# 1NC

### New Affs Bad

#### Interpretation—the aff must correctly disclose the plan text, framework, and advantage areas 30 minutes before the round. To clarify, disclosure can occur on the wiki or over message.

#### Violation—they didn’t – said the aff was new but it isnt

#### Vote neg for prep and clash—two internal links—a) neg prep—4 minutes of prep is not enough to put together a coherent 1nc or update generics—30 minutes is necessary to learn a little about the affirmative and piece together what 1nc positions apply and cut and research their applications to the affirmative b) lying – bruh this is quartesr of the TOC

#### Voters:

#### Fairness and education are voters – debate’s a game that needs rules to evaluate it and education gives us portable skills for life like research and thinking.

#### Precision o/w – anything else justifies the aff arbitrarily jettisoning words in the resolution at their whim which decks negative ground and preparation because the aff is no longer bounded by the resolution.

#### Drop the debater – a) they have a 7-6 rebuttal advantage and the 2ar to make args I can’t respond to, b) it deters future abuse and sets a positive norm.

#### Use competing interps – a) reasonability invites arbitrary judge intervention since we don’t know your bs meter, b) collapses to competing interps – we justify 2 brightlines under an offense defense paradigm just like 2 interps.

**Even if they win new affs are good, you should still err neg on 1AR theory vs new affs -- even if new affs are good for innovation, the neg needs flexiblity like condo and process CPs to react because it's impossible for us to have specific policy prep -- that outweighs because innovative affs are only good if we can clash over them -- that means you should use reasonability and DTA on 1AR theory, and every shell should have an implicit neg flex standard to correct for the aff's adv of breaking new**

#### No RVIs – a) illogical – you shouldn’t win for being fair – it’s a litmus test for engaging in substance, b) norming – I can’t concede the counterinterp if I realize I’m wrong which forces me to argue for bad norms, c) baiting – incentivizes good debaters to be abusive, bait theory, then collapse to the 1AR RVI, d) topic ed – prevents 1AR blipstorm scripts and allows us to get back to substance after resolving theory

#### Evaluate T before 1AR theory – a) magnitude – T affects a larger portion of the debate since the aff advocacy determines every speech after it, b) norms – we only have a couple months to set T norms but can set 1AR theory norms anytime

### 1 – Extra-T

#### 1] Interp – Affirmative’s may only Affirm that “The appropriation of outer space by private entities is unjust”. The Affirmative can only fiat a Plan that renders Appropriation unjust – anything beyond that is external to the scope of the Resolution and Extra-Topical.

#### Unjust means against the Law.

Black Laws No Date "What is Unjust?" <https://thelawdictionary.org/unjust/> //Elmer

Contrary to right and justice, or to the enjoyment of his rights by another, or to the standards of conduct furnished by the laws.

#### 2] Violation – plan veiws space as a ocmmons

#### 3] The Standard is Extra-T - it establishes a new governance regime which goes past just saying “appropriation is unjust” since it imposes an active duty of the Government to manage and take care of Outer Space Resources – that wrecks Predictability since the Aff can claim different Advantages off of the process of the PTD which exists outside the core topic question of Appropriation Good/Bad that also allows them to spike DA links by saying they don’t apply under the PTD.

#### 4] Paradigm Issues: cross apply

### 1 – Space Elevators PIC

#### Text – Private Appropriation of Outer Space except for Space Elevators is Unjust.

#### Space Elevators constitute Appropriation – they impede orbits.

Matignon 19 Louis de Gouyon Matignon 3-3-2019 "LEGAL ASPECTS OF THE SPACE ELEVATOR TRANSPORTATION SYSTEM" <https://www.spacelegalissues.com/space-law-legal-aspects-of-the-space-elevator-transportation-system/> [PhD in space law (co-supervised by both Philippe Delebecque, from Université Paris 1 Panthéon-Sorbonne, France, and Christopher D. Johnson, from Georgetown University || regularly write articles on the website Space Legal Issues so as to popularise space law and public international law]//Elmer

An Earth-based space elevator would consist of a cable with one end attached to the surface near the equator and the other end in space beyond geostationary orbit. An orbit is the curved path through which objects in space move around a planet or a star. The 1967 Treaty’s regime and customary law enshrine the principle of non-appropriation and freedom of access to orbital positions. Space Law and International Telecommunication Laws combined to protect this use against any interference. The majority of space-launched objects are satellites that are launched in Earth’s orbit (a very small part of space objects – scientific objects for space exploration – are launched into outer space beyond terrestrial orbits). It is important to precise that an orbit does not exist: satellites describe orbits by obeying the general laws of universal attraction. Depending on the launching techniques and parameters, the orbital trajectory of a satellite may vary. Sun-synchronous satellites fly over a given location constantly at the same time in local civil time: they are used for remote sensing, meteorology or the study of the atmosphere. Geostationary satellites are placed in a very high orbit; they give an impression of immobility because they remain permanently at the same vertical point of a terrestrial point (they are mainly used for telecommunications and television broadcasting). A geocentric orbit or Earth orbit involves any object orbiting Planet Earth, such as the Moon or artificial satellites. Geocentric (having the Earth as its centre) orbits are organised as follow: 1) Low Earth orbit (LEO): geocentric orbits with altitudes (the height of an object above the average surface of the Earth’s oceans) from 100 to 2 000 kilometres. Satellites in LEO have a small momentary field of view, only able to observe and communicate with a fraction of the Earth at a time, meaning a network or constellation of satellites is required in order to provide continuous coverage. Satellites in lower regions of LEO also suffer from fast orbital decay (in orbital mechanics, decay is a gradual decrease of the distance between two orbiting bodies at their closest approach, the periapsis, over many orbital periods), requiring either periodic reboosting to maintain a stable orbit, or launching replacement satellites when old ones re-enter. 2) Medium Earth orbit (MEO), also known as an intermediate circular orbit: geocentric orbits ranging in altitude from 2 000 kilometres to just below geosynchronous orbit at 35 786 kilometres. The most common use for satellites in this region is for navigation, communication, and geodetic/space environment science. The most common altitude is approximately 20 000 kilometres which yields an orbital period of twelve hours. 3) Geosynchronous orbit (GSO) and geostationary orbit (GEO) are orbits around Earth at an altitude of 35 786 kilometres matching Earth’s sidereal rotation period. All geosynchronous and geostationary orbits have a semi-major axis of 42 164 kilometres. A geostationary orbit stays exactly above the equator, whereas a geosynchronous orbit may swing north and south to cover more of the Earth’s surface. Communications satellites and weather satellites are often placed in geostationary orbits, so that the satellite antennae (located on Earth) that communicate with them do not have to rotate to track them, but can be pointed permanently at the position in the sky where the satellites are located. 4) High Earth orbit: geocentric orbits above the altitude of 35 786 kilometres. The competing forces of gravity, which is stronger at the lower end, and the outward/upward centrifugal force, which is stronger at the upper end, would result in the cable being held up, under tension, and stationary over a single position on Earth. With the tether deployed, climbers could repeatedly climb the tether to space by mechanical means, releasing their cargo to orbit. Climbers could also descend the tether to return cargo to the surface from orbit.

#### Private Companies are pursuing Space Elevators.

Alfano 15 Andrea Alfano 8-18-2015 “All Of These Companies Are Working On A Space Elevator” <https://www.techtimes.com/articles/77612/20150818/companies-working-space-elevator.htm> (Writer at the Tech Times)//Elmer

Space elevators are solid proof that any mundane object sounds way cooler if you stick the word "space" in front of it. But there's much more than coolness at stake when building a space elevator – this technology has the potential to revolutionize space transportation, and the Canadian private space company Thoth Technology that was recently awarded a patent for its space elevator design isn't the only company in the game. One of the other major players is a U.S.-based company called LiftPort Group, founded by space entrepreneur Michael Laine in 2003. Its plan for a space elevator is vastly different from the one for which Thoth received a patent, however. Whereas Thoth's plans entail tethering a 12-mile-high inflatable space elevator to the Earth, LiftPort is shooting for the moon. Originally, LiftPort had planned to build an Earth elevator, too, but it abandoned the idea in 2007 in favor of building a lunar elevator. The basic design for a lunar elevator is an anchor in the moon that is attached to a cable that extends to a space station situated at a very special point. Known as a Lagrange Point, this is the gravitational tipping point between the Earth and the moon, where their gravitational pulls essentially cancel one another out. A robot could then travel up and down the tether, ferrying cargo between the moon and the station. Out farther in space, a counterweight would balance out the system. Both types of space elevator are intended to increase space access, but in very different ways. Thoth's Earth elevator aims to make launches easier by starting off 12 miles above the Earth's surface. LiftPort's space elevator aims to increase access to the moon in particular, because it is much easier to launch a rocket to the Lagrange Point and dock it at a space station than it is to get to the moon directly. There's a third major company based in Japan called Obayashi Corp. whose plans look like a hybrid of Thoth's and LiftPort's. Obayashi is not a space company, however – it's actually a construction company. Like Thoth, Obayashi plans to build an Earth elevator. But its Earth elevator would consist of a cable tethered to the blue planet, a robotic cargo-carrier, a space station, and a counterweight. It essentially looks like LiftPort's plans, but stuck to the Earth instead of to the moon.

#### Yes Space Elevators – NASA confirms.

Snowden 18 Scott Snowden 10-2-2018 "A colossal elevator to space could be going up sooner than you ever imagined" <https://www.nbcnews.com/mach/science/colossal-elevator-space-could-be-going-sooner-you-ever-imagined-ncna915421> (Scott has written about science and technology for 20 years for publications around the world. He covers environmental technology for Forbes.)//Elmer

For more than half a century, rockets have been the only way to go to space. But in the not-too-distant future, we may have another option for sending up people and payloads: a colossal elevator extending from Earth’s surface up to an altitude of 22,000 miles, where geosynchronous satellites orbit. NASA says the basic concept of a space elevator is sound, and researchers around the world are optimistic that one can be built. The Obayashi Corp., a global construction firm based in Tokyo, has said it will build one by 2050, and China wants to build one as soon as 2045. Now an experiment to be conducted soon aboard the International Space Station will help determine the real-world feasibility of a space elevator. “The space elevator is the Holy Grail of space exploration,” says Michio Kaku, a professor of physics at City College of New York and a noted futurist. “Imagine pushing the ‘up’ button of an elevator and taking a ride into the heavens. It could open up space to the average person.”

#### Regardless of completion, Elevators spur investment in Nanotechnology

Liam O’Brien 16. University of Wollongong. 07/2016. “Nanotechnology in Space.” Young Scientists Journal; Canterbury, no. 19, p. 22.

Nanotechnology is at the forefront of scientific development, continuing to astound and innovate. Likewise, the space industry is rapidly increasing in sophistication and competition, with companies such as SpaceX, Blue Origin and Virgin Galactic becoming increasingly prevalent in what could become a new commercial space race. The various space programs over the past 60 years have led to a multitude of beneficial impacts for everyday society. Nanotechnology, through research and development in space has the potential to do the same. Potential applications of nanotechnology in space are numerous, many of them have the potential to capture and inspire generations to come. One of these applications is the space elevator. By using carbon nanotubes, a super light yet strong material, this concept would be an actual physical structure from the surface of the Earth to an altitude of approximately 36 000 km. The tallest building in the world would fit into this elevator over 42 000 times. The counterweight, used to keep the elevator taught, is proposed to be an asteroid. This would need to be at a distance of 100 000 km, a quarter of the distance to the moon. The benefits of such a structure would be enormous. 95% of a space shuttle's weight at take-off is fuel, costing US$ 20 000 per kilogram to send something into space. However, with a space elevator the cost per kilogram can be reduced to as little as US$ 200. Exploration to other planets can begin at the tower, and travel to and from the moon could become as simple as a morning commute to work. Solar sails provide the means to travel large distances and incredible speeds. Much like sails on a boat use wind, the solar sail uses light as a source of propulsion. Ideally these sails would be kilometres in length and only a few micrometres in thickness. This provides us with the ability to travel at speeds previously unheard of. Using carbon nanotubes once again, a solar sail has the capability to travel at 39 756 km/s which is 13% of the speed of light! This sail could reach Pluto in an astonishing 1.7 days, and Alpha Centauri in just 32 years. Space travel to other planets, other stars, could be possible with solar sails. The Planetary Society is funding for a space sail of itself, and has successfully launched one into orbit. NASA has also sent a sail into orbit, allowing it to burn up in the atmosphere after 240 days. Investing time and resources into nanotechnology for space exploration has benefits for society today. Materials such as graphene are being used in modern manufacturing at an increasing rate as the applications become utilised. Carbon nanotubes will change the way we think about materials and their strength. These nanotubes have a tensile strength one hundred times that of steel, yet are only a sixth of the weight. Imagine light weight vehicles using less petrol and energy as well as being just as strong as regular vehicles. With potentials to revolutionize the way we think about space travel, nanotechnology has a bright future. As a new field of science, it has the capability to push the human race to the outer reaches of our galaxy and hopefully one day to other stars. It will inspire generations of explorers and dreamers to challenge themselves and advance the human race into the next era. As Richard Feynman said in his 1959 talk 'There's Plenty of Room at the Bottom' "A field in which little has been done, but in which an enormous amount can be done. There is still plenty more to achieve.

#### Nano tech solves warming

Bhavya Khullar. September 4, 2017. Nanomaterials Could Combat Climate Change and Reduce Pollution. https://www.scientificamerican.com/article/nanomaterials-could-combat-climate-change-and-reduce-pollution/

The list of environmental problems that the world faces may be huge, but some strategies for solving them are remarkably small. First explored for applications in microscopy and computing, nanomaterials—materials made up of units that are each thousands of times smaller than the thickness of a human hair—are emerging as useful for tackling threats to our planet’s well-being. Scientists across the globe are developing nanomaterials that can efficiently use carbon dioxide from the air, capture toxic pollutants from water and degrade solid waste into useful products. “Nanomaterials could help us mitigate pollution. They are efficient catalysts and mostly recyclable. Now, they have to become economical for commercialization and better to replace present-day technologies completely,” says [Arun Chattopadhyay](http://www.iitg.ac.in/arun/), a member of the chemistry faculty at the Center for Nanotechnology, Indian Institute of Technology Guwahati. To help slow the climate-changing rise in atmospheric CO2levels, researchers have developed nanoCO2 harvesters that can suck atmospheric carbon dioxide and deploy it for industrial purposes. “Nanomaterials can convert carbon dioxide into useful products like alcohol. The materials could be simple chemical catalysts or photochemical in nature that work in the presence of sunlight,” says Chattopadhyay, who has been working with nanomaterials to tackle environmental pollutants for more than a decade. Many research groups are working to address a problem that, if solved, could be a holy grail in combating climate change: how to pull CO2 out of the atmosphere and convert it into useful products. Chattopadhyay isn’t alone. Many research groups are working to address a problem that, if solved, could be a holy grail in combating climate change: how to pull CO2 out of the atmosphere and convert it into useful products. Nanoparticles offer a promising approach to this because they have a large surface-area-to-volume ratio for interacting with CO2 and properties that allow them to facilitate the conversion of CO2into other things. The challenge is to make them economically viable. Researchers have tried everything from metallic to carbon-based nanoparticles to reduce the cost, but so far they haven’t become efficient enough for industrial-scale application. One of the most recent points of progress in this area is work by scientists at the CSIR-Indian Institute of Petroleum and the Lille University of Science and Technology in France. The researchers developed a nanoCO2 harvester that uses water and sunlight to convert atmospheric CO2 into methanol, which can be employed as an engine fuel, a solvent, an antifreeze agent and a diluent of ethanol. Made by wrapping a layer of modified graphene oxide around spheres of copper zinc oxide and magnetite, the material looks like a miniature golf ball, captures CO2 more efficiently than conventional catalysts and can be readily reused, according to Suman Jain, senior scientist of the Indian Institute of Petroleum, Dehradun in India, who developed the nanoCO2harvester. Jain says that the nanoCO2 harvester has a large molecular surface area and captures more CO2 than a conventional catalyst with similar surface area would, which makes the conversion more efficient. But due to their small size, the nanoparticles have a tendency to clump up, making them inactive with prolonged use. Jain adds that synthesizing useful nanoparticle-based materials is also challenging because it’s hard to make the particles a consistent size. Chattopadhyay says the efficiency of such materials can be improved further, providing hope for useful application in the future. CLEANSING WATER Most toxic dyes used in textile and leather industries can be captured with nanoparticles. “Water pollutants such as dyes from human-created waste like those from tanneries could get to natural sources of water like deep tube wells or groundwater if wastewater from these industries is left untreated,” says Chattopadhyay. “This problem is rather difficult to solve.” An international group of researchers led by professor Elzbieta Megiel of the University of Warsaw in Poland reports that nanomaterials have been widely studied for removing heavy metals and dyes from wastewater. According to the research team, adsorption processes using materials containing magnetic nanoparticles are highly effective and can be easily performed because such nanoparticles have a large number of sites on their surface that can capture pollutants and don’t readily degrade in water. Chattopadhyay adds that appropriately designed magnetic nanomaterials can be used to separate pollutants such as arsenic, lead, chromium and mercury from water. However, the nanotech-based approach has to be more efficient than conventional water purification technology to make it worthwhile. In addition to removing dyes and metals, nanomaterials can also be used to clean up oil spills. Researchers led by Pulickel Ajayan at Rice University in Houston, Texas, have developed a reusable nanosponge that can remove oil from contaminated seawater.

#### Warming causes Extinction

Kareiva 18, Peter, and Valerie Carranza. "Existential risk due to ecosystem collapse: Nature strikes back." Futures 102 (2018): 39-50. (Ph.D. in ecology and applied mathematics from Cornell University, director of the Institute of the Environment and Sustainability at UCLA, Pritzker Distinguished Professor in Environment & Sustainability at UCLA)//Re-cut by Elmer

In summary, six of the nine proposed planetary boundaries (phosphorous, nitrogen, biodiversity, land use, atmospheric aerosol loading, and chemical pollution) are unlikely to be associated with existential risks. They all correspond to a degraded environment, but in our assessment do not represent existential risks. However, the three remaining boundaries (**climate change**, global **freshwater** cycle, **and** ocean **acidification**) do **pose existential risks**. This is **because of** intrinsic **positive feedback loops**, substantial lag times between system change and experiencing the consequences of that change, and the fact these different boundaries interact with one another in ways that yield surprises. In addition, climate, freshwater, and ocean acidification are all **directly connected to** the provision of **food and water**, and **shortages** of food and water can **create conflict** and social unrest. Climate change has a long history of disrupting civilizations and sometimes precipitating the collapse of cultures or mass emigrations (McMichael, 2017). For example, the 12th century drought in the North American Southwest is held responsible for the collapse of the Anasazi pueblo culture. More recently, the infamous potato famine of 1846–1849 and the large migration of Irish to the U.S. can be traced to a combination of factors, one of which was climate. Specifically, 1846 was an unusually warm and moist year in Ireland, providing the climatic conditions favorable to the fungus that caused the potato blight. As is so often the case, poor government had a role as well—as the British government forbade the import of grains from outside Britain (imports that could have helped to redress the ravaged potato yields). Climate change intersects with freshwater resources because it is expected to exacerbate drought and water scarcity, as well as flooding. Climate change can even impair water quality because it is associated with heavy rains that overwhelm sewage treatment facilities, or because it results in higher concentrations of pollutants in groundwater as a result of enhanced evaporation and reduced groundwater recharge. **Ample clean water** is not a luxury—it **is essential for human survival**. Consequently, cities, regions and nations that lack clean freshwater are vulnerable to social disruption and disease. Finally, ocean acidification is linked to climate change because it is driven by CO2 emissions just as global warming is. With close to 20% of the world’s protein coming from oceans (FAO, 2016), the potential for severe impacts due to acidification is obvious. Less obvious, but perhaps more insidious, is the interaction between climate change and the loss of oyster and coral reefs due to acidification. Acidification is known to interfere with oyster reef building and coral reefs. Climate change also increases storm frequency and severity. Coral reefs and oyster reefs provide protection from storm surge because they reduce wave energy (Spalding et al., 2014). If these reefs are lost due to acidification at the same time as storms become more severe and sea level rises, coastal communities will be exposed to unprecedented storm surge—and may be ravaged by recurrent storms. A key feature of the risk associated with climate change is that mean annual temperature and mean annual rainfall are not the variables of interest. Rather it is extreme episodic events that place nations and entire regions of the world at risk. These extreme events are by definition “rare” (once every hundred years), and changes in their likelihood are challenging to detect because of their rarity, but are exactly the manifestations of climate change that we must get better at anticipating (Diffenbaugh et al., 2017). Society will have a hard time responding to shorter intervals between rare extreme events because in the lifespan of an individual human, a person might experience as few as two or three extreme events. How likely is it that you would notice a change in the interval between events that are separated by decades, especially given that the interval is not regular but varies stochastically? A concrete example of this dilemma can be found in the past and expected future changes in storm-related flooding of New York City. The highly disruptive flooding of New York City associated with Hurricane Sandy represented a flood height that occurred once every 500 years in the 18th century, and that occurs now once every 25 years, but is expected to occur once every 5 years by 2050 (Garner et al., 2017). This change in frequency of extreme floods has profound implications for the measures New York City should take to protect its infrastructure and its population, yet because of the stochastic nature of such events, this shift in flood frequency is an elevated risk that will go unnoticed by most people. 4. The combination of positive feedback loops and societal inertia is fertile ground for global environmental catastrophes **Humans** are remarkably ingenious, and **have adapted** to crises **throughout** their **history**. Our doom has been repeatedly predicted, only to be averted by innovation (Ridley, 2011). **However**, the many **stories** **of** human ingenuity **successfully** **addressing** **existential risks** such as global famine or extreme air pollution **represent** environmental c**hallenges that are** largely **linear**, have immediate consequences, **and operate without positive feedbacks**. For example, the fact that food is in short supply does not increase the rate at which humans consume food—thereby increasing the shortage. Similarly, massive air pollution episodes such as the London fog of 1952 that killed 12,000 people did not make future air pollution events more likely. In fact it was just the opposite—the London fog sent such a clear message that Britain quickly enacted pollution control measures (Stradling, 2016). Food shortages, air pollution, water pollution, etc. send immediate signals to society of harm, which then trigger a negative feedback of society seeking to reduce the harm. In contrast, today’s great environmental crisis of climate change may cause some harm but there are generally long time delays between rising CO2 concentrations and damage to humans. The consequence of these delays are an absence of urgency; thus although 70% of Americans believe global warming is happening, only 40% think it will harm them (http://climatecommunication.yale.edu/visualizations-data/ycom-us-2016/). Secondly, unlike past environmental challenges, **the Earth’s climate system is rife with positive feedback loops**. In particular, as CO2 increases and the climate warms, that **very warming can cause more CO2 release** which further increases global warming, and then more CO2, and so on. Table 2 summarizes the best documented positive feedback loops for the Earth’s climate system. These feedbacks can be neatly categorized into carbon cycle, biogeochemical, biogeophysical, cloud, ice-albedo, and water vapor feedbacks. As important as it is to understand these feedbacks individually, it is even more essential to study the interactive nature of these feedbacks. Modeling studies show that when interactions among feedback loops are included, uncertainty increases dramatically and there is a heightened potential for perturbations to be magnified (e.g., Cox, Betts, Jones, Spall, & Totterdell, 2000; Hajima, Tachiiri, Ito, & Kawamiya, 2014; Knutti & Rugenstein, 2015; Rosenfeld, Sherwood, Wood, & Donner, 2014). This produces a wide range of future scenarios. Positive feedbacks in the carbon cycle involves the enhancement of future carbon contributions to the atmosphere due to some initial increase in atmospheric CO2. This happens because as CO2 accumulates, it reduces the efficiency in which oceans and terrestrial ecosystems sequester carbon, which in return feeds back to exacerbate climate change (Friedlingstein et al., 2001). Warming can also increase the rate at which organic matter decays and carbon is released into the atmosphere, thereby causing more warming (Melillo et al., 2017). Increases in food shortages and lack of water is also of major concern when biogeophysical feedback mechanisms perpetuate drought conditions. The underlying mechanism here is that losses in vegetation increases the surface albedo, which suppresses rainfall, and thus enhances future vegetation loss and more suppression of rainfall—thereby initiating or prolonging a drought (Chamey, Stone, & Quirk, 1975). To top it off, overgrazing depletes the soil, leading to augmented vegetation loss (Anderies, Janssen, & Walker, 2002). Climate change often also increases the risk of forest fires, as a result of higher temperatures and persistent drought conditions. The expectation is that **forest fires will become more frequent** and severe with climate warming and drought (Scholze, Knorr, Arnell, & Prentice, 2006), a trend for which we have already seen evidence (Allen et al., 2010). Tragically, the increased severity and risk of Southern California wildfires recently predicted by climate scientists (Jin et al., 2015), was realized in December 2017, with the largest fire in the history of California (the “Thomas fire” that burned 282,000 acres, https://www.vox.com/2017/12/27/16822180/thomas-fire-california-largest-wildfire). This **catastrophic fire** embodies the sorts of positive feedbacks and interacting factors that **could catch humanity off-guard and produce a** true **apocalyptic event.** Record-breaking rains produced an extraordinary flush of new vegetation, that then dried out as record heat waves and dry conditions took hold, coupled with stronger than normal winds, and ignition. Of course the record-fire released CO2 into the atmosphere, thereby contributing to future warming. Out of all types of feedbacks, water vapor and the ice-albedo feedbacks are the most clearly understood mechanisms. Losses in reflective snow and ice cover drive up surface temperatures, leading to even more melting of snow and ice cover—this is known as the ice-albedo feedback (Curry, Schramm, & Ebert, 1995). As snow and ice continue to melt at a more rapid pace, millions of people may be displaced by flooding risks as a consequence of sea level rise near coastal communities (Biermann & Boas, 2010; Myers, 2002; Nicholls et al., 2011). The water vapor feedback operates when warmer atmospheric conditions strengthen the saturation vapor pressure, which creates a warming effect given water vapor’s strong greenhouse gas properties (Manabe & Wetherald, 1967). Global warming tends to increase cloud formation because warmer temperatures lead to more evaporation of water into the atmosphere, and warmer temperature also allows the atmosphere to hold more water. The key question is whether this increase in clouds associated with global warming will result in a positive feedback loop (more warming) or a negative feedback loop (less warming). For decades, scientists have sought to answer this question and understand the net role clouds play in future climate projections (Schneider et al., 2017). Clouds are complex because they both have a cooling (reflecting incoming solar radiation) and warming (absorbing incoming solar radiation) effect (Lashof, DeAngelo, Saleska, & Harte, 1997). The type of cloud, altitude, and optical properties combine to determine how these countervailing effects balance out. Although still under debate, it appears that in most circumstances the cloud feedback is likely positive (Boucher et al., 2013). For example, models and observations show that increasing greenhouse gas concentrations reduces the low-level cloud fraction in the Northeast Pacific at decadal time scales. This then has a positive feedback effect and enhances climate warming since less solar radiation is reflected by the atmosphere (Clement, Burgman, & Norris, 2009). The key lesson from the long list of potentially positive feedbacks and their interactions is that **runaway climate change,** and runaway perturbations have to be taken as a serious possibility. Table 2 is just a snapshot of the type of feedbacks that have been identified (see Supplementary material for a more thorough explanation of positive feedback loops). However, this list is not exhaustive and the possibility of undiscovered positive feedbacks **portends** even greater **existential risks**. The many environmental crises humankind has previously averted (famine, ozone depletion, London fog, water pollution, etc.) were averted because of political will based on solid scientific understanding. We cannot count on complete scientific understanding when it comes to positive feedback loops and climate change.

#### Counterplan solves the Case - Space Elevators solve Space Debris – reduces Rocket Launches. Also isn’t what their corpearte colonalism aff is talking about

Forgan 19, Duncan H. Solving Fermi's Paradox. Vol. 10. Cambridge University Press, 2019. (Associate Lecturer at the Centre for Exoplanet Science at the University of St Andrews, Scotland, founding member of the UK Search for Extra-terrestrial Intelligence (SETI) research network and leads UK research efforts into the search)//Elmer

All objects in HEO reside beyond the geostationary orbit (GEO). The orbital period at GEO (w'hich is aligned with the Earth's equator) is equal to the Earth’s rotational period. As a result, from a ground observer’s perspective the satellite resides at a fixed point in the sky, with clear advantages for uses such as global communication. Activities at HEO are considerably less than at LEO and MEO. Earth's orbital environment does contain a natural component - the meteoroids. These pose little to no threat to space operations - the true threat is self-derived. The current limitations of spacefaring technology ensure that every launch is accompanied by substantial amounts of space debris. This debris ranges in size from dust grains to paint flecks to large derelict spacecraft and satellites. According to NASA’s Orbital Debris Program Office, some 21.000 objects greater than 10 cm in size are currently being tracked in LEO. with the population below 10 cm substantially higher. Most debris produced at launch tends to be deposited with no supplemental velocity - hence these objects tend to follow the initial launch trajectory, which often orbits with high eccentricity and inclination. However, these orbits do intersect with the orbits of Earth’s artificial satellite population, resulting in impacts w'hich tend to produce further debris. The vast majority of the low-size debris population is so-called fragmentation debris. This is produced during spacecraft deterioration, and in the most abun- dance during spacecraft break-up and impacts. The first satellite-satellite collision occurred in 1961. resulting in a 400% increase in fragmentation debris (Johnson et al.. 2008). Most notably, a substantial source of fragmentation debris was the deliberate destruction of the Fengyun 1C satellite by the People’s Republic of China, which created approximately 2.000 debris fragments. As with collisions of ‘natural debris’, debris-debris collisions tend to result in an increased count of debris fragments. Since the late 1970s, it has been understood that man-made debris could pose an existential risk to space operations. Kessler and Cour-Palais (1978) worked from the then-population of satellites to extrapolate the debris production rate over the next 30 years. Impact rates on spacecraft at any location. /, can be calculated if one knows the local density of debris p, the mean relative velocity vrei\* and the cross-sectional area ct: [[EQUATION 13.5 OMITTED]] Each impact increases p without substantially altering vrel or o. We should there- fore expect the impact rate (and hence the density of objects) to continue growing at an exponential rate: [[EQUATION 13.6 OMITTED]] Kessler and Cour-Palais (1978) predicted that by the year 2000, p would have increased beyond the critical value for generating a collisional cascade. As new collisions occur, these begin to increase ^jjp, which in turn increases resulting in a rapid positive feedback, with p and I reaching such large values that LEO is rendered completely unnavigable. This has not come to pass - LEO remains navigable, partially due to a slight overprediction of debris produced by individual launches. The spectre of a collisional cascade (often referred to as Kessler syndrome) still looms over human space exploration, as debris counts continue to rise. Without a corresponding dedicated effort to reduce these counts, either through mitigating strategies to reduce the production of debris during launches, or through removal of debris fragments from LEO. we cannot guarantee the protection of the current flotilla of satellites, leaving our highly satellite-dependent society at deep risk. What strategies can be deployed to remove space debris? Almost all debris removal techniques rely on using the Earth’s atmosphere as a waste disposal sys- tem. Most debris is sufficiently small that atmospheric entry would result in its complete destruction, with no appreciable polluting effects. Atmospheric entry requires the debris fragments to be decelerated so that their orbits begin to intersect with lower atmospheric altitudes. Once a critical altitude is reached, atmospheric drag is sufficiently strong that the debris undergoes runaway deceleration and ultimately destruction. There are multiple proposed techniques for decelerating debris. Some mechani- cal methods include capturing the debris using either a net or harpoon, and applying a modest level of reverse thrust. These are most effective for larger fragments, and especially intact satellites (Forshaw et al., 2015). Attaching sails to the debris is also a possibility if the orbit is sufficiently low for weak atmospheric drag. The Japanese space agency JAXA’s Kounotori Integrated Tether Experiment (KITE) will trail a long conductive cable. As a current is passed through the cable, and the cable traverses the Earth’s magnetic field, the cable experiences a magnetic drag force that will de-orbit the spacecraft. Orbiting and ground-based lasers can decelerate the debris through a variety of means. For small debris fragments, the radiation pressure produced by the laser can provide drag. A more powerful laser can act on larger debris fragments through ablation. As the laser ablates the debris, the resulting recoil generated by the escaping material produces drag and encourages de-orbit. A more lateral solution is to ensure that launches and general space-based activity no longer generate debris. These approaches advocate lower-energy launch mechanisms that do not rely on powerful combustion. The most famous is the space elevator (see Aravind. 2007). Originally conceived by Tsiolkovsky, the ele- vator consists of an extremely durable cable extended from a point near the Earth’s equator, up to an anchor point located at GEO (most conceptions of the anchor point envision an asteroid parked in GEO). ‘Climber’ cars can then be attached to the cable and lifted to LEO, MEO and even GEO by a variety of propulsion methods. Most notably, the cars can be driven to GEO without the need for chemical rockets or nuclear explosions - indeed, a great deal of energy can be saved by having coupled cars, one ascending and one descending. Space elevators would solve a great number of problems relating to entering (and leaving) Earth orbit, substantially reducing the cost of delivering payload out of the Earth's atmosphere. The technical challenges involved in deploying a cable tens of thousands of kilometres long are enormous, not to mention the material science required to produce a cable of sufficient tensile strength and flexibility in the first place. The gravitational force (and centrifugal force) felt by the cable will vary significantly along its length. As cars climb the cable, the Coriolis force will move the car (and cable) horizontally also, providing further strain on the cable material. The relatively slow traversal of the biologically hazardous Van Allen Belt on the route to GEO is also a potential concern for crewed space travel. Whatever the means, a spacefaring civilisation (or at least, a civilisation that utilises its local orbital environment as we do) must develop a non-polluting solution to space travel, whether that is via the construction of a space elevator, a maglev launch loop, rail gun, or some other form of non-rocket acceleration. If it cannot perform pollution-free spacecraft launches (or fully clean up its pollution), then it will eventually succumb to Kessler syndrome, with potentially drastic consequences for future space use, with likely civilisation-ending effects (Solution C.13).

### Space Samples PIC

#### CP: <Plan with modification for science>

#### CP: The appropriation of outer space by private entities for asteroid material collection for scientific study is just. The appropriation of outer space by private entities for other space mining is unjust.

#### Space samples are appropriated for scientific study—it’s uncontroversial as customary law but the plan bans it

**Pershing 19** (Abigail D., J.D. from Yale Law School. Robina Fellow at the Europcean Court of Human Rights. “Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today,” 44 *Yale Journal of International Law* 149 2019)DR 22

The earliest hint of a change in customary international law relating to the interpretation of the non-appropriation clause came in 1969, when the United States first sent astronauts to the moon. As part of his historic journey, astronaut Neil **Armstrong** collected moonrocks that he brought back with him to Earth and promptly handed off to the National Aeronautics and Space Administration (NASA) as U.S. property.5 4 Later, the USSR similarly claimed lunar material as government property, some of which was eventually sold to private citizens.55

**These** first instances of space resource appropriation did not draw much attention, but they presented a distinct shift marking the beginning of a new period in State practice. Having previously been limited by their technological capabilities, States could now establish new practices with respect to celestial bodies. This was the beginning of a pattern of appropriation that slowly unfolded over the next few decades and has since solidified into the general and consistent State practice necessary to establish the existence of customary international law.

Currently, the U.S. government owns 842 pounds of lunar material.56 There is little question that NASA and the U.S. government consider this material, as well as other space materials collected by American astronauts, to be government property.5 7 In fact, NASA explicitly endorses U.S. property rights over these moon rocks, stating that "[1]unar material retrieved from the Moon during the Apollo Program is U.S. government property."

#### Private extraction key to study of space samples—costs

**OSI ND** (Outer Space Institute, network of world-leading space experts united by their commitment to highly innovative, transdisciplinary research that addresses grand challenges facing the continued use and exploration of space. http://outerspaceinstitute.ca/resources.html. No date but is referencing asteroid probes from 2021.)DR 22

Public-private partnerships are fostering the development of ISRU technology. NASA contracted [four private companies](https://www.nasa.gov/press-release/nasa-selects-companies-to-collect-lunar-resources-for-artemis-demonstrations/) to collect samples of regolith from the Moon’s south pole. Once collected, ownership of the samples will be [transferred to NASA in-situ](https://www.nasa.gov/press-release/nasa-selects-companies-to-collect-lunar-resources-for-artemis-demonstrations) as a move to kick-start space commerce and incentivize further investment in the development of ISRU technology. Additionally, [NASA awarded SpaceX](https://www.nasa.gov/press-release/as-artemis-moves-forward-nasa-picks-spacex-to-land-next-americans-on-moon) a $2.9 billion contract to build a human landing system that will carry astronauts to the lunar surface.

China has also made significant progress on the technological front with the success of their [Chang’e 5 spacecraft,](https://spaceflightnow.com/2021/01/01/chinese-mission-returned-nearly-4-pounds-of-lunar-samples/) which extracted a four-pound sample of lunar regolith and returned it to Earth.

The sample-return missions underway by [NASA](https://www.nasa.gov/osiris-rex) and [JAXA](https://www.hayabusa2.jaxa.jp/en/) serve as technological demonstrations of the possibilities, challenges, and dangers when interacting with asteroids. Other teams planning to do the same in the near future, some of which are commercial actors, will learn greatly from these missions

Mining asteroids could also become a very real prospect decades from now. New sample and return technology, namely the probes deployed by [JAXA](https://www.hayabusa2.jaxa.jp/en/) and [NASA,](https://www.nasa.gov/mission_pages/osiris-rex/about) have extracted material from the asteroids Ryugu and Bennu, respectively, and are returning it to Earth. Meanwhile, commercial launch companies, such as SpaceX, are drastically lowering the cost of launching equipment into space, making it accessible to a wider range of actors.

Despite[the declining investment into asteroid mining start-ups,](https://www.technologyreview.com/2019/06/26/134510/asteroid-mining-bubble-burst-history/) some ambitious companies remain waiting for a future date when it becomes economically feasible. In the meantime, they undertake other space activities, such as operating Earth imaging satellites, to maintain revenue streams.

Mining space resources, such as the Moon and asteroids, could greatly expand humanity’s knowledge about the origins of the solar system, the Earth, the abundance of water, and the origin of life. Ice and water-bearing minerals could be used to produce rocket fuel; fuel that, being sourced in space, will not need to be lifted – at great expense – out of Earth’s heavy gravity. Studying material from asteroids may also prove to be vital in humanity's defence against potential major impactors.

#### Specifically, SpaceX’s Starship enables sample collection at an unprecedented rate.

Heldmann et al 21 “Accelerating Martian and Lunar Science through SpaceX Starship Missions” May 2021 Jennifer L. Heldmann [NASA Ames Research Center, Division of Space Sciences & Astrobiology, Planetary Systems Branch], other authors listed in the article <https://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/623127/5489366/111-381503be1c5764e533d2e1e923e21477_HeldmannJenniferL.pdf> SM

Given the Starship’s anticipated low cost, high payload capacity, and potential for high flight cadence, the opportunities presented for planetary science missions have the potential to dramatically increase our progress towards NASA Planetary Science & Astrobiology goals and objectives. Building upon the NASA CLPS paradigm (Bussey et al. 2019), use of SpaceX Starships will allow for increased flights for science experiments, technology demonstrations, and capability development to enable human spaceflight missions through NASA partnership and purchase of flight payload accommodation. High priority science objectives as outlined in the Decadal Survey and NASA Strategic Plan for the Moon and Mars can uniquely be achieved through flights to lunar/Martian orbit and/or to the surface of these planetary bodies. In addition, Starship has the ability to deploy orbiters on approach. This capability would provide the opportunity to deliver either relatively large orbital assets with sophisticated remote sensing instrumentation and/or many smaller satellites that could serve a variety of purposes, including development of communications or meteorology networks.

Starship is designed to lift off from its planetary destination and return to Earth, thereby allowing not only the return of crew members but also the return of unprecedented quantities of lunar and Martian samples to Earth for scientific analysis. Because Starship can return tens of tons of payload from the surface of the Moon, the return sample mass of lunar samples from a single mission would dwarf the combined total returned mass of all lunar samples from all sample return missions to date. Many samples with greater sample variety will allow for more scientifically robust analytical studies in laboratories on Earth. Removing the need to severely high-grade and down-select samples on the Moon and Mars will also enable opportunistic science from returned samples to degrees previously not achievable. Never before has the science or exploration community had the potential to send such payload capacity to these destinations and return as much sample material as can be accommodated by Starship. The scientific progress achieved would be unprecedented.

#### Asteroid samples key to planetary defense

**Grove and Powell 20** (Phil Groves, producer of the award-winning documentary *Asteroid Hunters*. Corey Powell, reporter for discover magazine “We're Coming for the Asteroids. Are the Asteroids Coming for Us?” [https://www.discovermagazine.com/the-sciences/were-coming-for-the-asteroids-are-the-asteroids-also-coming-for-us November 30](https://www.discovermagazine.com/the-sciences/were-coming-for-the-asteroids-are-the-asteroids-also-coming-for-us%20November%2030), 2020)DR 22

Groves: The way I internalize that sort of thinking is an ounce of prevention is worth a pound of cure. You have a house. You buy a fire extinguisher, and the expense of that fire extinguisher relative to the overall cost of the house is pretty small. The amount of money that you would have to spend to send up a space telescope to look for asteroids so that we can find it before they find us, is pretty small compared to the overall economy of the world. When you go to sleep at night, you lock your front door. The chances of someone invading your house in the middle of the night is pretty minuscule as well, but you do it. This is the same thing, just on a grander scale.

And it doesn't even cost that much! NASA's budget for finding asteroids is probably less than what it costs to make **one** Hollywood asteroid-disaster movie.

Groves: That might be generous, by the way. NASA's budget for planetary defense in this past year is about 150 million bucks. Just about every Marvel movie made out there cost more than that. And this is the only natural disaster you can actually prevent from happening. You can't cork a volcano. You can't throw a net over a hurricane. You can't glue shut a fault line to stop earthquakes. But this we can stop.

What do you find most scientifically exciting about asteroids?

Groves: The coolest fact that I learned along the way [making Asteroid Hunters] is that the asteroid belt is a planet that never came to be because of this big gravitational bully called Jupiter. It jealously prevented a planet from ever taking shape because of its gravitational influences on planetesimals, which is what asteroids are. They're the leftover materials of construction of the planets of the solar system. The big gap between Mars and Jupiter is because of Jupiter's huge influence. It was the first planet to form, and it's the biggest. It kept things stirred up, gravitationally speaking, in that area, so the asteroids were never given a chance to come together and form a planet.

Then over the four-and-a-half billion years, most of the asteroids have either been sent packing outside of the solar system or sent inward, where they become impactors of the Moon and the Earth, not to mention Venus, Mercury, and Mars. Some also fall into the Sun. The asteroid belt today is maybe 1 percent of what it used to be. All of this stuff, it's a big ammo belt, just being flung outward and inward over the course of the eons.

It's an exciting time in **asteroid exploration**, with Hayabusa2 and OSIRIS-REx bringing asteroid samples back to Earth. Any thoughts **on these missions?**

Groves: They'll help us get an understanding of **the construction** of our solar system and maybe even the formation of life itself. A lot of these asteroids carry with them organic compounds. You want to know: Did they bring water to Earth and Mars and perhaps other planets?

What's also interesting about OSIRIS-REx is the asteroid it's investigating, Bennu, is one of these potentially hazardous asteroids I was referencing earlier. It's going to pass close to Earth in 2035. It's not going to hit then, but Earth's gravity could have some influence on its orbit around the Sun. After that, Bennu may become a real risk to our planet, and it's a pretty big asteroid. It’s about 500 meters across, more than 1,500 feet.

The images of Bennu are amazing. It's a diamond-shaped hunk of gravel.

Groves: It's a rubble pile, and **knowing that is an** important aspect of planetary defense. How you would mitigate the threat could depend on your understanding of the asteroid structure. Is it mostly metallic, like a big cannon ball? Or is it a rubble pile, where if you whack it too hard, it'll break apart? Then you'd have a pile of buckshot, which could be just as bad.

#### Core to deflection—poorly planned deflection makes collision more likely

**Andrews 21** (Robin George Andrews is a volcanologist and science writer based in London. His upcoming book Super Volcanoes: What They Reveal about Earth and the Worlds Beyond will be released in November 2021.“NASA’s DART Mission Could Help Cancel an Asteroid Apocalypse” <https://www.scientificamerican.com/article/nasas-dart-mission-could-help-cancel-an-asteroid-apocalypse/> November 18, 2021)DR 22

Mission planners are reasonably confident that DART’s hushed demise will successfully convey a billiardlike kick to Dimorphos, which seems hefty enough to be sufficiently squeezed by gravity’s clutches. But in the case of a slightly less substantial object, a kinetic impactor could just shoot right through, like a bullet through a cake, blowing it into small but still dangerous chunks. A successful deflection for such threats could require multiple, more gentle impacts rather than a one-and-done wallop.

Another huge unknown is Dimorphos’s appearance. It could be shaped like a potato, a dog bone, a rubber duck, [two bowling balls stuck together](https://www.scientificamerican.com/article/new-horizons-may-have-solved-planet-formation-cold-case/), or something else entirely. A colleague recently gifted Adams a donut-shaped fridge magnet, a wink to how often asteroids surprise scientists once unveiled up close by some deep-space robotic emissary. A near-spherical or even potatolike shape would be optimal for a clean hit, whereas the uneven distribution of mass from more **complex morphologies** would raise the chance of a glancing blow, one that could just “spin up the moonlet and not actually change its orbit,” says Olivier de Weck, a systems engineering researcher at the Massachusetts Institute of Technology.

In the specific and benign case of Dimorphos, all these uncertainties are mostly academic. But in the event of a deflection attempt for a true city-killer, they could prove critical. We could, for instance, **successfully deflect** a potentially hazardous asteroid only to inadvertently put it on a new orbit that makes it more likely to hit Earth in the long run. There are points in space around our planet known as gravitational keyholes, wherein Earth’s pull on the asteroid sets the errant space rock on an assuredly destructive journey. “Once you go through a keyhole, the probability of hitting the Earth is virtually 100 percent,” says de Weck. This, to put it mildly, constitutes a major hurdle for any preemptive strikes against nascent impact threats.

FOREWARNED IS FOREARMED

The emerging calculus is formidable indeed: Protecting ourselves from the most numerous and tricky (and thus most dangerous) space rocks requires more than making shots in the dark, especially when each “shot” is a multimillion-dollar deflection attempt. Ensuring **success** requires first scouting out the threat to learn any given space rock’s exact mass and ability to absorb a weighty impact.

Some of that work [can be done from Earth](https://www.scientificamerican.com/article/are-we-doing-enough-to-protect-earth-from-asteroids/), but as Dimorphos is deviously demonstrating, **tiny objects** are hard targets for remote studies. It is far better—albeit more difficult—to get up close and personal with any adversarial asteroid before trying to hit it at all. This was, in fact, ESA’s original plan, before schedule slips ensured that its reconnaissance spacecraft would arrive only after DART’s dramatic impact. In the future, miniaturized kinetic impactors could even be sent alongside scientific scouting missions, meant to merely nudge target asteroids to estimate how they would respond to more powerful deflective blows. “We have to go and characterize them better **before** we rest humanity’s fate in that one golden shot,” de Weck says.

#### Asteroid collisions cause extinction and nuclear miscalc

Baum 19 (Executive director of the Global Catastrophic Risk Institute, “Risk-Risk Tradeoff Analysis of Nuclear Explosives for Asteroid Deflection,” *Risk Analysis*, vol. 39, no. 11 (November 2019), p.2427-2442)DR 22

The most severe asteroid collisions and nuclear wars can cause global environmental effects. The core mechanism is the transport of particulate matter into the stratosphere, where it can spread worldwide and remain aloft for years or decades. Large asteroid collisions create large quantities of dust and large fireballs; the fire heats the dust so that some portion of it rises into the stratosphere. The largest collisions, such as the 10km Chicxulub impactor, can also eject debris from the collision site into space; upon reentry into the atmosphere, the debris heats up enough to spark global fires (Toon, Zahnle, Morrison, Turco, & Covey, 1997). The fires are a major impact in their own right and can send additional smoke into the stratosphere. For nuclear explosions, there is also a fireball and smoke, in this case from the burning of cities or other military targets.

While in the stratosphere, the particulate matter blocks sunlight and destroys ozone (Toon et al., 2007). The ozone loss increases the amount of ultraviolet radiation reaching the surface, causing skin cancer and other harms (Mills, Toon, Turco, Kinnison, & Garcia, 2008). The blocked sunlight causes abrupt cooling of Earth’s surface and in turn reduced precipitation due to a weakened hydrological cycle. The cool, dry, and dark conditions reduce plant growth. Recent studies use modern climate and crop models to examine the effects for a hypothetical India Pakistan nuclear war scenario with 100 weapons (50 per side) each of 15KT yield. The studies find **ag**riculture declines in the range of approximately 2% to 50% depending on the crop and location.11 Another study compares the crop data to existing poverty and malnourishment and estimates that the crop declines could threaten starvation for two billion people (Helfand, 2013). However, the aforementioned studies do not account for new nuclear explosion fire simulations that find approximately five times less particulate matter reaching the stratosphere, and correspondingly weaker global environmental effects (Reisner et al., 2018). Note also that the 100 weapon scenario used in these studies is not the largest potential scenario. Larger nuclear wars and large asteroid collisions could cause greater harm. The largest asteroid collisions could even **reduce sunlight below the minimum needed for vision** (Toon et al., 1997). Asteroid risk analyses have proposed that the global environmental disruption from large collisions could cause one billion deaths (NRC, 2010) or the death of 25% of all humans (Chapman, 2004; Chapman & Morrison, 1994; Morrison, 1992), though these figures have not been rigorously justified (Baum, 2018a).

The harms from asteroid collisions and nuclear wars can also include important secondary effects. The **food shortages** from severe global environmental disruption could lead to infectious disease outbreaks as public health conditions deteriorate (Helfand, 2013). Law and order could be lost in at least some locations as people struggle for survival (Maher & Baum, 2013). Today’s complex global political-economic system already shows fragility to shocks such as the 2007- 2008 financial crisis (Centeno, Nag, Patterson, Shaver, & Windawi, 2015); an asteroid collision or nuclear war could be an extremely large shock. The systemic consequences of a nuclear war would be further worsened by the likely loss of major world cities that serve as important hubs in the global economy. Even a single detonation in nuclear terrorism would have ripple effects across the global political-economic system (similar to, but likely larger than, the response prompted by the terrorist attacks of 11 September 2001).

It is possible for asteroid collisions to cause nuclear war. An asteroid explosion could be misinterpreted as a **nuclear attack**, prompting nuclear attack that is believed to be retaliation. For example, the 2013 Chelyabinsk event occurred near an important Russian military installation, prompting concerns about the event’s interpretation (Harris et al., 2015)

### Uv

#### 1AR theory is skewed towards the aff – a) the 2NR must cover substance and over-cover theory, since they get the collapse and persuasive spin advantage of the 3min 2AR, b) their responses to my counter interp will be new, which means 1AR theory necessitates intervention. Implications – a) reject 1AR theory since it can’t be a legitimate check for abuse, b) drop the arg to minimize the chance the round is decided unfairly, c) use reasonability with a bar of defense or the aff always wins since the 2AR can line by line the whole 2NR without winning real abuse

### Cosmic Colonialism

#### AT Jackson – won’t apply – our Turns are all Space specific – the warrant in this card are about Terrestrial Economies which don’t apply to our Warrants – there also is no spill-down from Space Economies to Terrestrial Economies which means they can’t go for generic Cap Bad.

#### AT Shammas and Holen – 1] It’s so sparsely highlighted, you shouldn’t give it to them as a total scenario story for all of environmental degradation – there is a singular line about “biospheric crisis” and 2] Is about destroying Space’s environment which is a disconnect from Kareiva which is about Earth.

#### AT Shammas and Holen 1 – this is power-tagged – it doesn’t say that it’s reverse causal – those resources are used for Space which doesn’t result in the collapse of non-Space related Industries like Tech or Entertainment.

#### Capitalism is sustainable and solves Warming.

McAfee 19, Andrew. More from Less: The Surprising Story of How We Learned to Prosper Using Fewer Resources—and What Happens Next. Scribner, 2019. Props to DML for finding. (Cofounder and codirector of the MIT Initiative on the Digital Economy at the MIT Sloan School of Management, former professor at Harvard Business School)//Elmer

The decreases in resource use, pollution, and other exploitations of the earth cataloged in the preceding chapters are great news. But are they going to last? It could be that we're just living in a pleasant interlude between the Industrial Era and another rapacious period during which we massively increase our footprint on our planet and eventually cause a giant Malthusian crash. It could be, but I don't think so. Instead, I think we're going to take better care of our planet from now on. I'm confident that the Second Machine Age will mark the time in our history when we started to progressively and permanently tread more lightly on the earth, taking less from it and generally caring for it better, even as we humans continue to become more numerous and prosperous. The work of Paul Romer, who shared the 2018 Nobel Prize in economics, is one of the sources of this confidence. Growth Mindset Romer's largest contribution to economics was to show that **it's best not to think of new technologies as something that companies buy and bring in from the outside, but instead as something they create themselves** (the title of his most famous paper, published in 1990, is "Endogenous Technological Change"). These technologies are like designs or recipes; as Romer put it, they’re "the instructions that we follow for combining raw materials." This is close to the definitions of technology presented in chapter 7. Why do companies invent and improve technologies? Simply, to generate profits. They come up with instructions, recipes, and blueprints that will let them grow revenues or shrink costs. As we saw repeatedly in chapter 7, capitalism provides ample incentive for this kind of tech progress. So far, all this seems like a pretty standard argument for how the first two horsemen work together. Romer's brilliance was to highlight the importance of two key attributes of the technological ideas companies come up with as they pursue profits. The first is that they're nonrival, meaning that they can be used by more than one person or company at a time, and that they don't get used up. This is obviously not the case for most resources made out of atoms—I can't also use the pound of steel that you've just incorporated into the engine of a car—but it is the case for ideas and instructions. The Pythagorean theorem, a design for a steam engine, and a recipe for delicious chocolate chip cookies aren't ever going to get "used up" no matter how much they're used. The second important aspect of corporate technologies is that they're partially excludable. This means that companies can kind of prevent others from using them. They do this by keeping the technologies secret (such as the exact recipe for Coca-Cola), filing for patents and other intellectual-property protection, and so on. However, none of these measures is perfect (hence the words partially and kind of). Trade secrets leak. Patents expire, and even before they expire, they must describe the invention they're claiming and so let others study it. Partial excludability is a beautiful thing. It provides strong incentives for companies to create useful, profit-enhancing new technologies that they alone can benefit from for a time, yet it also ensures that the **new techs will eventually "spill over**"—that with time they’ll diffuse and get adopted by more and more companies, even if that's not what their originators want. Romer equated tech progress to the production by companies of nonrivalrous, partially excludable ideas and showed that these ideas cause an economy to grow. What's more, he also demonstrated that this **idea-fueled growth** doesn't have to slow down with time. It's **not constrained by** the size of the **labor** force, the amount of natural **resources**, or other such factors. Instead, economic growth is limited only by the idea-generating capacity of the people within a market. Romer called this capacity "human capital" and said at the end of his 1990 paper, "The most interesting positive implication of the model is that an economy with a larger total stock of human capital will experience faster growth." This notion, which has come to be called "increasing returns to scale," is as powerful as it is counterintuitive. Most formal models of economic growth, as well as the informal mental ones most of us walk around with, feature decreasing returns—growth slows down as the overall economy gets bigger. This makes intuitive sense; it just feels like it would be easier to experience 5 percent growth in a $1 billion economy than a $1 trillion one. But Romer showed that as long as that economy continued to add to its human capital—the overall ability of its people to come up with new technologies and put them to use—it could actually grow faster even as it grew bigger. This is because the stock of useful, nonrivalrous, nonexcludable ideas would keep growing. As Romer convincingly showed, economies run and grow on ideas. The Machinery of Prosperity Romer's ideas should leave us optimistic about the planetary benefits of digital tools—hardware, software, and networks—for three main reasons. First, countless examples show us how good these tools are at fulfilling the central role of technology, which is to provide "instructions that we follow for combining raw materials." Since raw materials cost money, profit-maximizing companies are particularly keen to find ways to use fewer of them. So they use digital tools to come up with beer cans that use less aluminum, car engines that use less steel and less gas, mapping software that removes the need for paper atlases, and so on and so on. None of this is done solely for the good of the earth—it's done for the pursuit of profit that's at the heart of capitalism—yet it benefits the planet by, as we've seen, causing us to take less from it. Digital tools are technologies for creating technologies, the most prolific and versatile ones we've ever come up with. They're machines for coming up with ideas. Lots of them. The same piece of computer-aided design software can be used to create a thinner aluminum can or a lighter and more fuel-efficient engine. A drone can be used to scan farmland to see if more irrigation is needed, or to substitute for a helicopter when filming a movie. A smartphone can be used to read the news, listen to music, and pay for things, all without consuming a single extra molecule. In the Second Machine Age, the global stock of digital tools is increasing much more quickly than ever before. It's being used in countless ways by profit-hungry companies to combine raw materials in ways that use fewer of them. In advanced economies such as America's, the cumulative impact of this combination of capitalism and tech progress is clear: **absolute dematerialization** of the economy and society, **and thus a smaller footprint on our planet**. The second way Romer's ideas about technology and growth are showing up at present is via decreased excludability. Pervasive digital tools are making it much easier for good designs and recipes to spread around the world. While this is often not what a company wants—it wants to exclude others from its great cost-saving idea— excludability is not as easy as it used to be. This isn't because of weaker patent protection, but instead because of stronger digital tools. Once one company shows what's possible, others use hardware, software, and networks to catch up to the leader. Even if they can't copy exactly because of intellectual-property restrictions, they can use digital tools to explore other means to the same end. So, many farmers learn to get higher yields while using less water and fertilizer, even though they combine these raw materials in different ways. Steve Jobs would certainly have preferred for Apple to be the only provider of smartphones after it developed the iPhone, but he couldn't maintain the monopoly no matter how many patents and lawsuits he filed. Other companies found ways to combine processors, memory, sensors, a touch screen, and software into phones that satisfied billions of customers around the world. The operating system that powers most non-Apple smartphones is Android, which is both free to use and freely modifiable. Google's parent company, Alphabet, developed and released Android without even trying to make it excludable; the explicit goal was to make it as widely imitable as possible. This is an example of the broad trend across digital industries of giving away valuable technologies for free. The Linux operating system, of which Android is a descendant, is probably the best-known example of free and open-source software, but there are many others. The online software repository GitHub maintains that it's "the largest open source community in the world" and hosts millions of projects. The Arduino community does something similar for electronic hardware, and the Instructables website contains detailed instructions for making equipment ranging from air-particle counters to machine tools, all with no intellectual-property protection. Contributors to efforts such as these have a range of motivations (Alphabet's goals with Android were far from purely altruistic—among other things, the parent of Google wanted to achieve a quantum leap in mobile phone users around the world, who would avail themselves of Google Search and services such as YouTube), but they're all part of the trend of technology without excludability, which is great news for growth. As we saw in chapter 10, smartphone use and access to the Internet are increasing quickly across the planet. This means that people no longer need to be near a decent library or school to gain knowledge and improve their abilities. Globally, people are taking advantage of the skill-building opportunities of new technologies. This is the third reason that the spread of digital tools should make us optimistic about future growth: these tools are helping human capital grow quickly. The free Duolingo app, for example, is now the world's most popular way to learn a second language. Of the nearly 15 billion Wikipedia page views during July of 2018, half were in languages other than English. Google's chief economist, Hal Varian, points out that hundreds of millions of how-to videos are viewed every day on YouTube, saying, "We never had a technology before that could educate such a broad group of people anytime on an as-needed basis for free." Romer's work leaves me hopeful because it shows that it's our ability to build human capital, rather than chop down forests, dig mines, or burn fossil fuels that drives growth and prosperity. His model of how economies grow also reinforces how well capitalism and tech progress work together, which is a central point of this book. The surest way to boost profits is to cut costs, and modern technologies, especially digital ones, offer unlimited ways to combine and recombine materials—to swap, slim, optimize, and evaporate—in cost-reducing ways. **There's no reason to expect that the two horsemen of capitalism and tech progress will stop** riding together anytime soon. Quite the contrary. Romer's insights reveal that they're likely to gallop faster and farther as economies grow. Our Brighter, Lighter Future The world still has billions of desperately poor people, but they won't remain that way. All available evidence strongly suggests that most will become much wealthier in the years and decades ahead. As they earn more and consume more, what will be the impact on the planet? The history and economics of the Industrial Era lead to pessimism on this important question. Resource use increased in lockstep with economic growth throughout the two centuries between James Watt's demonstration of his steam engine and the first Earth Day. Malthus and Jevons seemed to be right, and it was just a question of when, not if, we'd run up against the hard planetary limits to growth. But in America and other rich countries something strange, unexpected, and wonderful happened: we started getting more from less. We decoupled population and economic growth from resource consumption, pollution, and other environmental harms. Malthus's and Jevons's ideas gave way to Romer's, and the world will never be the same. This means that instead of worrying about the world's poor becoming richer, we should instead be helping them upgrade economically as much and as quickly as possible. Not only is it the morally correct thing to do, it's also the smart move for our planet. As today’s poor countries get richer, their institutions will improve and most will eventually go through what Ricardo Hausmann calls "the capitalist makeover of production." This makeover doesn't enslave people, nor does it befoul the earth. As today’s poor get richer, they'll consume more, but they'll also consume much differently from earlier generations. They won't read physical newspapers and magazines. They'll get a great deal of their power from renewables and (one hopes) nuclear because these energy sources will be the cheapest. They’ll live in cities, as we saw in chapter 12; in fact, they already are. They'll be less likely to own cars because a variety of transportation options will be only a few taps away. Most important, they'll come up with ideas that keep the growth going, and that benefit both humanity and the planet we live on. Predicting exactly how technological progress will unfold is much like predicting the weather: feasible in the short term, but impossible over a longer time. Great uncertainty and complexity prevent precise forecasts about, for example, the computing devices we’ll be using thirty years from now or the dominant types of artificial intelligence in 2050 and beyond. But even though we can't predict the weather long term, we can accurately forecast the climate. We know how much warmer and sunnier it will be on average in August than in January, for example, and we know that global average temperatures will rise as we keep adding greenhouse gases to the atmosphere. Similarly, we can predict the "climate" of future technological progress by starting from the knowledge that it will be heavily applied in the areas where it can affect capitalism the most. As we've seen over and over, tech progress supplies opportunities to trim costs (and improve performance) via dematerialization, and capitalism provides the motive to do so. As a result, the Second Enlightenment will continue as we move deeper into the twenty-first century. I'm confident that it will accelerate as digital technologies continue to improve and multiply and global competition continues to increase. We’ll see some of the most striking examples of slim, swap, evaporate, and optimize in exactly the places where the opportunities are biggest. Here are a few broad predictions, spanning humanity's biggest industries. Manufacturing. Complex parts will be made not by the techniques developed during the Industrial Era, but instead by three- dimensional printing. This is already the case for some rocket engines and other extremely expensive items. **As 3-D printing** improves and becomes cheaper, it will spread to automobile engine blocks, manifolds and other complicated arrangements of pipes, airplane struts and wings, and countless other parts. Because 3-D printing **generates virtually no waste** and doesn't require massive molds, it accelerates dematerialization.

### 1NC – Adv1

#### No impact to innovation

#### No Escalation over Satellites:

#### 1] Planning Priorities

Bowen 18 Bleddyn Bowen 2-20-2018 “The Art of Space Deterrence” <https://www.europeanleadershipnetwork.org/commentary/the-art-of-space-deterrence/> (Lecturer in International Relations at the University of Leicester)//Elmer

Space is often an afterthought or a miscellaneous ancillary in the grand strategic views of top-level decision-makers. A president may not care that one satellite may be lost or go dark; it may cause panic and Twitter-based hysteria for the space community, of course. But the terrestrial context and consequences, as well as the political stakes and symbolism of any exchange of hostilities in space matters more. The political and media dimension can magnify or minimise the perceived consequences of losing specific satellites out of all proportion to their actual strategic effect.

#### 2] Military Precedent

Zarybnisky 18, Eric J. Celestial Deterrence: Deterring Aggression in the Global Commons of Space. Naval War College Newport United States, 2018. (Senior Materiel Leader at United States Air Force)//Elmer

PREVENTING AGGRESSION IN SPACE While deterrence and the Cold War are strongly linked in the public’s mind through the nuclear standoff between the United States and the Soviet Union, the fundamentals of deterrence date back millennia and deterrence remains relevant. Thucydides alludes to the concept of deterrence in his telling of the Peloponnesian War when he describes rivals seeking advantages, such as recruiting allies, to dissuade an adversary from starting or expanding a conflict.6F 6 Aggression in space was successfully avoided during the Cold War because both sides viewed an attack on military satellites as highly escalatory, and such an action would likely result in general nuclear war.7F 7 In today’s more nuanced world, attacking satellites, including military satellites, does not necessarily result in nuclear war. For instance, foreign countries have used highpowered lasers against American intelligence-gathering satellites8F 8 and the United States has been reluctant to respond, let alone retaliate with nuclear weapons. This shift in policy is a result of the broader use of gray zone operations, to which countries struggle to respond while limiting escalation. Beginning with the fundamentals of deterrence illuminates how it applies to prevention of aggression in space.

#### Debris and collisions won’t be interpreted as ASAT attacks---attribution works.

Eric J. Zarybnisky 2018, PhD in Operations Research @ MIT, Material Leader @ USAF, 28 March 2018, “Celestial Deterrence: Deterring Aggression in the Global Commons of Space,” https://apps.dtic.mil/dtic/tr/fulltext/u2/1062004.pdf

Unlike nuclear deterrence during the Cold War, deterring aggression in space does not have a fundamental philosophy such as Mutually Assured Destruction, which dictated a specific response to a nuclear attack. Reliance on satellites is neither equal among countries nor static over time. As more countries rely on space assets, policymakers need to understand the impact on deterrence, from both kinetic and non-kinetic engagements, to maintain the utility of the space environment. This paper argues that traditional deterrence theory is effective for kinetic space attacks but not for other types of attacks, namely non-kinetic physical, electromagnetic, and cyber. Underlying this argument is the fact that kinetic attacks can be readily attributed and a small number of countries have kinetic attack capability allowing for credible deterrence, which includes communication of the deterrent threat, without significant risk for miscalculation between countries. Traditional deterrence theory is not effective for other types of attacks including non-kinetic physical attacks (e.g., lasers or high-power microwaves), electromagnetic attacks (e.g., jamming) and cyber attacks, due to the challenges of attribution. Deterring kinetic aggression in space requires policymakers to develop a credible deterrent through exercises, budgetary authority, new international norms, and mechanisms to prevent inadvertent escalation.

#### Space debris isn’t a threat --- current monitoring systems and rules solve.

Dave Mosher 18. Journalist for Business Insider, citing Jesse Gossner, an orbital-mechanics engineer who teaches at the US Air Force's Advanced Space Operations School/ 8-30-2018, "A space junk disaster could cut off human access to space. Here's how." https://www.businessinsider.com/space-junk-kessler-syndrome-chain-reaction-prevention-2018-3

The Kessler syndrome plays center-stage in the movie "Gravity," in which an accidental space collision endangers a crew aboard a large space station. But Gossner said that type of a runaway space-junk catastrophe is unlikely. "Right now I don't think we're close to that," he said. "I'm not saying we couldn't get there, and I'm not saying we don't need to be smart and manage the problem. But I don't see it ever becoming, anytime soon, an unmanageable problem." There is no current system to remove old satellites or sweep up bits of debris in order to prevent a Kessler event. Instead, space debris is monitored from Earth, and new rules require satellites in low-Earth orbit be deorbited after 25 years so they don't wind up adding more space junk. "Our current plan is to manage the problem and not let it get that far," Gossner said. "I don't think that we're even close to needing to actively remove stuff. There's lots of research being done on that, and maybe some day that will happen, but I think that — at this point, and in my humble opinion — an unnecessary expense."

#### Only damaging debris generates political pressure

Schladebach, 13—visiting professor at the University of Göttingen in Air Law (Marcus, “Space Debris as a Legal Challenge,” Max Planck Yearbook of United Nations Law Online, Volume 17, Issue 1, 61-85, dml)

A number of stakeholders claim that the removal of inactive satellites or other Space debris would be too expensive.47 According to satellite producers, the production, transport to an orbit in Outer Space and use of a satellite are so cost-intensive that further investments cannot feasibly be borne without severely restricting them. Another reason for the lack of regulation concerning Space debris lies in the fact that political pressure surrounding the problem is still quite weak.48

In many cases, mankind only becomes active when greater damage has occurred. Despite the older and younger incidents mentioned above, damage on a catastrophic level, to such an extent that one could speak of an overwhelming and immediate necessity to regulate, is yet to happen. Although there would be a real chance to avoid damages with foresighted regulation, the law will unfortunately remain in a reactive role. Whether these aspects justify the inactivity of the state community seems doubtful. States are entitled to give their opinion whether they are ready for further investments and to evaluate the question of how intensive the danger of damage is. However, it should be obvious for the state community that the territorial integrity and individual security of states face considerable damage if the state community continues to remain inactive.