### Hobbes NC

#### Presumption and permissibility negate – a. the aff has to prove the resolution true, b. For every true statement there are infinite false ones, ie if something is a pen it isn’t a car, cat etc

#### The metaethic is perspectivism – objective appeals to ethics fail.

#### [1] Opacity – we can never access another person’s perspective because we can never fully understand who someone else is or what they think, as we can only ever perceive them from the outside.

#### [2] Relativism – we each have different experiences which affects our understanding of what is true and how we construct claims. For example, a person who grew up in a racist household would be more likely to believe racist things.

#### The state of nature leads to infinite violence – competing truth claims means conflicts cannot be resolved. Everyone can assert their own claims to be true and refuse contestation, and everyone wants their truth claims to be true since it benefits them.

Irwin ‘17

“Psychological Egoism and Self-Interest” William Irwin, King’s College, Wilkes-Barre, PA Reason Papers Vol. 39, no. 2 <https://reasonpapers.com/wp-content/uploads/2018/02/rp_392_5.pdf> Lindale PP

The first step in arguing for psychological egoism is to note that the I, the ego, is inescapable. The word “egoism” itself suggests that the subject is primary. The I can never do what the I does not want to do. Alas, the illusion that a person can do, and perhaps ought to do, what that person does not want to do in the interest of others is a mainstay in philosophical discourse. Michael Slote, for example, worries, “If there is no such thing as (human) altruism, then the altruistic demands of most social codes and most moral philosophies may be deeply undermined,” and he scolds defenders of psychological egoism for “show[ing] precious few signs of recognizing and regretting the destructively iconoclastic direction of their views and arguments.”10 I, for one, do recognize that psychological egoism is destructive and iconoclastic, but those are not reasons to deny a philosophical truth. As I shall argue below, embracing enlightened self-interest can alleviate Slote’s concerns about negative consequences. Of course, why the I wants to do x is often complex. People believe what they think is true, and people do what they want to do. It does not make sense to say, “I believe the cat is on the mat, but I do not think it is true.”11 If you did not think it was true, you would not believe it (at least not anymore). Likewise, it does not make literal sense to say, “I do not want to exercise, but I am now going to exercise.” This, however, sounds more reasonable and less contradictory than the claim about the cat, the mat, belief, and truth. We can have competing desires. We can want and not want to do the same thing at the same time in the sense that our emotions and intellect may be in conflict. For example, a prudential, rational decision to do something unpleasant, like exercise, may override a strong emotional desire for something with more short-term pleasure, like lying on the couch. So it can make non-literal, hyperbolic sense to say “I do not want to do this at all” and yet do it in the next moment. But what is being expressed, in the exercise example, by “I do not want to do this at all” is that there is no emotional desire to do the action. The subsequent action attests, however, that there is a strong rational desire, which in this case trumped the emotional desire. In Human, All Too Human, Friedrich Nietzsche says, “No man has ever done anything that was done wholly for others and with no personal motivation whatever; how, indeed, should a man be able to do something that had no reference to himself, that is to say lacked all inner compulsion (which would have its basis in personal need)? How could the ego act without the ego?”12 The buck has to stop somewhere. It stops with the ego.13 The ego ultimately does what it wants to do; it is foundational. At the ultimate level, why you want to do something for someone else is because you want to. Thus, all actions are ultimately rooted in the desire of the ego to do what it wants. The “my own-ness” of the action, the desire that motivates it, makes it egoistic and self-interested, just not necessarily in an ugly, selfish way. Joel Marks argues: What we do is always an action, and an action is always motivated, and another name for motivation is ‘desire’. Thus, even a moralist who always strove consciously to do the right thing, even when this meant acting in opposition to other things she would much rather be doing, would, in the last analysis, be doing what she wanted to do, simply in virtue of being motivated to do the right thing.14 Marks believes that we always do what we want to do, but he also believes that what we want to do is not always what we perceive to be in our self-interest. That sounds reasonable at first, but it raises a question: If it is not in my perceived self-interest, then why do I want to do it? The easy answer is, “For the benefit of someone else.” However, that raises the question: “Why do I want to benefit someone else?” The answer then comes down to “because I want to,” and that desire may be bound up with love, guilt, duty, or what have you. But if I am doing it because I want to, then that is tantamount to acting out of self-interest. Clearly, I am acting out of an interest, and just as clearly that interest is my own. My loves, guilts, and sense of duty are my own, and I act to address them. Addressing them is my self-interest. I cannot act purely out of love, duty, or anything else. Foundational or ultimate egoism is inescapable. Foundational or ultimate or pure altruism is impossible because it would require what is impossible: doing what I ultimately do not want to do.15 This is important to recognize because it dismantles an impossible ideal that sets people up for perpetual failure and the feelings that attend the failure. To be clear, we should not equate egoism or self-interest with hedonism. For example, when you make a sacrifice to help your child, this does not necessarily mean that you are doing something you will enjoy or feel great pleasure in, but it does mean that you are choosing to do what you ultimately want to do. Satisfying that most basic desire is tantamount to serving self-interest as we have articulated it. Selfinterest cannot be defined solely in terms of pleasure, happiness, or even advantage, but only in terms of desire to make a person’s life go best. Talk of sacrifice calls to mind the well-worn example of the soldier who throws herself on a grenade to save her friends. This example is typically offered as a counterexample to disprove psychological egoism. The counterexample is ineffective, however, because it could be that, seeing the opportunity, the soldier decides she would not be able to live with allowing her friends to die.16 Or it could be that she sees this as a moment of glory that will allow her memory to live on. Or it could be that she believes there will be a heavenly reward, and so she will benefit after all. What is impossible is that the soldier does something that she does not want to do. In other words, an ultimately altruistic motivation is impossible.

#### Thus, the standard is consistency with the will of the sovereign. Outweighs on bindingness: only the sovereign is able to get everyone to follow its rule and enforce the law, it creates motivations for any moral rules we create. They’ll say it’s impact-justified but the state of nature is more than just physical violence – it’s also a state of war which prevents genuine truth, since genuine truth requires cooperation.

#### Vote neg – the will of the sovereign is to expand the private space industry, the aff rejects that. All of their uniqueness evidence proves this also applies to megaconstellations

Ben-Itzhak 2022 Svetla Ben-Itzhak (professor in the Political Science department at Kansas State University specializing in space and IR). January 11, 2022. Washington Post. "Companies are commercializing outer space. Do government programs still matter?". https://www.washingtonpost.com/politics/2022/01/11/companies-are-commercializing-outer-space-do-government-programs-still-matter/

2021 was a big year for private companies and space travel, and 2022 will probably be just as busy. Last year, three companies — SpaceX, Blue Origin and Virgin Galactic — achieved key feats in space travel previously reserved to countries. They transported astronauts to the International Space Station, flew space enthusiasts into space, delivered cargo to low Earth orbit and developed reusable booster rockets.

In November, Elon Musk announced that his company’s Starship project may launch as early as this month. Developed by SpaceX, the Starship system is seen by many as a game-changer for space travel and exploration. When operational, the fully reusable transport system will be capable of carrying up to 100 people to Mars, marking the next step in the commercialization of outer space.

Will commercial ventures replace national governments in space travel and exploration? My research suggests it is not very likely. While private companies have made considerable strides in popularizing space, national governments dictate the rules and provide much of the funding, securing their central role in space endeavors.

Over the last 15 years, commercial activity in space more than tripled, growing from $110 billion in 2005 to nearly $357 billion in 2020. Commercial activity in 2020 accounted for about 80 percent of the estimated $447 billion global space economy that year. Morgan Stanley projects that the sector will rocket to more than $1 trillion by 2040, with growth concentrated in the commercial space sector.

Commercial space operations kicked off in 1962 with the launch of the first transatlantic communication satellite, Telstar 1. In the United States, the Communications Satellite Act of 1962 affirmed the right of private companies to own and operate commercial satellites. Other major milestones include the Commercial Space Launch Act in 1984, a more independent U.S. Office of Commercial Space Transportation and the 2015 US SPACE Act aimed at encouraging the commercial exploration and exploitation of space.

This gradual deregulation in the United States resulted in tremendous growth of commercial space initiatives. The first privately funded rocket, the Conestoga, was launched in 1982 by Space Services. In 2004, the first private, suborbital human spaceflight took place on board SpaceShipOne. In 2012, SpaceX, a private company, began transporting cargo to and from the International Space Station. And in 2020, SpaceX flew American astronauts from U.S. soil for the first time since 2011, when NASA’s space shuttle missions ended.

Commercial space ventures picked up in 2021

Commercial ventures in space made global headlines last year when SpaceX flew two additional space station missions: Crew-2 and Crew-3, and launched Inspiration4, the first all-civilian mission to orbit Earth. Virgin Galactic launched two suborbital human spaceflights from Spaceport America, and Blue Origin conducted two spaceflights close to the 62-mile Kármán line, demarcating the beginning of outer space (Jeff Bezos, Blue Origin’s founder, owns The Washington Post).

Virgin Galactic and Blue Origin announced additional spaceflights, while SpaceX is preparing to go to the moon, Mars and beyond. NASA partnered with Blue Origin, Nanoracks and Northrop Grumman to develop commercial destinations in low-earth orbit. Bigelow, Nanoracks and Axiom Space are designing human habitats in space; Maxar and Northrop Grumman are working on the future Gateway lunar space station, Orbital Assembly plans to open the first space hotel in 2027, and Japan’s Obayashi Corp. aims to create a space elevator by 2050.

Why the commercial space sector won’t replace governments’ role

Three factors help explain why the role of national space initiatives will continue. First, countries dictate the rules in space. The 1967 Outer Space Treaty, which provides the basic legal framework of international space law, gives countries full responsibility (Article 6), liability (Article 7) and ownership (Article 8) of any commercial entity and object in space. Governments have written and signed into effect current space laws, and this means governments will continue to have primacy in space affairs. While companies may operate in space, the current system remains centered around national governments.

Second, national governments continue to play a major role in commercial space activities, often by providing substantial funding. Under NASA’s 2008 Commercial Resupply Services, for example, the U.S. agency awarded $5.9 billion in the first round of commercial resupply contracts, and up to $14 billion in the second. And under its 2011 Commercial Crew Program, NASA invested billions of dollars in a number of companies, with the goal of developing a safe and reliable U.S. commercial crew space transportation capability.

#### Also, the aff forces the sovereign to be held to external standards set by international bodies, which is a restriction on the will of the sovereign.

### Hacking DA – Megaconstellations

#### Hacking towards Satellites is coming now – incentives and vulnerabilities align.

Culpan 21 Tim Culpan 11-2-2021 "The Next Big Hack Could Come From the Stars" <https://archive.is/XElln#selection-3035.0-3040.0> (Bloomberg Opinion Columnist)//Elmer

“As space becomes more important, there becomes unfortunately even greater incentives for malicious actors to disrupt, deny or alter our space-based assets,” Bob Kolasky, head of the Department of Homeland Security’s National Risk Management Center, told the same conference organized by the National Institute of Standards and Technology. “With space, whatever you put in orbit is what you must live with. Systems must be designed so that they can address threats and hazards throughout their lifespan.” What makes satellites and their associated land-based infrastructure more vulnerable is that the data they transmit can be easily accessed by anyone on Earth with $300 worth of TV reception equipment, allowing you to eavesdrop on unencrypted financial data or download information from Russian and American weather satellites in real time. A nefarious actor with its own satellite could even cause interference or block the signal from these orbiting stations. But among the scariest of scenarios would be for an adversary to break into the control systems of a satellite, redirect its movement or even crash it into another satellite or the planet. That may have already happened. According to one account, a breach at the Goddard Space Flight Center in Washington, D.C., in 1998 led to a U.S.-German satellite called ROSAT being overtaken and turned toward the sun, damaging the ultraviolet filter on its image sensors. This allegation has been denied, yet whether real or apocryphal the incident (the filter was indeed destroyed by the sun) shows the challenges of repairing hardware 360 miles above the earth’s surface or even investigating the cause of the malfunction.

#### Megaconstellations solves satellite hacking – multiple warrants.

Hallex and Cottom 20 Hallex, Matthew, and Travis Cottom. "Proliferated commercial satellite constellations: Implications for national security." Joint Forces Quarterly 97.July (2020): 20-29. (Matthew A. Hallex is a Research Staff Member at the Institute for Defense Analyses. Travis S. Cottom is a Research Associate at the Institute for Defense Analyses.)//Re-cut by Elmer

While potentially threatening the sustainability of safe orbital operations, new proliferated constellations also offer opportunities for the United States to increase the resilience of its national security space architectures. Increasing the resilience of U.S. national security space architectures has strategic implications beyond the space domain. Adversaries such as China and Russia see U.S. dependence on space as a key vulnerability to exploit during a conflict. Resilient, proliferated satellite constellations support deterrence by denying adversaries the space superiority they believe is necessary to initiate and win a war against the United States.28 Should deterrence fail, these constellations could provide assured space support to U.S. forces in the face of adversary counterspace threats while imposing costs on competitors by rendering their investments in counterspace systems irrelevant. Proliferated constellations can support these goals in four main ways. First, the extreme degree of disaggregation inherent in government and commercial proliferated constellations could make them more resilient to attacks by many adversary counterspace systems. A constellation composed of hundreds or thousands of satellites could withstand losing a relatively large number of them before losing significant capability. Conducting such an attack with kinetic antisatellite weapons—like those China and Russia are developing—would require hundreds of costly weapons to destroy satellites that would be relatively inexpensive to replace. Second, proliferated constellations would be more resilient to adversary electronic warfare. Satellites in LEO can emit signals 1,280 times more powerful than signals from satellites in GEO.29 They also are faster **in the sky** than satellites in more distant orbits, which, combined with the planned use of small spot beams for communications proliferated constellations, would shrink the geographic area in which an adversary ground-based jammer could effectively operate, making jammers less effective and easier to geolocate and eliminate.30 Third, even if the United States chooses not to deploy national security proliferated constellations during peacetime, industrial capacity for mass-producing proliferated constellation satellites could be repurposed during a conflict. Just as Ford production lines shifted from automobiles to tanks and aircraft during World War II, one can easily imagine commercial satellite factories building military reconnaissance or communications satellites during a conflict. Fourth, deploying and maintaining constellations of hundreds or thousands of satellites will drive the development of low-cost launches to a much higher rate than is available today. Inexpensive, high-cadence space launch could provide a commercial solution to operationally responsive launch needs of the U.S. Government. In a future where space launches occur weekly or less, the launch capacity needed to augment national security space systems during a crisis or to replace systems lost during a conflict in space would be readily available.31

#### Hacking on Satellites goes Nuclear.

Miller and Fontaine 17 James Miller and Richard Fontaine 11-26-2017 "Cyber and Space Weapons Are Making Nuclear Deterrence Trickier" <https://www.defenseone.com/ideas/2017/11/cyber-and-space-weapons-are-making-nuclear-deterrence-trickier/142767/> (James N. Miller, Jr. is a member of the Board of Advisors of the Center for a New American Security. He served as U.S. Under Secretary of Defense for Policy from 2012 to 2014.)//Elmer

Cyber weapons are not, of course, the sole preserve of Russia. Washington has acknowledged its own development of them, and senior U.S. officials have highlighted their use against ISIS. Their possession by both Russia and the United States complicates traditional notions of strategic stability. Using non-kinetic, non-lethal cyber tools is likely to be very attractive in a crisis, and certainly in a conflict. Yet with both sides possessing the means to disrupt or destroy the other’s military systems and critical infrastructure – both war-supporting infrastructure as well as purely civilian infrastructure - a small “cyber-spark” could prompt rapid escalation. Such an attack could inadvertently “detonate” a cyber weapon that had been intended to lay dormant in the other side’s systems. Or a spark produced by sub-national actors – “patriotic hackers” inside or outside the government – could generate unintended cascading effects. The spark could even come via a false flag attack, with a third-party trying to pit the United States and Russia against one another. A second scenario could appear if armed conflict looks likely. At the outset, there would exist strong incentives to use offensive cyber and counter-space capabilities early, in order to negate the other side’s military. The U.S. and Russian militaries depend (though not equally) on information technology and space assets to collect and disseminate intelligence, as well as for command, control, and communications. Hence the incentive to use non-kinetic cyber or space attacks to degrade the other side’s military, with few if any direct casualties. By moving first, the cyber- or space-attacker could gain military and coercive advantage, while putting the onus on the attacked side to dare escalate with “kinetic” lethal attacks. Would the United States or Russia respond with, say, missile strikes or a bombing campaign in response to some fried computers or dead robots in outer space? Given the doubt that they would, large-scale cyber and space attacks – before a kinetic conflict even starts – are likely to be seen as a low-risk, high-payoff move for both sides. A third scenario plays out if one side believes that its critical infrastructure and satellites are far less vulnerable than the other side. In that case, a severe crisis or conflict might prompt the country to threaten (and perhaps provide a limited demonstration of) cyber attacks on civilian critical infrastructure, or non-kinetic attacks on space assets. Such a move would require the attacked side to respond not in kind but by escalating. So far, the three scenarios we have described could well undermine stability between the United States and Russia, but need not implicate nuclear stability. Yet consider this: U.S. and Russian nuclear forces rely on information technology and space assets for warning and communications. Attack the right satellites, or attack the right computers, and one side may disrupt the other’s ability to use nuclear weapons – or at least place doubt in the minds of its commanders. As a result, a major cyber and space attack could put nuclear “use-or-lose” in play early in a crisis. While we are generally accustomed to thinking about nuclear use as the highest rung on the escalatory ladder, such pressures – generated via non-nuclear attacks – could bring the horrors of a nuclear exchange closer rather than substituting for them.

### Can’t spec appropriation

#### Interpretation: The aff may not defend a subset of appropriation of outer space by private entities being unjust.

#### Violation – they only defend megaconstellations

#### Vote neg:

#### 1] Limits – they can pick any form of appropriation from internet satellites to asteroid mining to moon basing to Mars colonization and there’s no universal disad since they’re all different and require different uses space – explodes neg prep and leads to random appropriation of the week affs which makes cutting stable neg links impossible.

#### 2] TVA – read the aff as an advantage to a whole rez aff.

#### Fairness is a voter since the winner can’t be decided if the round was skewed and education too since it’s the point of the activity

#### Drop the debater – key to preventing future abuse since if they get dropped for unfair arguments they’re disincentivized from reading them

#### Prefer Competing interps – reasonability collapses since it’s just two brightlines justified under an offense defense paradigm, which is better because it creates a clear method for deciding the winner of the theory debate

#### No RVIs- a) illogical, you don’t win for being fair b) having the 2ar means you can sit on an RVI for 3 minutes to moot all NC offense which dissuades people from pointing out abuse.

## Case

### O/V On util – short (0:20)

#### 1] Aggregation fails – no way to compare harms, for example 50 bullet wounds to 15 cases of torture which means it’s impossible to calculate properly.

#### 2] Induction is circular – the only warrant for it is that it’s always worked in the past.

#### 3] Infinite consequences – each consequence causes another consequence which goes on infinitely – any cutoff point is arbitrary and means we can’t decide if an action is good or bad.

#### 4] Subjectivity – each person experiences pleasure and pain differently, in different amounts, and from different sources which effectively makes calculation under util impossible.

### A2 Extinction First (0:20)

#### 1] Freezes action – anything has at least a 1% chance of causing extinction so we could never act

#### 2] Assumes consequences cause extinction

#### 3] It means people will only ever go for extinction level arguments, means reject it even if theoretically true – A] it kills education and argument diversity. B] it kills inclusion and safety – critiques of oppression and arguments based around people’s identities which they extend in an attempt to spread awareness about the importance of an issue through the ballot will always become irrelevant because uh oh no extinction impact.

### Epistemic Confidence (0:30)

#### Epistemic confidence:

#### [1] Resolvability – It’s impossible to know or multiply the numerical probability by the magnitude of an impact

#### [2] Debate Solves – Whomever wins the arguments for their framework in this round is winning 100% strength of link so the judge can objectively decide under which FW to evaluate offense

#### [3] Vacuum – without an underlying moral theory we do not even know if it’s moral to engage in the multiplication process of epistemic modesty

#### [4] Circular – Modesty presumes confidence in modesty

#### [5] Key to phil ed – otherwise debaters will always go for extinction level impacts and never learn the nuances of a FW which outweighs on portability since learning about different philosophies is important to how we live our day to day lives.

### Case – analytics

#### A] companies have a vested interest in minimizing debris so they can continue to make a profit

B] megaconstellations in the thermosphere nonunique the impact

On warming – just getting analytics about climate doesn’t mean people will do anything about it – past couple decades prove

### A2 Ozone Loss (0:30)

#### Ozone Layer is increasing – flips U/Q.

Horton 21 Helena Horton 9-15-2021 "‘Larger than usual’: this year’s ozone layer hole bigger than Antarctica" <https://www.theguardian.com/environment/2021/sep/16/larger-than-usual-ozone-layer-hole-bigger-than-antarctica> (Environmental Journalist for the Guardian)//Elmer

The hole in the ozone layer that develops annually is “rather larger than usual” and is currently bigger than Antartica, say the scientists responsible for monitoring it. Researchers from the Copernicus Atmosphere Monitoring Service say that this year’s hole is growing quickly and is larger than 75% of ozone holes at this stage in the season since 1979. Ozone exists about seven to 25 miles (11-40km) above the Earth’s surface, in the stratosphere, and acts like a sunscreen for the planet, shielding it from ultraviolet radiation. Every year, a hole forms during the late winter of thesouthern hemisphere as the sun causes ozone-depleting reactions, which involve chemically active forms of chlorine and bromine derived from human-made compounds. In a statement Copernicus said that this year’s hole “has evolved into a rather larger than usual one”. Vincent-Henri Peuch, the service’s director, told the Guardian: “We cannot really say at this stage how the ozone hole will evolve. However, the hole of this year is remarkably similar to the one of 2020, which was among the deepest and the longest-lasting – it closed around Christmas – in our records since 1979.

#### Three Thumpers:

#### 1] Dichloromethane

Perkins 17 Sid Perkins 6-27-2017 "New threat to ozone layer found" <https://www.science.org/content/article/new-threat-ozone-layer-found> (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)//Elmer

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.

#### 2] Copper

Berkeley 1/13 (Robert Rhew and Berkeley geo chemists, [UC Berkeley professor of geography and of environmental science, policy and management], 1-13-2022, “Copper-based chemicals may be contributing to ozone depletion: Some ozone-destroying chemicals are unaccounted for. Are copper-based fungicides producing them?“, ScienceDaily, accessed: 1-15-2022, https://www.sciencedaily.com/releases/2022/01/220113151441.htm) ajs

In a paper appearing this week in the journal Nature Communications, UC Berkeley geochemists show that copper in soil and seawater acts as a catalyst to turn organic matter into both methyl bromide and methyl chloride, two potent halocarbon compounds that destroy ozone. Sunlight worsens the situation, boosting production of these methyl halides by a factor of 10. The findings answer, at least in part, a long-standing mystery about the origin of much of the methyl bromide and methyl chloride in the stratosphere. Since the worldwide ban on chlorofluorocarbon (CFC) refrigerants and brominated halons used in fire extinguishers starting in 1989, these methyl halides have become the new dominant sources of ozone-depleting bromine and chlorine in the stratosphere. As the long-lived CFCs and halons slowly disappear from the atmosphere, the role of methyl halides increases. "If we don't know where methyl bromide and methyl chloride are coming from, then how can we make sure that those compounds are reduced along with CFCs?" said the paper's senior author, Robert Rhew, UC Berkeley professor of geography and of environmental science, policy and management. "By 2050, we should be back to relatively normal ozone, but things like the continued emissions of methyl bromide and methyl chloride are road bumps in the road to recovery. Copper usage in the environment is projected to increase rapidly in the next few years, and this should be considered when predicting future halogen load and ozone recovery."

### A2 Debris

#### Kessler Syndrome false – less debris and existing guidelines solve

Lewis 15 (Hugh, Senior Lecturer in Aerospace Engineering at the University of Southampton, “Space debris, Kessler Syndrome, and the unreasonable expectation of certainty.” Room, <https://room.eu.com/article/Space_debris_Kessler_Syndrome_and_the_unreasonable_expectation_of_certainty>, Accessed 8/10/19, JMoore)

There is now widespread awareness of the space debris problem amongst policymakers, scientists, engineers and the public. Thanks to pivotal work by J.C. Liou and Nicholas Johnson in 2006 we now understand that the continued growth of the debris population is likely in the future even if all launch activity is halted. The reason for this sustained growth, and for the concern of many satellite operators who are forced to act to protect their assets, are collisions that are expected to occur between objects – satellites and rocket stages – already in orbit. In spite of several commentators warning that these collisions are just the start of a collision cascade that will render access to low Earth orbit all but impossible – a process commonly referred to as the ‘Kessler Syndrome’ after the debris scientist Donald Kessler – the reality is not likely to be on the scale of these predictions or the events depicted in the film Gravity. Indeed, results presented by the Inter-Agency Space Debris Coordination Committee (IADC) at the Sixth European Conference on Space Debris show an expected increase in the debris population of only 30% after 200 years with continued launch activity. Collisions are still predicted to occur, but this is far from the catastrophic scenario feared by some. Constraining the population increase to a modest level can be achieved, the IADC suggested, through widespread and good compliance with existing space debris mitigation guidelines, especially those relating to passivation (whereby all sources of stored energy on a satellite are depleted at the end of its mission) and post-mission disposal, such as de-orbiting the satellite or re-orbiting it to a graveyard orbit. Nevertheless, the anticipated growth of the debris population in spite of these robust efforts merits the investigation of additional measures to address the debris threat, according to the IADC.

#### Collision risk is infinitesimally small

Fange 17 Daniel Von Fange 17, Web Application Engineer, Founder and Owner of LeanCoder, Full Stack, Polyglot Web Developer, “Kessler Syndrome is Over Hyped”, 5/21/2017, http://braino.org/essays/kessler\_syndrome\_is\_over\_hyped/

The orbital area around earth can be broken down into four regions. Low LEO - Up to about 400km. Things that orbit here burn up in the earth’s atmosphere quickly - between a few months to two years. The space station operates at the high end of this range. It loses about a kilometer of altitude a month and if not pushed higher every few months, would soon burn up. For all practical purposes, Low LEO doesn’t matter for Kessler Syndrome. If Low LEO was ever full of space junk, we’d just wait a year and a half, and the problem would be over. High LEO - 400km to 2000km. This where most heavy satellites and most space junk orbits. The air is thin enough here that satellites only go down slowly, and they have a much farther distance to fall. It can take 50 years for stuff here to get down. This is where Kessler Syndrome could be an issue. Mid Orbit - GPS satellites and other navigation satellites travel here in lonely, long lives. The volume of space is so huge, and the number of satellites so few, that we don’t need to worry about Kessler here. GEO - If you put a satellite far enough out from earth, the speed that the satellite travels around the earth will match the speed of the surface of the earth rotating under it. From the ground, the satellite will appear to hang motionless. Usually the geostationary orbit is used by big weather satellites and big TV broadcasting satellites. (This apparent motionlessness is why satellite TV dishes can be mounted pointing in a fixed direction. You can find approximate south just by looking around at the dishes in your northern hemisphere neighborhood.) For Kessler purposes, GEO orbit is roughly a ring 384,400 km around. However, all the satellites here are moving the same direction at the same speed - debris doesn’t get free velocity from the speed of the satellites. Also, it’s quite expensive to get a satellite here, and so there aren’t many, only about one satellite per 1000km of the ring. Kessler is not a problem here. How bad could Kessler Syndrome in High LEO be? Let’s imagine a worst case scenario. An evil alien intelligence chops up everything in High LEO, turning it into 1cm cubes of death orbiting at 1000km, spread as evenly across the surface of this sphere as orbital mechanics would allow. Is humanity cut off from space? I’m guessing the world has launched about 10,000 tons of satellites total. For guessing purposes, I’ll assume 2,500 tons of satellites and junk currently in High LEO. If satellites are made of aluminum, with a density of 2.70 g/cm3, then that’s 839,985,870 1cm cubes. A sphere for an orbit of 1,000km has a surface area of 682,752,000 square KM. So there would be one cube of junk per .81 square KM. If a rocket traveled through that, its odds of hitting that cube are tiny - less than 1 in 10,000.

#### No impact to debris – it hits stations all the time.

Cain ’15 (Fraser; 12/23/15; writer for Universe Today; “How Do Astronauts Avoid Debris”; http://www.universetoday.com/121067/how-do-astronauts-avoid-debris)

So, just how do we keep our space stations, ships and astronauts from being riddled with holes from all of the space junk in orbit around Earth? We revel in the terror grab bag of all the magical ways to get snuffed in space. Almost as much as we celebrate the giant brass backbones of the people who travel there. We’ve already talked about all the scary ways that astronauts can die in space. My personal recurring “Hail Mary full of grace, please don’t let me die in space” nightmare is orbital debris. We’re talking about a vast collection of spent rockets, dead satellites, flotsam, jetsam, lagan and derelict. It’s not a short list. NASA figures there are **21,000 bits of junk** bigger than 10 cm, **500,000 particles** between 1 and 10 cm, and more than **100 million** smaller than 1 cm. Sound familiar, humans? This is our high tech, sci fi great Pacific garbage patch. Sure, a tiny rivet or piece of scrap foil doesn’t sound very dangerous, but consider the fact that astronauts are orbiting the Earth at a velocity of about 28,000 km/h. And the Tang packets, uneaten dehydrated ice cream, and astronaut poops are also traveling at 28,000 km/h. Then think about what happens when they collide. Yikes… or yuck. Here’s the International Space Station’s solar array. See that tiny hole? Embiggen and clarinosticate! That’s a tiny puncture hole made in the array by a piece of orbital crap. The whole station is **pummeled by tiny pieces of space program junk drawer contents**. Back when the Space Shuttle was flying, NASA had to **constantly replace their windows because of the damage they were experiencing** from the orbital equivalent of Dennis the Menace hurling paint chips, fingernail clippings, and frozen scabs.