## Disclosure

#### Interpretation: Debaters must disclose all constructive speech docs open source with highlighting on the NDCA LD wiki within an hour after debating at a bid tournament

#### Violation – they don’t- specifically look to Ridge where there is not a single OS in sight, also they won’t disclose the aff

SS from today at 7:39:23

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#### Standards

#### Debate resource inequities—you’ll say people will steal cards, but that’s good—it’s the only way to truly level the playing field for students such as novices in under-privileged programs.

#### Evidence ethics – open source is the only way to verify before round that cards aren’t miscut – otherwise you could have highlighted unethically. That’s a voter – maintaining ethical ev practices is key to being good academics and we should be able to verify you didn’t cheat

**Voters**

#### Fairness is a voter – its constitutive of any competitive activity based on skills, wins, and losses – unfair practices skew the judge’s ability to determine the better debater

#### Drop the debater to set a norm – if you lose you’ll open source from now on

#### Competing interps – reasonability is arbitrary and begs the question of what’s reasonable requiring judge intervention

#### No neg rvi – otherwise the 6 minute 2nr can collapse to a short shell and get away with infinite 1nc abuse via sheer brute force and time spent on theory

**They literally just disclosed the Ridge rounds 20 minutes before round- this skews the neg horribly. 20 minutes isn’t enough to formulate strat. Pairings came out 2 HOURS AGO. THAT’S TIME HE HAD WITH EVERYTHING I HAVE EVER READ THAT I CAN’T GET BACK. Also reality proves strat skew- I had to reconstruct this doc**

(Here’s my wiki, Cites are broken for some but everything is OS and CITES WERE ALWAYS SUBMITTED)

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## Montreal Protocol DA

#### Broad legislation to protect the ozone layer further is triggered by increased rocket launches- stopping rocket launches would mean legislation never happens

**Ross and Vedda** 18 Martin Ross & James Vedda. Martin Ross, Ph.D. planetary science from UCLA, senior project engineer in civil and commercial launch programs at the Aerospace Corporation; James Vedda, Ph.D. political science from the University of Florida, senior policy analyst at the Aerospace Corporation’s Center for Space Policy & Strategy. "Time To Clear The Air About Launch Pollution". SpaceNews. 7-3-2018. https://spacenews.com/op-ed-time-to-clear-the-air-about-launch-pollution/

A policy to promote objective and vigorous research, across the full range of propellant types, will provide the space industry with the information required to take ownership of the problem and exert strong influence on the future debate. By accepting the reality of the risk to freedom of action presented by rocket emissions, and promoting a full and complete scientific understanding of the global impacts, the industry can best inoculate itself from attempts to regulate or limit launch development and operations and disassociate itself from other polluters. There is historical precedent for such an approach. In order to promote supersonic civil aviation development, during the 1990s NASA partnered with the aviation industry to carry out the High Speed Research (HSR) program. One of the goals of HSR was to understand how High Speed Civil Transport (HSCT) aircraft would affect stratospheric ozone. Earlier HSCT efforts in the 1970s were severely and wrongly hampered by knowledge gaps with respect to ozone depletion. HSR demonstrated the airframe, engine, and operational combinations that would minimize ozone impacts and permit (if the economics had been convincing) unregulated development and deployment. The launch industry should organize around a similar approach and partner with the scientific and regulatory communities to determine how space launch can freely develop while minimizing the risks of regulatory intervention. As launch rates and launch vehicle sizes increase, the impact of rocket emissions approaches a “tipping point” when international regulation becomes likely, probably beginning with efforts to protect the ozone layer or limit stratospheric pollution to ward off geoengineering. If the launch industry moves quickly to support the necessary scientific research and fully understand these impacts – in concert with other private-sector and government stakeholders – it is more likely that future regulation will be well-informed and as limiting as possible. As with other large-scale ventures, the application of specialized expertise is essential to anticipating the risks and needs of the enterprise and to managing the impacts on society. With irrefutable data, modeling, and analyses, emissions-related regulations or limitations can be anticipated and configured to ensure that space-based capabilities and systems continue to enhance and improve human life and extend the space industry’s progress made over the past six decades.

#### Legislation is DESPERATELY needed because of new compounds found to harm the OZone

Perkins 17, Sid Perkins, Sid is a freelance science journalist based in Crossville, Tennessee. He specializes in earth sciences and paleontology but often tackles topics such as astronomy, planetary sciences, materials sciences, and engineering. Sid has a bachelor’s degree in natural science from Christian Brothers College in Memphis, Tennessee; bachelor’s and master’s degrees in aeronautical engineering from the Air Force Institute of Technology in Ohio; and a master’s degree in journalism from the University of Missouri in Columbia.

In 2009, Sid won the Award for Distinguished Science Journalism in the Atmospheric and Related Sciences from the American Meteorological Society. And in 2002, he was co-winner of the American Astronomical Society’s Solar Physics Division’s Award for Popular Writing on Solar Physics. Sid’s writing also appears in Nature, Scientific American, the Proceedings of the National Academy of Sciences, Science News, and Science News for Students.

27-06-2017, "New threat to ozone layer found," Science, <https://www.science.org/content/article/new-threat-ozone-layer-found> Livingston RB

The ozone layer—a high-altitude expanse of oxygen molecules that protects us from the sun's ultraviolet rays—has been on the mend for the past decade or so. But a newly discovered threat could delay its recovery. Industrial emissions of a chemical commonly used in solvents, paint removers, and the production of pharmaceuticals have doubled in the past few years, researchers have found, which could slow the healing of the ozone layer over Antarctica anywhere between 5 and 30 years—or even longer if levels continue to rise. The findings are "frightening" and "a big deal," says Robyn Schofield, an environmental scientist at the University of Melbourne in Australia who was not involved with the work. The chemical in question is called dichloromethane (CH2Cl2). Natural sources of this substance are small, says Ryan Hossaini, an atmospheric chemist at Lancaster University in the United Kingdom. Thus, he notes, the increase in emissions seen in recent years likely stems from human sources. Between 2000 and 2012, low-altitude concentrations of CH2Cl2 vapor rose, on average, about 8% per year, he adds. Globally, concentrations of CH2Cl2 approximately doubled between 2004 and 2014. Current CH2Cl2 emissions are about 1 million metric tons per year, Hossaini and his team estimate. Like chlorofluorocarbons (CFCs) and several other ozone-destroying chemicals you may have heard of, CH2Cl2 breaks apart when struck by sunlight. The chlorine atoms that are released then dismantle any ozone molecules they interact with. In 1987, an international agreement known as the Montreal Protocol led to a ban on the production and use of CFCs and many related compounds in industrial nations, but it ignored CH2Cl2 because researchers thought it didn't stay intact in the atmosphere long enough to rise into the stratosphere. Recent evidence now suggests, however, that the molecules can reach the lower edge of the stratosphere, which includes the ozone layer, despite its height 8 kilometers above the poles. To gauge the current and future threat to high-altitude ozone from CH2Cl2, Hossaini and his colleagues used computer simulations. In 2016, their analyses suggest, about 3% of the summer ozone loss in the Antarctic could be traced to CH2Cl2. That seems small, but in 2010 the substance was responsible for only 1.5% of the region's summer ozone loss, Hossaini says. If CH2Cl2 emissions continue to rise at the rate seen in the last decade, recovery of the ozone hole would be delayed about 30 years, the researchers estimate in Nature Communications. But if emissions of CH2Cl2 are held to current levels, healing of the ozone hole would be delayed only 5 years or so, the team finds. Simulations that don't include the effect of CH2Cl2 suggest that high-altitude ozone in the Antarctic will return to pre-1980 levels, the concentration measured before CFCs and other ozone-destroying chemicals were recognized as a problem, in 2065. The team's analyses "are quite important," says Björn-Martin Sinnhuber, an atmospheric scientist at Karlsruhe Institute of Technology in Germany. "It's clear that concentrations [of CH2Cl2] have increased quite a lot," he notes. But one critical question, he contends, is what will happen to emissions over the long term: "They've been quite variable in recent years, and it's difficult to say how they might evolve." Although the rapid rise in CH2Cl2 emissions may one day level off, it's also possible that emissions of this multipurpose chemical may accelerate even further. Hossaini and his team also assessed what would happen to high-altitude ozone if CH2Cl2 emissions rose at twice the rate seen in the past decade. The answer? Not good. Antarctic ozone wouldn't recover to pre-1980 levels until well after the year 2100, the analyses suggest. All this means that scientists now reviewing the Montreal Protocol should consider expanding the agreement to also regulate substances like CH2Cl2 that have atmospheric lifetimes of less than 6 months, Schofield says. Possibly as important, however, the team's results might also help other researchers identify which sources of CH2Cl2 are contributing most to the recent rise in emissions. That sort of information, Hossaini admits, is sadly lacking as of now.

#### Regulation solves the aff and stops a MASS Extinction

Dove ND, Laurie L. Dove is an award-winning journalist who covers timely topics for HowStuffWorks. She is the author of six books and the former owner of a newspaper and magazine. When not reporting on the latest tech breakthrough, health advance or economic development, Dove is tracking down hidden history, science innovations and biologic discoveries. As the Honorable Laurie Dove, Mayor, she has brought multi-million-dollar improvements to the small Midwest town where she lives with her husband, five children and two Akitas. HowStuffWorks, xx-xx-xxxx, "What if the ozone layer disappeared?," <https://science.howstuffworks.com/science-vs-myth/what-if/what-if-ozone-layer-disappeared.htm> Livingston RB

This natural sunscreen, known as Earth's ozone layer, absorbs and blocks the majority of the sun's UV [radiation](https://science.howstuffworks.com/radiation.htm). Without this barrier in place, all of the radiation would reach Earth, damaging the DNA of plants and animals, like us humans. Skin cancer rates would soar, but we might not even live long enough to experience that cause of death

Within days of the ozone layer's disappearance, many plants would die. The intensity of the sun's radiation would make photosynthesis — a process by which plants convert light energy into chemical energy to fuel their growth — an impossibility for all but the largest and slowest-growing florae. And even these holdouts, primarily massive trees, would eventually die, too. Without plants, the food chain would collapse. Herbivores would starve. Omnivores and carnivores could feed off their bodies for a time, but their food supply would dwindle and cause widespread extinction So where is the ozone layer, exactly, and how does it work? A layer of ozone gas acts as a shield encircling Earth, and exists between 9.3 (15 kilometers) to 18.6 miles (30 kilometers) above its surface. As one might suspect, the ozone layer is filled with ozone, also known as 03 or trioxygen. Ozone is created when oxygen molecules (02) are split by the sun into a duo of free-ranging oxygen atoms. When one of these free atoms bonds with an 02 molecule, an 03 molecule -- ozone -- is created. Despite its protective powers, ozone isn't necessarily stable, and it doesn't take much to reduce ozone to its base elements. Take chlorofluorocarbons (CFCs), for example. When these synthetic chemicals, once used as refrigerants and aerosol-spray propellants, travel to the upper atmosphere they begin a chain reaction that spells disaster for the ozone layer. The CFCs are broken down by ultraviolet light and, as a result, release free chlorine atoms that attract oxygen atoms from ozone molecules. And what happens when you take an oxygen atom from ozone? It becomes oxygen. In this way, CFCs can make quick work of the ozone layer, which is why they have been placed under ever-tightening regulations over the past several decades, with a goal of eliminating their use completely later this century

#### Regulation WORKS. It worked with the Montreal protocol before, and AMENDMENTS have been passed

**UN Environment 19**, United Nations Environment Programme, 11-15-2019, "Thirty years on, what is the Montreal Protocol doing to protect the ozone?," UNEP, <https://www.unep.org/news-and-stories/story/thirty-years-what-montreal-protocol-doing-protect-ozone> Livingston RB

[The Montreal Protocol to protect the Earth’s ozone layer](https://ozone.unep.org/) is to date the only United Nations environmental agreement to be ratified by every country in the world. It is also one of the most successful. With the parties to the Protocol having phased out 98 per cent of their ozone-depleting substances, they saved an estimated two million people from skin cancer every year. Following the [thirty-first meeting of the parties in Rome during 4–8 November](https://www.unenvironment.org/news-and-stories/press-release/countries-commit-protect-ozone-layer-and-climate-under-montreal), Stephanie Haysmith, the communications officer for the Ozone Secretariat, explained why the Montreal Protocol has been so successful and what lies ahead for the treaty. The 2019 ozone hole is the smallest on record since its discovery. How does the ozone repair and how long will it take? The Montreal Protocol has been successful in reducing ozone-depleting substances and reactive chlorine and bromine in the stratosphere. As a result, the ozone layer is showing the first signs of recovery. It is expected that the ozone layer will return to pre-1980s levels by the middle of the century and the Antarctic ozone hole by around 2060s. This is because once released, ozone-depleting substances stay in the atmosphere for many years and continue to cause damage. The 2019 hole is indeed the smallest since recording of its size began in 1982 but the ozone is also influenced by temperature shifts and dynamics in the atmosphere through climate change. In 2019, the stratosphere was particularly warm during the Antarctic winter and spring. The [Kigali Amendment, which came into force January 2019](https://ozone.unep.org/sites/default/files/2019-04/Original_depositary_notification_english_version_with_corrections.pdf), requires countries to limit hydrofluorocarbons in refrigerators and air-conditioners by more than 80 percent.  Yet, there is a growing demand for cooling. How can the two needs be met?

## Space Colonization DA

#### Space colonization only happens because of market demand from Starship – and our ev indicates the field is booming but on the brink

Maidenberg, 21, 12/28/21, WSJ, “SpaceX’s Future Depends on a Gigantic Rocket and 42,000 Internet Satellites”, He reports on longtime and newer space companies, as well as issues tied to the safe operation of commercial planes and other aircraft. As part of his work, he focuses on government agencies such as the National Aeronautics and Space Administration (NASA) and the Federal Aviation Administration (FAA). Prior to his current role, Micah worked as a breaking news reporter for the Journal and the Dow Jones Newswires. He began writing about business and economic issues for Crain’s Chicago Business, where he reported on real estate, manufacturing and transportation beats. He also completed an investigative-reporting fellowship at the Columbia University School of Journalism, where he earned a Master's degree. URL: <https://www.wsj.com/articles/spacexs-future-depends-on-a-gigantic-rocket-and-42-000-internet-satellites-11640687404>, KR

SpaceX wants to use its Starship rocket for the kind of voyages to Mars and beyond that Elon Musk has long dreamed of pursuing.

Starship also forms an important foundation of the future business strategy at his space company, which wants to use the vehicle in part to build out Starlink, the satellite-internet service many investors believe could eventually form the bulk of the company’s revenue.

Space Exploration Technologies Corp., the formal name for the company Mr. Musk founded almost two decades ago, faces steep challenges in engineering Starship into a reusable rocket that would sharply drive down launch costs. Mr. Musk recently said the ship takes up more of his time than any other single initiative, and warned the vehicle, along with the internet service, are creating significant challenges for the company.

“Starship is a hard, hard, hard, hard project,” he said at a December event hosted by The Wall Street Journal. “This is the biggest rocket ever made.”

Starship, which would be blasted to orbit on a booster dubbed Super Heavy, stands 160 feet tall and has a diameter of 30 feet, creating room to send hundreds of Starlink satellites to orbit at once, more than the several dozen it is able to deploy right now on one of its Falcon 9 rockets. More than half of the launches tracked by U.S. flight-safety regulators that the company has conducted the past two years have been Starlink deployments. The company plans to rapidly boost the pace of satellite launches in the years ahead. SpaceX, in a July presentation to the Federal Communications Commission, said it had so far launched around 1,800 Starlink satellites and was active in more than 20 countries. The FCC has authorized SpaceX to launch around 12,000 satellites, but the company wants to add at least around 30,000 more, according to commission filings. Mr. Musk said at an industry conference this summer that SpaceX is likely to invest at least $5 billion and perhaps as much as $10 billion in Starlink before it fully starts generating cash, with ongoing investments after that. In a November tweet, Mr. Musk said if severe global recession cut into the availability of capital and liquidity while SpaceX was losing billions on Starship and Starlink, then bankruptcy “while still unlikely, is not impossible.” Over the past two years, the company began equity sales that raised at least $3.8 billion, according to filings that some private companies like SpaceX may have to disclose under Securities and Exchange Commission rules. SpaceX doesn’t release financial statements. A spokesman for the company pointed to a recent statement posted to SpaceX’s website that said in part the company’s year ahead would include a potential first orbital mission for Starship and expanding Starlink. Mr. Musk unveiled Starlink in 2015, aiming to develop a network of smaller satellites in a low orbit around Earth that could provide high-speed internet access around the world. SpaceX set out aggressive targets for Starlink, projecting that year more than 40 million subscribers by 2025, The Wall Street Journal previously reported. SpaceX said this summer that it had around 140,000 Starlink customers. Starlink lists costs for the service at $99 a month, with a $499 charge for an internet terminal—or roughly half the amount it costs the company to make it, Mr. Musk said over the summer. Other companies, such as London-based OneWeb, are also creating networks of internet satellites, and an Amazon.com Inc. unit plans to do so in the future. Around 3.7 billion people globally remain unconnected to the internet, according to a recent report from two agencies at the United Nations, while U.S. officials have worked for years to improve access to high-speed internet in underserved areas. “There’s a need for connectivity in places that don’t have it right now,” or where connections are very limited or expensive, Mr. Musk said this summer. In addition to consumers, Mr. Musk has indicated Starlink could offer services to other businesses, recently saying in a tweet that fliers should ask airlines for Starlink.

The internet service creates a source of demand for Starship, said Matt Weinzierl, a Harvard Business School professor who has studied the space economy.

Historically, those behind big rockets without a clear use for them have faced challenges: “If we don’t know why we built them, it can be a real losing proposition,” Mr. Weinzierl said, adding he thinks the company will identify other uses for the rocket.

Starship, meanwhile, has at least one confirmed customer in place: the National Aeronautics and Space Administration, which in April awarded SpaceX a $2.9 billion contract to develop a Starship to take astronauts back to the surface of the moon.

As it works to develop Starship and Starlink, SpaceX has built out a business based on government customers such as NASA and on commercial-satellite operators.

The value of its contracts with public-sector clients amounted to $2.2 billion for the federal government’s 2021 fiscal year, up from $195 million a decade earlier, according to a contracts database. SpaceX typically charges private clients $60 million to $65 million for Falcon 9 launches, according to people familiar with the matter.

The company’s valuation has soared as it proved its spacecraft like Falcon 9 could work as intended and as it started constructing its fleet of Starlink satellites. SpaceX was valued at $100 billion in October, more than double its valuation in the summer of 2020, according to PitchBook. The latest figure rests heavily on prospects for Starlink because the potential demand for the high-speed internet service globally is much larger than the size of the launch market, investors say.

#### Specifically, Starship from spaceX is the most prominent solution

O’Callaghan, 21, 12/7/21, MIT Review, “How SpaceX’s massive Starship rocket might unlock the solar system—and beyond”, Jonathan O'Callaghan is a freelance space journalist based in London, UK who covers commercial spaceflight, astrophysics, and space exploration. URL: <https://www.technologyreview.com/2021/12/07/1041420/spacex-starship-rocket-solar-system-exploration/>, KR

Much has already been made of Starship’s human spaceflight capabilities. But the rocket could also revolutionize what we know about our neighboring planets and moons. “Starship would totally change the way that we can do solar system exploration,” says Ali Bramson, a planetary scientist from Purdue University. “Planetary science will just explode.”

If it lives up to its billing, scientists are already talking about sending missions to Neptune and its largest moon in the outer solar system, bringing back huge quantities of space rock from Earth’s moon and Mars, and even developing innovative ways to protect Earth from incoming asteroids.

Starship—which is being built at a Texas site dubbed “Starbase”—consists of a giant spaceship on top of a large booster, known as Super Heavy. Both can land back on Earth so they can be reused, reducing costs. The entire vehicle will be capable of lifting 100 metric tons (220,000 pounds) of cargo and people into space on regular low-cost missions. The volume of usable space within Starship is a whopping 1,000 cubic meters—big enough to fit the entire Eiffel Tower, disassembled. And that’s got scientists excited.

“Starship is, like, wow,” says James Head, a planetary scientist from Brown University.

In mid-November, speaking in a publicly accessible virtual meeting about Starship hosted by the US National Academies of Sciences, Engineering, and Medicine, Musk discussed the project’s scientific potential. “It’s extremely important that we try to become a multiplanet species as quickly as possible,” he said. “Along the way, we will learn a great deal about the nature of the universe.” Starship could carry “a lot of scientific instrumentation” on flights, said Musk—far more than is currently possible. “We’d learn a tremendous amount, compared to having to send fairly small vehicles with limited scientific instrumentation, which is what we currently do,” he said.

“You could get a 100-ton object to the surface of Europa,” said Musk.

Cheap and reusable

Central to many of these ideas is that Starship is designed to be not just large but cheap to launch. Whereas agencies like NASA and ESA must carefully choose a smattering of missions to fund, with launch costs in the tens or hundreds of millions of dollars, Starship’s affordability could open the door to many more. “The low cost of access has the potential to really change the game for science research,” says Andrew Westphal, a lecturer in physics at the University of California, Berkeley, with flights potentially as low as $2 million per launch. “You can imagine privately financed missions and consortia of citizens who get together to fly things.”

NASA has selected SpaceX’s Starship as the lander to take astronauts to the moon

When the first astronauts in over 50 years set foot on the moon, they’ll be riding to the surface aboard Starship.

What’s more, Starship has a key advantage over other super-heavy-lift rockets in development, such as NASA’s much-delayed Space Launch System and Blue Origin’s New Glenn rocket. The upper half of the rocket is designed to be refueled in Earth orbit by other Starships, so more of its lifting capability can be handed over to scientific equipment rather than fuel. Taking humans to the moon, for example, might require eight separate launches, with each consecutive “tanker Starship” bringing up fuel to the “lunar Starship” that then makes its way to the moon with scientific equipment and crew.

Scientists are now starting to dream of what Starship might let them do. Earlier this year, a paper published by Jennifer Heldmann of NASA Ames Research Center explored some of the scientific opportunities that might be opened by Starship missions to the moon and Mars. One great benefit is that Starship could carry full-sized equipment from Earth—no need to miniaturize it to fit in a smaller vehicle, as was required for the Apollo missions to the moon. For example, “you could bring a drilling rig,” says Heldmann. “You could drill down a kilometer, like we do on Earth.” That would afford unprecedented access to the interior of the moon and Mars, where ice and other useful resources are thought to be present. Before, such an idea have been “a little bit insane,” says Heldmann. But with Starship, “you could do it, and still have room to spare,” she adds. “What else do you want to bring?”

Because Starship can land back on Earth, it will also—theoretically—be able to bring back vast amounts of samples. The sheer volume that could be returned, from a variety of different locations, would give scientists on Earth unprecedented access to extraterrestrial material. That could shed light on a myriad of mysteries, such as the volcanic history of the moon or “the question of life and astrobiology” on Mars, says Heldmann.

Starship could also enable more extravagant missions to other locations, either via a direct launch from Earth or perhaps by using the moon and Mars as refueling stations, an ambitious future envisioned by Musk.

## CASE

### 1NC­—Collisions

#### No Kessler Syndrome –

**1] Probability – 0.1% chance of a collision.**

**Salter 16** [(Alexander William, Economics Professor at Texas Tech) “SPACE DEBRIS: A LAW AND ECONOMICS ANALYSIS OF THE ORBITAL COMMONS” 19 STAN. TECH. L. REV. 221 \*numbers replaced with English words] TDI

The probability of a collision is currently low. Bradley and Wein estimate that the maximum probability in LEO of a collision over the lifetime of a spacecraft remains below one in one thousand, conditional on continued compliance with NASA’s deorbiting guidelines.3 However, the possibility of a future “snowballing” effect, whereby debris collides with other objects, further congesting orbit space, remains a significant concern.4 Levin and Carroll estimate the average immediate destruction of wealth created by a collision to be approximately $30 million, with an additional $200 million in damages to all currently existing space assets from the debris created by the initial collision.5 The expected value of destroyed wealth because of collisions, currently small because of the low probability of a collision, can quickly become significant if future collisions result in runaway debris growth.

**2] Time frame – Kessler effect 200 years away**

**Stubbe 17** [(Peter, PhD in law @ Johann Wolfgang Goethe University Frankfurt) “State Accountability for Space Debris: A Legal Study of Responsibility for Polluting the Space Environment and Liability for Damage Caused by Space Debris,” Koninklijke Brill Publishing, ISBN 978-90-04-31407-8, p. 27-31] TDI

The prediction of possible scenarios of the future evolution of the debris p o p ulation involves many uncertainties. Long-term forecasting means the prediction of the evolution of the future debris environment in time periods of decades or even centuries. Predictions are based on models84 that work with certain assumptions, and altering these parameters significantly influences the outcomes of the predictions. Assumptions on the future space traffic and on the initial object environment are particularly critical to the results of modeling efforts.85 A well-known pattern for the evolution of the debris population is the so-called Kessler effect’, which assumes that there is a certain collision probability among space objects because many satellites operate in similar orbital regions. These collisions create fragments, and thus additional objects in the respective orbits, which in turn enhances the risk of further collisions. Consequently, the num ber of objects and collisions increases exponentially and eventually results in the formation of a self-sustaining debris belt aroundthe Earth. While it has long been assumed that such a process of collisional cascading is likely to occur only in a very long-term perspective (meaning a time 1 n of several hundred years),87 a consensus has evolved in recent years that an uncontrolled growth of the debris population in certain altitudes could become reality much sooner.88 In fact, a recent cooperative study undertaken by various space agencies in the scope of i a d c shows that the current l e o debris population is unstable, even if current mitigation measures are applied. The study concludes:

Even with a 90% implementation of the commonly-adopted mitigation measures [...] the l e o debris population is expected to increase by an average of 30% in the next 200 years. The population growth is primarily driven by catastrophic collisions between 700 and 1000 km altitudes and such collisions are likely to occur every 5 to 9 years.89

**No debris risk to satellites, and slew of alt causes**

Wein 9 (Lawrence M. Wein, Professor & Senior Fellow at Stanford’s Center for International Security and Cooperation , Jeffrey S. Skoll Professor of Management Science at Stanford University and Senior Fellow at Stanford’s Center for International Security and Cooperation, former DEC Leaders for Manufacturing Professor of Management Science at MIT, and Andrew M. Bradley, PhD-Institute for Computational and Mathematical Engineering at Stanford University, Space debris: Assessing risk and responsibility, Advances in Space Research 43 (2009) 1372–1390 DD)

More importantly, while our **numerical results** **mimic** earlier results (Liou and Johnson, 2005; Walker and Martin, 2004) that stressed the importance of postmission deorbiting, **we do not** necessarily **agree with the claim** that the only way to prevent future problems is to **remove existing large intacts** from space (Liou and Johnson, 2006, 2008). The **divergence** between our views and those in Liou and Johnson (2006, 2008) is perhaps due to the **different performance metrics** used. The **root causes for alarm** in Liou and Johnson (2006, 2008) appear to be the **growth rate** of fragments and the **small increase** in the rate of catastrophic collisions over the **next 200 years** (Liou and Johnson, 2008, Fig. 2). However, **the great majority of catastrophic collisions** in the SOI **do not involve operational spacecraft**, and are hazardous only in the sense that the **fragments generated** from such a collision could subsequently damage or destroy operational spacecraft. Therefore, we introduced the notion of **the lifetime risk of an operational spacecraft** as the primary performance metric. **Our model predicts** that the **lifetime risk is** <5x10^-4 **[less than .0005%] over the next two centuries, and always** stays <10^-3 **[less than .001%]** than if there is very high (>98%) spacecraft deorbiting compliance. These **risks appear to be low** relative to the **immense cost** and **considerable technological uncertainty involved** in removing large objects from space, are **dwarfed by the ~20% historical** mission-impacting (but **not** necessarily **mission-ending**) **failure rate of spacecraft** (Frost and Sullivan, 2004), and could be **overestimated** if improved traffic management techniques lower future collision risks (Johnson, 2004). Hence, the **need to bring large objects down** from space **does not** **appear** to be as **clear** cut as suggested in Liou and Johnson (2006, 2008). Nonetheless, our model does not incorporate the possibility of intentional catastrophic collisions (ASAT tests, space wars) that could conceivably occur in the future. In addition, Fig. 5 considers only catastrophic collisions, whereas noncatastrophic intact-fragment collisions could easily disable an operational spacecraft. If the operational lifetime risk is modified to include noncatastrophic collisions with fragments >= 10cm, then the sustainable risk rises by ~50%: it increases from 2.19x10^-2 [.0219%] to 3.09x10^-2 in the base case, and increases from 4.91x10^-4 [.000491%] to 7.94x10^-4 in the full compliance case. Moreover, if fragments >= 1 cm (rather than >= 10 cm) are harmful to spacecraft (Johnson, 2004), then we (as well as other researchers) could be underestimating the risk.

In summary, **in the absence of the removal of large objects** from space, the **sustainable lifetime risks** in Figs. 3–5 **do not appear** to be obviously **above** or below **a tolerable level**. Even if these risks are deemed acceptable, it is prudent to invest in research and development for space remediation technologies, **which is a topic of current study** (Proposal for forming an IAA study group, 2000). However, given the optimality of full deorbit compliance from a societal, sustainable perspective, and the sensitivity of sustainable lifetime risk to postmission deorbit compliance, the primary focus for policymakers should be on increasing compliance, which leads us to a discussion of economic instruments that could be used to address this issue.

### 1NC—Plan Flaw

#### Plan flaw – their plantext says lower Earth orbit which isn’t a term of art – voting issue for precision

NASA 21 (National Aerospace Agency) 11/17/2021 https://www.nasa.gov/leo-economy/faqs

What is LEO (Low-Earth Orbit)?

Low-Earth orbit (often known as LEO) encompasses Earth-centered orbits with an altitude of 2,000 km (1,200 mi) or less. For the purposes of the Commercial Use Policy, low-Earth orbit is considered the area in Earth orbit near enough to Earth for convenient transportation, communication, observation and resupply. This is the area where the International Space Station currently orbits and where many proposed future platforms will be located.