### 1

#### Interp: Affirmatives must be directly topical.

#### Violation: They defend the resolution through their effects—they don’t defend the banning of outer space appropriation by private entities.

#### Standards:

#### Limits—their model of debate allows for the aff to not defend the resolution as an advocacy meaning there’s infinite affirmative advocacies that don’t affirm the resolution but whose solvency is the resolution making negs prep burden explode and killing predictability. kills fairness since the aff can functionally do whatever they want as long as they have some link to the potential of their solvency being the resolution while the neg has to adapt and education since literally… no… neg… prep… applies. Their abuse is exacerbated by the lack of a solvency advocate.

#### Strat Skew – Allows you to moot key neg ground by going past the res, your aff functionally defends public entities as well

#### Voter:

#### 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.

#### Drop the debater – if we prove that the aff isn’t topical, there’s no aff to evaluate making DTA the same as DTD

#### Use competing interps – reasonability invites arbitrary judge intervention

#### No RVI’s – you don’t win for proving your topical, that’s a burden that you must meet and you shouldn’t win for being fair – it’s a litmus test for engaging in substance

### 2

#### The US commercial space industry is booming – private space companies are driving innovation

**Lindzon 2/23** [(Jared Lindzon, A FREELANCE JOURNALIST AND PUBLIC SPEAKER BORN, RAISED AND BASED IN TORONTO, CANADA. LINDZON'S WRITING FOCUSES ON THE FUTURE OF WORK AND TALENT AS IT RELATES TO TECHNOLOGICAL INNOVATION) "How Jeff Bezos and Elon Musk are ushering in a new era of space startups," Fast Company, 2/23/21, https://www.fastcompany.com/90606811/jeff-bezos-blue-origin-elon-musk-spaces-space] TDI

In early February, Jeff Bezos, the founder of Amazon and one of the planet’s wealthiest entrepreneurs, dropped the bombshell announcement that he would be stepping down as CEO to free up more time for his other passions. Though Bezos listed a few targets for his creativity and energy—The Washington Post and philanthropy through the Bezos Earth Fund and Bezos Day One Fund—one of the highest-potential areas is his renewed commitment and focus on his suborbital spaceflight project, Blue Origin.

Before space became a frontier for innovation and development for privately held companies, opportunities were limited to nation states and the private defense contractors who supported them. In recent years, however, billionaires such as Bezos, Elon Musk, and Richard Branson have lowered the barrier to entry. Since the launch of its first rocket, Falcon 1, in September of 2008, Musk’s commercial space transportation company SpaceX has gradually but significantly reduced the cost and complexity of innovation beyond the Earth’s atmosphere. With Bezos’s announcement, many in the space sector are excited by the prospect of those barriers being lowered even further, creating a new wave of innovation in its wake.

“What I want to achieve with Blue Origin is to build the heavy-lifting infrastructure that allows for the kind of dynamic, entrepreneurial explosion of thousands of companies in space that I have witnessed over the last 21 years on the internet,” Bezos said during the Vanity Fair New Establishment Summit in 2016.

During the event, Bezos explained how the creation of Amazon was only possible thanks to the billions of dollars spent on critical infrastructure—such as the postal service, electronic payment systems, and the internet itself—in the decades prior.

“On the internet today, two kids in their dorm room can reinvent an industry, because the heavy-lifting infrastructure is in place for that,” he continued. “Two kids in their dorm room can’t do anything interesting in space. . . . I’m using my Amazon winnings to do a new piece of heavy-lifting infrastructure, which is low-cost access to space.”

In the less than 20 years since the launch of SpaceX’s first rocket, space has gone from a domain reserved for nation states and the world’s wealthiest individuals to everyday innovators and entrepreneurs. Today, building a space startup isn’t rocket science.

THE NEXT FRONTIER FOR ENTREPRENEURSHIP

According to the latest Space Investment Quarterly report published by Space Capital, the fourth quarter of 2020 saw a record $5.7 billion invested into 80 space-related companies, bringing the year’s total capital investments in space innovation to more than $25 billion. Overall, more than $177 billion of equity investments have been made in 1,343 individual companies in the space economy over the past 10 years.

“It’s kind of crazy how quickly things have picked up; 10 years ago when SpaceX launched their first customer they removed the barriers to entry, and we’ve seen all this innovation and capital flood in,” says Chad Anderson, the managing partner of Space Capital. “We’re on an exponential curve here. Every week that goes by we’re picking up the pace.”

#### The plan creates a restriction that encourages companies to move their operations to states with lower standards

Albert 14 [(Caley Albert, J.D. Loyola Marymount University) “Liability in International Law and the Ramifications on Commercial Space Launches and Space Tourism,” Loyola of Los Angeles International and Comparative Law Review, 11/1/14, <https://digitalcommons.lmu.edu/cgi/viewcontent.cgi?article=1708&context=ilr>] TDI

A parallel can be drawn here between the commercial space industry and the maritime law concept of the Flag of Convenience. The term has evolved over time, but in this day and age, it is commonly used to mean the owner of a vessel does not want to create an obligation with a country with stricter standards for registry; hence, the owner will register strictly for economic reasons with a country that has a more convenient registry.133 By flying a Flag of Convenience, ship owners are able to avoid taxation on earnings of ships registered under these flags, and in some cases, they can also receive relief from stricter crew standards and corresponding operating costs.134 A Flag of Convenience is flown by a vessel that is registered in one state, which the vessel has little if any connection to, when in reality the vessel is owned and operated from another state.135 This way the vessel avoids any unfavorable economic requirements from its true home state.136 In this sense, “flag shopping” is similar to “launch forum shopping,” similar in that Flags of Convenience are utilized for economic reasons, such as to avoid high taxes and compliance with certain restrictive international conventions, commercial space companies will forum shop when choosing which country to launch from. As of today, there has yet to be a catastrophic commercial launch incident, so for now commercial space companies do not have an incentive to forum shop, but if there is, the indemnification policies described above may lead companies to seek out countries that provide more coverage so they pay less in the event something goes wrong. This comparison to Flags of Convenience brings up two separate yet equally important issues. First, launch companies may try to follow the Flags of Convenience model and soon catch on to the wisdom of their maritime predecessors by “registering” in countries with more favorable conditions. Of course, in this case the concern is not with registration so much as launching. If launch companies follow the Flags of Convenience model, they will seek out the most convenient state for launch, most likely the state that provides the most liability coverage and has the least safety precautions. Launching from states with low safety standards increases the potential for catastrophic launch events. This, in turn, will place states that are potentially incapable of paying for damages from launch disasters in a position they would not normally assume if these commercial companies had not been drawn to their shores with the promise of more favorable regulations. Second, launch customers may also seek out companies located in states with lower cost liability regimes (lower insurance policy limits) since those companies will presumably charge less to launch their payloads. In this scenario, instead of the launch companies seeking out states with lower liability caps and softer regulations, the launch customers themselves will seek companies located in states with lowcost liability regimes. Here, the effect will be the same as above. Under the Liability Convention, the launching state will be liable for any damage caused by a vehicle launched from within its borders; hence, if customers start engaging in “launch forum shopping,” states will be incentivized to put in place low-cost liability regimes, which in turn will increase the states’ potential payout in the event of a catastrophic launch incident. Looking at the indemnification program the United States has in place in comparison to other countries, it is possible to see how either launch companies or launch customers could engage in “launch forum shopping” when a catastrophic launch incident ever occur. It is also important to keep in mind that various factors go into where a company or customer decides to launch from. A state’s indemnification program is just one factor in this decision. With this in mind, it is clear that if a launch incident did occur in the United States, the commercial launch company would be liable for much more than it would in another country. For instance, why would a commercial space company launch in the United States, where it would be liable up to $500 million and the additional costs that the government would not cover? The argument can be made that a catastrophic space incident has yet to occur, and even if it did, it is unlikely to cost above the $2.7 billion covered by the United States government. Other states like Russia or France, which has the two-tier liability system, would simply cover all claims above the initial insurance, which is much lower than the $500 million mark required by the United States. In that case, the commercial company would never have to pay more than the initial liability insurance. If there ever is a catastrophic commercial space incident in the future, it is easy to see why commercial companies or launch customers might be drawn to “launch forum shop” outside the United States.

#### Maintaining US space dominance requires a homegrown commercial space industry – private companies offshoring gives China the advantage they need

**Cahan and Sadat 1/6** [(Bruce Cahan, J.D) (Dr. Mir Sadat, ) "US Space Policies for the New Space Age: Competing on the Final Economic Frontier," based on Proceedings from State of the Space Industrial Base 2020 Sponsored by United States Space Force, Defense Innovation Unit, United States Air Force Research Laboratory, 1/6/21, https://www.politico.com/f/?id=00000177-9349-d713-a777-d7cfce4b0000] TDI

Today, China’s commercial space sector is in its infancy but is set to grow with continued national and provincial support, which have been rapidly increasing over the past three years.64 Since 2004, the United States and China accounted for 74% of the $135.2 billion venture capital (VC) invested in commercial space. 65 The early 2020s are pivotal, as it would be far cheaper for China and Chinese commercial space firms to acquire space technologies from the United States or allied nation companies seeking revenues or facing cashflow constraints, than to build the companies and their teams and technologies from scratch in China. The tight coupling of Chinese military goals and an economy organized to achieve those goals magnifies the economic threats and market disruptions that the United States must immediately address, in order for DoD and national security operations to rely on US commercial space capabilities.

3. ISSUES AND CHALLENGES

Peaceful Uses of Space and Space Exploration Space has been primarily a shared, not a warfighting, domain.67 With each passing second of Planck time,68 space enables a modern way of life, provides instantaneous global imagery, assures telecommunications, and captures humanity’s imagination for civil space exploration. As a result, space is a burgeoning marketplace and territory for commercial ventures and investors. Strengthening the US commercial space industrial base is vital to and beyond US national security. Civil space activities are a source of US “soft power” in global commerce, cooperation, and investment. 69 The civil space sector, led by NASA, is fundamental to America’s national security. 70 NASA is on an ambitious critical path to return to the Moon by 2024,71 along with developing the capabilities and infrastructure for a sustained lunar presence. NASA’s lunar plans provide a lunar staging area for missions to Mars and beyond. They offer a strategic and economic presence for the United States on the Moon. Congress, the White House, DoD, and NASA must recognize that economic and strategic dominance in service of national security requires catalyzing and accelerating growth of a vibrant, private US industrial and cultural expansion into the Solar System. Human visitation and eventual settlement beyond the Earth require sustaining visionary leaders, aided by, and aiding, US national security. A recurring theme in US policy is “maintaining and advancing United States dominance and strategic leadership in space” because US global competitors and adversaries are competent and capable of outpacing American space capabilities. 72 The stakes are high: At this historic moment, there is a real race for dominance over cislunar access and resources.   
Regulations Should Foster US Commercial Space as a National Asset   
Leveraging the reimagination and disruption of terrestrial industries, the US commercial space industry is pushing the frontiers of the United States and global space economics and capabilities. A pre-COVID19 assessment by the US Chamber of Commerce projected that the US space market will increase from approximately $385 billion in 2020, to at least $1.5 trillion by 2040. 73 This projection represents a seven percent (7%) annual compound average growth rate (CAGR), driven largely by expanded business opportunities in Low Earth Orbit (LEO). Total addressable market (TAM) for US commercial space companies could be far larger were they to have federal and financial support for initiating cislunar space operations and opportunities. Recent advancements in commercial space technologies and business models have driven down costs and unlocked new areas of economic growth and space capabilities that outpace and de-risk acquiring capabilities through traditional US government economic development, research and development (R&D), procurement and regulatory policies and processes. US regulations must ensure that US companies lead in commercial space. In specific, technological advances that lower access costs and expand space mission capabilities, content, continuity, and redundancies must be fully supported by or incorporated into US government programs, budgets, requirements, and acquisition processes. Until commercial space offerings are fully incorporated, and federal acquisition policies and personnel commit to innovation, US government fiscal buying power, intelligence and program support will lag and remain inadequate in comparison to US private sector companies and the nation’s global competitors and adversaries in space.

Addressing COVID-19’s Impact on US Commercial Space The COVID-19 pandemic damaged and still challenges the US space industrial base. US domestic investors’ funding of space R&D remains inconsistent across the lifecycle of New Space companies and the spectrum of technologies necessary to grow the space economy. To date, public R&D, government procurements and visionary space entrepreneurs have played a major role in establishing and funding the New Space industrial base. In the last five years, $11 billion of private capital has been invested.74 Traditional private investors may become reluctant to fund space technologies due to perceptions of higher risk over longer time horizons before receiving profitable returns on their capital. Institutional and long-horizon investors who manage patient capital have an appetite for illiquid, but higher yielding, terrestrial alternative asset investments such as commodities, private equity limited partnerships and real estate.75 The COVID-19 pandemic has created economic uncertainties making the New Space’s funding model unreliable. COVID-19 significantly impacted venture capital (VC)-backed companies: the pace of VC space investments fell 85% between April - June, as compared to January – March, in 2020. 76 Pre-COVID-19, the New Space industrial base confronted multiple challenges in raising later stages of venture capital such as (1) the lag between having an early-stage startup with an idea and commercializing a viable revenue-generating product, (2) the lack of market liquidity for founder and private equity space investments to attract and retain talented teams, and (3) the lack of a market to re-sell contracts for space goods and services when customers buy more capacity than needed. Even prior to the COVID-19 pandemic, federal financing of US R&D was at a historically minor level, as compared to businesses and universities.77 US government support for basic research has steadily declined as a percent of GDP. The federal government will experience near- to medium-term budget constraints.78 The vibrant venture community in the United States has taken up a portion of this slack by increasing R&D investment in later-stage and applied research. However, founding teams and VC financing rely on government to fund earlier R&D for basic science and engineering. Therefore, government must resume the sustainable and impactful past levels of support for basic research, an essential role in the space economy’s public-private partnership that ensures US leadership in space.

Space as Existential Terrain for National Security  
  
In this Digital Era, space integrates and drives all elements of US national security. The Cold War may be over, but since the early 2010s, a renewed era of great power competition has emerged across terrestrial land, air, sea, and cyber domains. This competition extends into space, where a great game ensues.79 Space is no longer an uncontested or sanctuary domain. Competent and capable global competitors and peer adversaries are challenging US military, commercial, and civil space interests. The United States, along with its allies and partners, has had to accept and anticipate that space may be a warfighting domain, as suggested primarily by Russian and Chinese counter-space capabilities, military operations, and declarative statements. On December 20, 2019, the bipartisan National Defense Authorization Act (NDAA) for Fiscal Year 202080 authorized the creation of the US Space Force, under the Department of the Air Force, to secure US national interests in an increasingly contested domain.81 Back in October 1775, the Continental Congress established the US Navy to ensure that commercial and government fleets could freely navigate the Atlantic coastline - today, that includes the South China Sea. Likewise, the USSF’s mission is to ensure unfettered access to and the freedom to operate in space. The 2017 National Security Strategy considers space to be a “priority domain.”82 Freedom of navigation is a sovereign right that nations have fought to achieve and defend. 83 The USSF’s main role is to organize, train and equip, as well as to protecting US space interests and supporting terrestrial and joint warfighters (e.g., US Space Command). Thus, USSF must secure US national interests in space, whether military, commercial, scientific, civil, or enhancing US competitiveness for cislunar leadership.

#### US space dominance prevents global war

**Zubrin 15** [(Robert Zubrin, president of Pioneer Energy, a senior fellow with the Center for Security Policy) “US Space Supremacy is Now Critical,” Space News, 1/22/15, <https://spacenews.com/op-ed-u-s-space-supremacy-now-critical/>] TDI

The United States needs a new national security policy. For the first time in more than 60 years, we face the real possibility of a large-scale conventional war, and we are woefully unprepared. Eastern and Central Europe is now so weakly defended as to virtually invite invasion. The United States is not about to go to nuclear war to defend any foreign country. So deterrence is dead, and, with the German army cut from 12 divisions to three, the British gone from the continent, and American forces down to a 30,000-troop tankless remnant, the only serious and committed ground force that stands between Russia and the Rhine is the Polish army. It’s not enough. Meanwhile, in Asia, the powerful growth of the Chinese economy promises that nation eventual overwhelming numerical force superiority in the region. How can we restore the balance, creating a sufficiently powerful conventional force to deter aggression? It won’t be by matching potential adversaries tank for tank, division for division, replacement for replacement. Rather, the United States must seek to totally outgun them by obtaining a radical technological advantage. This can be done by achieving space supremacy.To grasp the importance of space power, some historical perspective is required. Wars are fought for control of territory. Yet for thousands of years, victory on land has frequently been determined by dominance at sea. In the 20th century, victory on both land and sea almost invariably went to the power that controlled the air. In the 21st century, victory on land, sea or in the air will go to the power that controls space. The critical military importance of space has been obscured by the fact that in the period since the United States has had space assets, all of our wars have been fought against minor powers that we could have defeated without them. Desert Storm has been called the first space war, because the allied forces made extensive use of GPS navigation satellites. However, if they had no such technology at their disposal, the end result would have been just the same. This has given some the impression that space forces are just a frill to real military power — a useful and convenient frill perhaps, but a frill nevertheless. But consider how history might have changed had the Axis of World War II possessed reconnaissance satellites — merely one of many of today’s space-based assets — without the Allies having a matching capability. In that case, the Battle of the Atlantic would have gone to the U-boats, as they would have had infallible intelligence on the location of every convoy. Cut off from oil and other supplies, Britain would have fallen. On the Eastern front, every Soviet tank concentration would have been spotted in advance and wiped out by German air power, as would any surviving British ships or tanks in the Mediterranean and North Africa. In the Pacific, the battle of Midway would have gone very much the other way, as the Japanese would not have wasted their first deadly airstrike on the unsinkable island, but sunk the American carriers instead. With these gone, the remaining cruisers and destroyers in Adm. Frank Jack Fletcher’s fleet would have lacked air cover, and every one of them would have been hunted down and sunk by unopposed and omniscient Japanese air power. With the same certain fate awaiting any American ships that dared venture forth from the West Coast, Hawaii, Australia and New Zealand would then have fallen, and eventually China and India as well. With a monopoly of just one element of space power, the Axis would have won the war. But modern space power involves far more than just reconnaissance satellites. The use of space-based GPS can endow munitions with 100 times greater accuracy, while space-based communications provide an unmatched capability of command and control of forces. Knock out the enemy’s reconnaissance satellites and he is effectively blind. Knock out his comsats and he is deaf. Knock out his navsats and he loses his aim. In any serious future conventional conflict, even between opponents as mismatched as Japan was against the United States — or Poland (with 1,000 tanks) is currently against Russia (with 12,000) — it is space power that will prove decisive. Not only Europe, but the defense of the entire free world hangs upon this matter. For the past 70 years, U.S. Navy carrier task forces have controlled the world’s oceans, first making and then keeping the Pax Americana, which has done so much to secure and advance the human condition over the postwar period. But should there ever be another major conflict, an adversary possessing the ability to locate and target those carriers from space would be able to wipe them out with the push of a button. For this reason, it is imperative that the United States possess space capabilities that are so robust as to not only assure our own ability to operate in and through space, but also be able to comprehensively deny it to others. Space superiority means having better space assets than an opponent. Space supremacy means being able to assert a complete monopoly of such capabilities. The latter is what we must have. If the United States can gain space supremacy, then the capability of any American ally can be multiplied by orders of magnitude, and with the support of the similarly multiplied striking power of our own land- and sea-based air and missile forces be made so formidable as to render any conventional attack unthinkable. On the other hand, should we fail to do so, we will remain so vulnerable as to increasingly invite aggression by ever-more-emboldened revanchist powers. This battle for space supremacy is one we can win. Neither Russia nor China, nor any other potential adversary, can match us in this area if we put our minds to it. We can and must develop ever-more-advanced satellite systems, anti-satellite systems and truly robust space launch and logistics capabilities. Then the next time an aggressor commits an act of war against the United States or a country we are pledged to defend, instead of impotently threatening to limit his tourist visas, we can respond by taking out his satellites, effectively informing him in advance the certainty of defeat should he persist. If we desire peace on Earth, we need to prepare for war in space.

## Case

### Debris

#### Alt cause – broad space privatization and existing debris.

Muelhapt et al 19 [(Theodore J., Center for Orbital and Reentry Debris Studies, Center for Space Policy and Strategy, The Aerospace Corporation, 30 year Space Systems Analyst and Operator, Marlon E. Sorge, Jamie Morin, Robert S. Wilson), “Space traffic management in the new space era,” Journal of Space Safety Engineering, 6/18/19, https://doi.org/10.1016/j.jsse.2019.05.007] TDI

The last decade has seen rapid growth and change in the space industry, and an explosion of commercial and private activity. Terms like NewSpace or democratized space are often used to describe this global trend to develop faster and cheaper access to space, distinct from more traditional government-driven activities focused on security, political, or scientific activities. The easier access to space has opened participation to many more participants than was historically possible. This new activity could profoundly worsen the space debris environment, particularly in low Earth orbit (LEO), but there are also signs of progress and the outlook is encouraging. Many NewSpace operators are actively working to mitigate their impact. Nevertheless, NewSpace represents a significant break with past experience and business as usual will not work in this changed environment. New standards, space policy, and licensing approaches are powerful levers that can shape the future of operations and the debris environment.

2. Characterizing NewSpace: a step change in the space environment

In just the last few years, commercial companies have proposed, funded, and in a few cases begun deployment of very large constellations of small to medium-sized satellites. These constellations will add much more complexity to space operations. Table 1 shows some of the constellations that have been announced for launch in the next decade. Two dozen companies, when taken together, have proposed placing well over ~~20,000~~ [twenty thousand] satellites in orbit in the next ~~10~~ [10]years. For perspective, fewer than ~~8100~~[eight thousand one hundred] payloads have been placed in Earth orbit in the entire history of the space age, only 4800 [1] remain in orbit and approximately 1950 [2] of those are still active. And it isn't simply numbers – the mass in orbit will increase substantially, and long-term debris generation is strongly correlated with mass.

[Table 1 Omitted]

This table is in constant flux. It is based largely on U.S. filings with the Federal Communications Commission (FCC) and various press releases, but many of the companies here have already altered or abandoned their original plans, and new systems are no doubt in work. Although many of these large constellations may never be launched as listed, the traffic created if just half are successful would be more than double the number of payloads launched in the last 60 years and more than 6 times the number of currently active satellites.

Current space safety, space surveillance, collision avoidance (COLA) and debris mitigation processes have been designed for and have evolved with the current population profile, launch rates and density of LEO space.

By almost any metric used to measure activity in space, whether it is payloads in orbit, the size of constellations, the rate of launches, the economic stakes, the potential for debris creation, the number of conjunctions, NewSpace represents a fundamental change.

3. Compounding effects of better SSA, more satellites, and new operational concepts

The changes in the space environment can be seen on this figurative map of low Earth orbit. Fig. 1 shows the LEO environment as a function of altitude. The number of objects found in each 10 km “bin” is plotted on the horizontal axis, while the altitude is plotted vertically. Objects in elliptical orbits are distributed between bins as partial objects proportional to the time spent in each bin. Some notable resident systems are indicated in blue text on the right to provide an altitude reference. The (dotted) red line shows the number of objects in the current catalog tracked by the U.S. Space Surveillance Network (SSN). All the COLA alerts and actions that must be taken by the residents are due to their neighbors in the nearby bins, so the currently visible risk is proportional to the red line.



The red line of the current catalog does not represent the complete risk; it indicates the risk we can track and perhaps avoid. A rule of thumb is that the current SSN LEO catalog contains objects about 10 cm or larger. It is generally accepted that an impact in LEO with an object 1 cm or larger will cause damage likely to be fatal to a satellite's mission. Therefore, there is a large latent risk from unobserved debris. While we cannot currently track and catalog much smaller than 10 cm, experiments have been performed to detect and sample much smaller objects and statistically model the population at this size [3]. The (solid) blue line represents the model of the 1 cm and larger debris that is likely mission-ending, usually called lethal but not trackable. If LEO operators avoid collisions with all the objects in the red line, they are nonetheless inherently accepting the risk from the blue line. This risk is already present.

The (dashed) orange line is an estimate of the population at 5 cm and larger and is thus an estimate of what the catalog might conservatively be a few years after the Space Fence, a new radar system being built by the Air Force, comes on line (currently planned for 2019) [4]. Commercial companies offering space surveillance services, such as LeoLabs, ExoAnalytics, Analytic Graphics Inc., Lockheed, and Boeing, might also add to the number of objects currently tracked. Space Policy Directive 3 (SPD-3) [13] specifically seeks to expand the use of commercial SSA services.

Existing operators can expect a sharp increase in the number of warnings and alerts they will receive because of the increase in the cataloged population. Almost all the increase will come from newly detected debris [5].

The pace of safety operations for each satellite on orbit will significantly change because of the increase in the catalog from the Space Fence. This effect is compounded because the NewSpace constellations described in Table 1 will drastically change the profile of satellites in LEO. The green bars in Fig. 1 represent the number of objects that will be added to the catalog (red or orange lines) from only the NewSpace large LEO constellations at their operational altitudes. This does not include the rocket stages that launch them, or satellites in the process of being phased into or removed from the operational orbits. Neighbors of one of these new constellations may face a radically different operations environment than their current practices were designed to address.

Satellites in these large LEO constellations typically have planned operational lifetimes of 5–10 years. Some companies have proposed to dispose of their satellites using low thrust electric propulsion systems, which would spiral satellites down over a period of months or years from operating altitudes as high as 1500 km through lower orbits where the Hubble Space Telescope, the International Space Station, and other critical LEO satellites operate [6]. Similar propulsive techniques would raise replacement satellites from lower launch injection orbits to higher operational orbits. These disposal and replenishment activities will add thousands of satellites each year transiting through lower altitudes and posing a risk to all resident satellites in those lower orbits. More importantly, failures will occur both among transiting satellites and operational constellations, potentially leaving hundreds more stranded along the transit path.

1. **1AC Munoz-Patchen is about squo debris – that should have triggered your impact**
2. **Probability – 0.1% chance of a collision.**

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

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

1. **Time frame – Kessler effect 200 years away**

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

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

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

#### Debris removal projects happening now

Sean Ainley, 20 [Sean Ainley. “Looking to the Stars for the Silver Lining”. 4-8-2020. Astroscale. https://astroscale.com/looking-to-the-stars-for-the-silver-lining/. Accessed 7-25-2021] ab

The spread of COVID-19 has been a troubling welcome to the new decade. However, if there is a potential silver lining to recent events, it may be that this is a timely reminder of how as a species, we are all intrinsically linked. We breathe the same air, share the same ecosystem and inhabit the same fragile planet that is the one and only home to all known living creatures. The degree to which the spread of this virus has shaped our day-to-day lives perhaps highlights that, as humanity, we cannot take tomorrow for granted. A bright future is not a guarantee, but instead must be something that we strive for, by recognising the issues we collectively face, and putting in place the hard work and determination to do what is right for ourselves, those around us, and the generations yet to come. Astroscale was founded on the ideal of working to address an environmental issue which similarly has the potential to affect us all – the accumulation of human-made debris in our orbital environment. As we have become more reliant on satellites for nearly every aspect of our daily lives, the orbits in which these resources reside have become increasingly contaminated and dangerous. In the past, the technologies necessary for removing orbital debris either did not exist, were not adequately supported, or were prohibitively expensive to implement. Although those challenges still remain, the technologies are improving to the level where real and positive progress toward sustainability can be achieved. Furthermore, there is a collective recognition among government legislators and private business leaders that a shift in policy is essential to solve this problem. We are collectively reaching the point where we can, almost literally, reach toward the stars and take the steps necessary to pursue a sustainable tomorrow. Astroscale continues to firmly believe in this vision and has established teams across the globe to address this challenge. Our End-of-Life Services by Astroscale-demonstration (ELSA-d) mission, which is going through final testing in Japan, is on schedule to launch later this year. This will mark a huge first step forward, demonstrating unassisted rendezvous and docking of objects in space. In the UK, the Astroscale team has been working to evolve and further progress the technology from ELSA-d to develop commercially viable solutions to remove failed satellites and other orbital debris. Finally, Astroscale’s US office has been pursuing the solutions necessary to develop a market that can be a path to orbital environmental sustainability. Together, our global Astroscale teams are working collaboratively to solve the technical, policy and business challenges of debris removal, and moving society toward the global goal of responsible use of the orbital environment. Although the next few months will continue to offer uncertainty as we find solutions for this global pandemic, Astroscale believes that great endeavours can be achieved through the vision, hard work, and application of the same spirit that has moved humankind forward over past millennia. Let’s continue to look toward space as a silver lining during challenging times, and resolve to do what is necessary to build a brighter tomorrow, by taking the steps that we can, today.