seen that corporations may be more capable than the government of regulating their business activities. But if they are more capable, they are not necessarily more willing to regulate effectively. This is the fundamental weakness of voluntary self-regulation. A voluntary program will stop many violations that cost the company money and others that are cost neutral; it will even halt some violations that benefit the company financially in the short term, for the sake of the long-term benefit... Recommendations that involve consequences beyond the cost neutral or short term, however, commonly will be ignored.” Unless we reckon with these issues responsibly, sustainably, and — most importantly — quickly, we could be dealing with the fallout from these rapidly deployed satellite megaconstellations for generations, and perhaps even centuries, to come.

**Definitions So I don’t get killed**

**Outerspace**

**"Outer Space definition and meaning | Collins English Dictionary". 2022 https://www.collinsdictionary.com/us/dictionary/en glish/appropriation. Accessed 12 January 2022.**

1. **the physical universe beyond the earth's atmosphere.**

### **A2: Everything the Neg says**

