### Space Debris AC

#### I defend the resolution: the appropriation of outer space by private entities is unjust

#### My framework is utilitarianism – the primary function of a just government is preserving life, without which there are no other values.

#### Contention One: Privatization Increases Space Debris

#### 1. Space debris is a rapidly growing problem – we are at the tipping point as collisions are escalating

Bushnell and Moses, 2019 - chief scientist and rocket scientist at NASA Langley Research Center [Dennis M. and Robert W. “Reliability, Safety, and Performance for Two Aerospace Revolutions - UAS/ODM and Commercial Deep Space,” <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20190025268.pdf>]

Since the late 1950s, we have launched around 6600 satellites, approximately 1130 of which are still operational. However, many of the non-operational satellites are still in space. There have been approximately 240 explosions in space and many collisions, two of which were major events. All of this has contributed to the current space debris issue. The amount of this space debris is daunting. Estimates indicate about 6000 tons, with some 5000 pieces greater than 1 meter in size, 22,000 greater than 10 cm, 700,000 greater than 1 cm, and 150,000,000 bits greater than 1 mm. Even the smaller pieces, given the closure speeds, can create worrisome effects upon impact. As an example, an impact speed of 12 km/sec has approximately 10 times the energy density of dynamite. A quote from a 2011 National Research Council report entitled Limiting Future Collision Risk to Spacecraft, summarizes that year’s outlook, which is becoming ever more serious: “When a handful of reasonable assumptions are used in NASA’s models, scenarios are uncovered that conclude that the current orbital debris environment has already reached a ‘tipping point,’ meaning the amount of debris currently in orbit–in terms of the population of large debris objects, as well as overall mass of debris in orbit–has reached a threshold where it will continually collide with itself, further increasing the population of orbital debris.” The increase in orbital debris will lead to corresponding increases in spacecraft failures, which will only result in more debris in orbit. The increase thus far has been most rapid in LEO, with GEO potentially suffering the same fate, although over a much longer time period. The exact timing and pace of this exponential growth are uncertain, but the serious implications of such a scenario require careful attention because of the strategic and commercial importance of U.S. space operations. In the literature, this cascading of collisions producing ever more debris until the space region is essentially unusable is termed the Kessler Effect. Given the increasing worldwide reliance upon space assets, our positional Earth utilities have made space debris an increasingly serious problem.

#### 2. Private property rights in space increase debris because it undermines environmental protection

Cherian, 2007 - National University of Advanced Legal Studies[Jijo Geroge, with Job Abraham , “Concept of Private Property in Space – An Analysis” Journal of International Commercial Law and Technology Vol. 2, Issue 4 <https://media.neliti.com/media/publications/28805-EN-concept-of-private-property-in-space-an-analysis.pdf>]

One of the primary concerns is the degradation of celestial bodies in exercise of property rights granted to persons. The International community fears whether degradation of celestial bodies would have a negative impact on the environment of the Earth. Man seems to have an inherent trait to alter the ecology of his habitat sometimes knowingly, sometimes unknowingly. Space is one of the very few realms that mankind has not been able to effectively pollute, but even that challenge is being overcome. The issue of space debris is one of such concern. Even in the absence of private players, space debris is now assuming alarming proportions, especially since mankind’s contribution to the increase in space debris is substantial. In the event that there exists a possibility that, the climate of earth maybe negatively affected, a thorough study must be undertaken to swot up the possible repercussions of such degradation. And if property rights are indeed deemed to be fit to be incorporated into space law, the issue of pollution of space environment will need to be addressed on “war footing”.

#### 3. Privatization dramatically increases debris because it exponentially increases launches and undermines government regulations.

Gagnon, 2003 - coordinator of the Global Network Against Weapons & Nuclear Power in Space[Bruce, “Space Privatization: Road to Conflict?”, <http://www.space4peace.org/articles/road_to_conflict.htm>]

Three major issues come immediately to mind concerning space privatization. Space as an environment, space law, and profit in space. We've all probably heard about the growing problem of space junk where over 100,000 bits of debris are now tracked on the radar screens at NORAD in Colorado as they orbit the earth at 18,000 m.p.h. Several space shuttles have been nicked by bits of debris in the past resulting in cracked windshields. The International Space Station (ISS) recently was moved to a higher orbit because space junk was coming dangerously close. Some space writers have predicted that the ISS will one day be destroyed by debris. As we see a flurry of launches by private space corporations the chances of accidents, and thus more debris, becomes a serious reality to consider. Very soon we will reach the point of no return, where space pollution will be so great that an orbiting minefield will have been created that hinders all access to space. The time as certainly come for a global discussion about how we treat the sensitive environment called space before it is too late. When the United Nations concluded the 1979 Moon Treaty the U.S. refused, and still does, to sign it. One key reason is that the treaty outlaws military bases on it but also outlaws any nation, corporation, or individual from making land "claims" on the planetary body. The 1967 U.N. Outer Space Treaty takes similar position in regard to all of the planetary bodies. The U.N., realizing we needed to preempt potential conflict over "ownership" of the planetary bodies, made claim that the heavens were the province of all humankind. As the privateers move into space, in addition to building space hotels and the like, they also want to claim ownership of the planets because they hope to mine the sky. Gold has been discovered on asteroids, helium-3 on the moon, and magnesium, cobalt and uranium on Mars. It was recently reported that the Haliburton Corporation is now working with NASA to develop new drilling capabilities to mine Mars. One organization that seeks to rewrite space law is called United Societies in Space (USIS). They state, "USIS provides legal and policy support for those who intend to go to space. USIS encourages private property rights and investment. Space is the Free Market Frontier." Check their web site at http://www.space-law.org The taxpayers, especially in the U.S. where NASA has been funded with taxpayer dollars since its inception, have paid billions of dollars in space technology research and development (R & D). As the aerospace industry moves toward forcing privatization of space what they are really saying is that the technological base is now at the point where the government can get out of the way and lets private industry begin to make profit and control space. Thus the idea that space is a "free market frontier." Of course this means that after the taxpayer paid all the R & D, private industry now intends to gorge itself in profits. One Republican Congressman from Southern California, an ally of the aerospace industry, has introduced legislation in Congress to make all space profits "tax free". In this vision the taxpayers won't see any return on our "collective investment."

#### 4. Private companies are not held responsible for the debris collisions they cause – they believe that they are immune.

Salin, 2001 – senior researcher at the Center and Institute of Air and Space Law at McGill Univ[Patrick A. “Privatization and militarization in the space business environment”, Space Policy, Vol. 17, Issue 1, [https://www.sciencedirect.com/science/article/abs/pii/S0265964600000503#](https://www.sciencedirect.com/science/article/abs/pii/S0265964600000503)!]

The administrative status of global space operators, whether public or private, has no impact on their final liability (if any), but their actions may (and will) heavily impact on the global international community. Private corporations have a de facto equal status to that of public space agencies. The worrying factor in the development of outer space exploitation is that — so far — there has been little in the way of an effective international responsibility (or liability) for wrongful acts that are committed or that bear consequences in outer space. This is the consequence of the fact that no litigation has ever been pursued on the basis of the 1972 Liability Convention or of the 1967 Outer Space Treaty, neither of which has yet been tested in terms of benefit sharing [[10](http://www.sciencedirect.com.ezproxy.library.unlv.edu/science/article/pii/S0265964600000503" \l "bib10" \t "_blank)]. This means that, for practical purposes, the Liability Convention is unworkable. Large private corporations are on an equal footing with public bodies and behave as if they were enjoying a kind of ‘national’ immunity that is commensurate with the size of their project. A good illustration of that observation was provided in March 1997 with the licensing of Teledesic Corp. by the US Federal Communications Commission (FCC), after intense diplomatic pressure had been exercised by the US delegation during WARC-95.[8](http://www.sciencedirect.com.ezproxy.library.unlv.edu/science/article/pii/S0265964600000503" \l "fn8" \t "_blank) Contrary to its actions over much smaller projects, the FCC did not check any of Teledesic's technical or financial parameters, nor did it even impose an agenda for a project of the magnitude of close to 1000 satellites, according to its original plan, i.e. more than three times the total number of US civilian satellites that were in outer space at that time. Since then, this project has been scaled down two or three times and we are not even sure that it will ever be launched. So far, the fully licensed Teledesic project is nothing more than a huge ‘paper satellite’ system, while the competing SkyBridge project still awaits FCC authorization in order to be operated over North America as part of its global coverage of the Earth. That shows there is always a national state that backs up a satellite operator — public or private — that is active in Outer Space at a global scale. Here we have a paradox consisting in having ‘national’ regulators that license ‘global’ operators, thanks to technology. This paradox fully explains the difficulties that global operators are facing in their relationship with other national authorities [[11](http://www.sciencedirect.com.ezproxy.library.unlv.edu/science/article/pii/S0265964600000503" \l "bib11" \t "_blank)]. This is inevitable as long as there is no such thing as a World Space Organization under which global satellite operators must be registered and to which they must be liable. The ITU does not provide such a commitment because it is only a technical organization; we may say that global satellite systems have no accountability towards the international community and, even worse, behave by taking into account the ITU's own weaknesses. [9](http://www.sciencedirect.com.ezproxy.library.unlv.edu/science/article/pii/S0265964600000503" \l "fn9" \t "_blank) Reforms have been proposed in order to restructure the ITU organization [[12](http://www.sciencedirect.com.ezproxy.library.unlv.edu/science/article/pii/S0265964600000503" \l "bib12" \t "_blank), [13](http://www.sciencedirect.com.ezproxy.library.unlv.edu/science/article/pii/S0265964600000503" \l "bib13" \t "_blank) and [14](http://www.sciencedirect.com.ezproxy.library.unlv.edu/science/article/pii/S0265964600000503" \l "bib14" \t "_blank)]. But others think it is better to keep things as they are, with outer space being exploited almost like a lawless ‘wild outer space’, with minimal supervision, under benevolent home state licensing and passive ITU registration. If this situation remains unchanged, no doubt such private operators will inevitably drag their licensing state to the forefront. Unfortunately, in outer space we won’t talk about oil spills, but we may in the future see satellite explosions, or satellites colliding with one another, or we may simply notice malfunctions causing a satellite to cease functioning properly, sometimes without being able to really identify the cause of the malfunction or of the incident [[15](http://www.sciencedirect.com.ezproxy.library.unlv.edu/science/article/pii/S0265964600000503" \l "bib15" \t "_blank)]. [10](http://www.sciencedirect.com.ezproxy.library.unlv.edu/science/article/pii/S0265964600000503" \l "fn10" \t "_blank) And what about a nuclear accident in outer space?

#### 5. Enforcing outer space as a global commons makes companies accountable to clean up debris.

Munoz-Patchen, 2018, J.D. Candidate at Univ of Chicago [Chelsea, Chicago Journal of International Law 8-16-2018 “Regulating the Space Commons: Treating Space Debris as Abandoned Property in Violation of the Outer Space Treaty,” <https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=1741&context=cjil>]

VI. CONCLUSION Space debris poses a serious threat to the continued use of space. Many have called for a new treaty to solve the perceived failure of the current space treaty regime to address debris clean up and define space debris.174 This Comment has demonstrated that the existing treaties, resolutions, and guidelines create a definition of space debris as nonfunctional objects, separate from space objects. This Comment has also shown that space debris has been abandoned and must be regulated in order to rid the space commons of this negative externality. This Comment has demonstrated that the existing treaty regime can be used to enforce an obligation to clean debris up. This is based on first principles such as free access, included in the original Outer Space Treaty and reflected in other specific treaties and guidelines for outer space activities. This Comment has shown how failing to clean up space debris violates the Outer Space Treaty and has proposed a market-share liability regime under which debris-creating nations fund the cleanup. This Comment has provided an avenue for bringing practice and understanding into accordance with the existing legal regime in international space law. An obligation to clean up is critical for the removal of the debris that already exists in space and, in line with the Debris Mitigation Guidelines, preventing the creation of any new debris. The Outer Space Treaty establishes space as a common resource. In order to preserve this common resource for all, spacefaring nations must be held to regulations that make them internalize the costs created by their debris.175

#### Contention Two: Space Debris is a Catastrophe

#### 1. Orbital Debris triggers miscalculated war – collisions can be mistaken for a preemptive attack.

Dockrill, 2016 - Deputy Editor of ScienceAlert [Peter “Space Junk Accidents Could Trigger Armed Conflict, Study Finds.” ScienceAlert 25 January <https://www.sciencealert.com/space-junk-accidents-could-trigger-armed-conflict-expert-warns>]

The increasingly crowded space in Earth's low orbit could set the stage for an international armed conflict, says a new study. Researchers from the Russian Academy of Sciences warn that accidents stemming from the steady rise in space junk floating around the planet could incite political rows and even warfare, with nations potentially mistaking debris-caused incidents as the results of intentional aggressive acts by others. In a paper published in Acta Astronautica, the team suggests that space debris in the form of spent rocket parts and other fragments of hardware hurtling at high speed pose a "special political danger" that could dangerously escalate tensions between nations. According to the study, destructive impacts caused by random space junk cannot easily be told apart from military attacks. "The owner of the impacted and destroyed satellite can hardly quickly determine the real cause of the accident," the authors write. The risks of such an event occurring are compounded by the sheer volume of debris now orbiting Earth. Recent figures from NASA indicate that there are more than 500,000 pieces of space junk currently being tracked in orbit, travelling at speeds up to 28,160 km/h (17,500 mph). The majority of those objects are small – around the size of a marble – but some 20,000 of them are bigger than a softball. In addition to these 500,000 or so fragments – which are big enough for scientists to know about them – NASA estimates that there are millions of undetectable pieces of debris in orbit that are too small to be monitored. But even extremely small fragments such as these pose a threat – in fact, they're considered a greater risk than trackable debris, as their invisible status means spacecraft and satellites can't do anything to avoid them until it's too late. As NASA observed in 2013: "Even tiny paint flecks can damage a spacecraft when travelling at these velocities. In fact a number of space shuttle windows have been replaced because of damage caused by material that was analysed and shown to be paint flecks… With so much orbital debris, there have been surprisingly few disastrous collisions." While we may have been lucky in the past, we can't rely on that to continue. The study by the Russian team cites the repeated sudden failures of defence satellites in past decades that were never explained. The researchers attribute two possible causes: either unrecorded collisions with space junk, or aggressive actions from adversaries. "This is a politically dangerous dilemma," the authors write.

#### 2. Space debris makes any use of space impossible – it is a threat to all space projects.

Anzaldua and Dunlop 2017 – former State Department diplomat and National Space Society [Al and Dave “Why the US and Russia should work together to clean up orbital debris.” The Space Review <http://www.thespacereview.com/article/3156/1>]

Orbital debris is any human-made and uncontrollable litter left in Earth orbit. It includes inactive satellites, rocket stages, and fragments created by collisions, explosions, and even normal operations. There are over 22,000 Earth-orbiting debris objects larger than a softball (10 centimeters) and around a million shrapnel fragments between 0.5 and 10 centimeters (ESA 2013). With relative impact velocities reaching higher than 55,000 kilometers per hour in low Earth orbit (LEO—between 160 and 2,000 kilometers in altitude—even debris as small as a pea can take out spacecraft (Liou 2014). The deliberate destruction in 2007 of the Chinese Fengyun satellite with an antisatellite weapon and the catastrophic 2009 collision between a defunct Russian Cosmos satellite and an operating Iridium satellite have together more than doubled the number of cataloged debris fragments (National Academy 2011). NASA, analyzing data from six space agencies, estimates that if nothing is done about the growing quantity of debris and increasing number of satellites in Earth orbit, there will be another catastrophic collision every five to nine years and the pace will accelerate (Liou 2014). At least some who have been studying orbital debris for many years believe that we may have already reached a “tipping point” whereby orbital debris in congested LEO altitude bands is colliding in a runaway debris-generating cascade, often called the Kessler syndrome. Although this assertion is controversial, and a debris cascade would take years to unfold, at some point a Kessler cascade would nevertheless make spacecraft operation in affected altitude bands virtually impossible (McKnight 2012). Orbital debris is an ever-growing hazard to the International Space Station (NASA 2015) and the approximately 1,300 operating satellites, which represent only six percent of the 22,000 tracked objects in orbit (Baiocchi 2015). Although about 70 countries operate satellite, the US, China, and Russia have the three largest fleets (Aerospace 2015) and thus have the most at risk. The ISS must maneuver one or more times a year to avoid collisions with debris (NASA 2015). Satellites in certain higher LEO orbits (see figure 1 below) face a much higher threat of collision. Even the satellites in geosynchronous orbit, at an altitude of more than 35,000 kilometers where relative collisional velocities are usually much lower, are nevertheless threatened by multi-ton debris bodies tumbling uncontrollably (Anselmo 2000). The current risk to satellites, which provide commercial services worth over $200 billion annually for television, radio, telephone, search and rescue, weather and climate reporting, navigation, and national defense, varies with debris object number, mass, and potential impact velocity within an altitude and inclination band. Although it is difficult to determine what percentage of satellite failures are due to orbital debris strikes, as opposed to other causes such as meteoroid impacts, the increasing amount of orbital debris is undoubtedly a factor in annual economic losses in the satellite industry. In this regard, claims paid out by insurance companies for on-orbit spacecraft failures in 2013 reached $800 million (OECD 2014). Large structures planned for Earth orbits, such as commercial space stations, tourism hotels, space solar power satellites, and staging and fueling platforms, will be especially vulnerable to orbital debris that will certainly grow from future collisions, even if we put no new spacecraft into Earth orbit.

#### 3. The Kessler Effect – space debris can cause a cascade effect that knocks down All satellites – modern civilization is dependent on satellites in numerous ways.

Dvorsky 2015 - Senior staff reporter at Gizmodo specializing in space exploration [George "What Would Happen If All Our Satellites Were Suddenly Destroyed?" 6/04/15 <https://io9.gizmodo.com/what-would-happen-if-all-our-satellites-were-suddenly-d-1709006681>]

Lastly, there’s the [Kessler Syndrome](http://www.spacesafetymagazine.com/space-debris/kessler-syndrome/) to consider. This scenario was portrayed in the 2013 film Gravity. In the movie, a Russian missile strike on a defunct satellite inadvertently causes a cascading chain reaction that formed an ever-growing cloud of orbiting space debris. Anything in the cloud’s wake — including satellites, space stations, and astronauts — gets annihilated. Disturbingly, the Kessler Syndrome is a very real possibility, and the likelihood of it happening [is steadily increasing as more stuff gets thrown into space](http://io9.com/how-to-clean-up-deadly-space-junk-before-disaster-strik-1443463338). Given these grim prospects, it’s fair to ask what might happen to our civilization if any of these things happened. At the risk of gross understatement, the complete loss of our satellite fleet would instigate a tremendous disruption to our current mode of technological existence — disruptions that would be experienced in the short, medium, and long term, and across multiple [domains](https://io9.gizmodo.com/what-would-happen-if-all-our-satellites-were-suddenly-d-1709006681). Compromised Communications Almost immediately we’d notice a dramatic reduction in our ability to communicate, share information, and conduct transactions. “If our communications satellites are lost, then bandwidth is also lost,” [Jonathan McDowell](http://planet4589.org/) tells io9. He’s an astrophysicists and Chandra Observatory scientist who works out of the [Harvard-Smithsonian Center for Astrophysics](http://planet4589.org/jcm/cfa-www.harvard.edu). McDowell says that, with telecommunication satellites wiped out, the burden of telecommunications would fall upon undersea cables and ground-based communication systems. But while many forms of communication would disappear in an [instant](https://io9.gizmodo.com/what-would-happen-if-all-our-satellites-were-suddenly-d-1709006681), others would remain. All international calls and data traffic would have to be re-routed, placing tremendous pressure on terrestrial and undersea lines. Oversaturation would stretch the capacity of these systems to the limit, preventing many calls from going through. Hundreds of millions of Internet connections would vanish, or be severely overloaded. A similar number of cell phones would be rendered useless. In remote areas, people dependent on satellite for television, Internet, and radio would practically lose all service. “Indeed, a lot of television would suddenly disappear,” says McDowell. “A sizable portion of TV comes from cable whose companies relay programming from satellites to their hubs.” It’s important to note that we actually have a precedent for a dramatic — albeit brief — disruption in com-sat capability. Back in 1998, [there was a day in which a single satellite failed and all the world’s pagers stopped working](http://articles.latimes.com/1998/may/21/news/mn-52190). Get Out Your Paper Maps We would also lose the Global Positioning System. In the years since its inception, GPS has become ubiquitous, and a surprising number of systems have become reliant on it. “Apart from the fact that everyone has forgotten to navigate without GPS in their cars, many airplanes use GPS as well,” says McDowell. Though backup systems exist, airlines use GPS to chart the most fuel-efficient and expeditious routes. Without GPS and telecomm-sats, aircraft controllers would have tremendous difficulty communicating with and routing airplanes. Airlines would have to fall back to legacy systems and procedures. Given the sheer volume of airline traffic today, accidents would be all but guaranteed. Other affected navigation systems would include those aboard cargo vessels, supply-chain management systems, and transportation hubs driven by GPS. But GPS does more than just provide positioning — it also provides for timing. Ground-based atomic clocks can perform the same function, but GPS is increasingly being used to distribute the universal time standard via satellites. Within hours of a terminated service, any distributing networks requiring tight synchronization would start to suffer from “clock drift,” leading to serious performance issues and outright service outages. Such disruptions could affect everything from the power grid through to the financial sector. In the report, “[A Day Without Space: Economic and National Security Ramifications](http://marshall.org/wp-content/uploads/2013/08/Day-without-Space-Oct-16-2008.pdf),” Ed Morris, the Executive Director of the Office of Space Commerce at the Department of Commerce, writes: If you think it is hard to get work done when your internet connection goes out at the office, imagine losing that plus your cell [phone](https://io9.gizmodo.com/what-would-happen-if-all-our-satellites-were-suddenly-d-1709006681), TV, radio, ATM access, [credit cards](https://io9.gizmodo.com/what-would-happen-if-all-our-satellites-were-suddenly-d-1709006681), and possibly even your electricity. [...] Wireless services, especially those built to [CDMA standard](http://www.protocols.com/pbook/cellular.htm), would fail to hand off calls from one cell to the next, leading to dropped connections. Computer networks would experience slowdowns as data is pushed through finite pipelines at reduced bit rates. The same would be true for major networks for communication and entertainment, since they are all IP-based today and require ultra-precise timing to ensure digital traffic reaches its destination. The lack of effective synch would hit especially hard in banking, where the timing of transactions needs to be recorded. Credit card payments and bank accounts would likely freeze, as billions of dollars could be sucked away from businesses. A financial crash is not out of the question. The Loss of Military Capability The sudden loss of satellite capability would have a profound effect on the military. The Marshall Institute puts it this way: “Space is a critical enabler to all U.S. warfare domains,” including intelligence, navigation, communications, weather prediction, and warfare. McDowell describes satellite capability as as the “backbone” of the U.S. military. And as 21st century warfare expert [Peter W. Singer](http://www.pwsinger.com/biography.html) from [New America Foundation](https://www.newamerica.org/) tells io9, “He who controls the heavens will control what happens in the battles of Earth.” Singer summarized the military consequences of losing satellites in an email to us: Today there are some 1,100 active satellites which act as the nervous system of not just our economy, but also our military. Everything from communications to GPS to intelligence all depend on it. Potential foes have noticed, which is why Russia and China have recently begun testing a new generation of anti-satellite weapons, which in turn has sparked the U.S. military to recently budget $5 billion for various space warfare systems. What would happen if we lost access to space? Well, the battles would, as one U.S. military officer put it, take us back to the “pre digital age.” Our drones, our missiles, even our ground units wouldn’t be able to operate the way we plan. It would force a rewrite of all our assumptions of 21st century high tech war. We might have a new generation of stealthy battleships...but the loss of space would mean naval battles would in many ways be like the game of Battleship, where the two sides would struggle to even find each other. Moreover, and as McDowell explains to io9, the loss of satellite capability would have a profound effect on arms control capabilities. Space systems can monitor compliance; without them, we’d be running blind. “The overarching consideration is that you wouldn’t really know what’s going on,” says McDowell. “Satellites provide for both global and local views of what’s happening. We would be less connected, less informed — and with considerably degraded situational awareness.” Compromised Weather Prediction and Climate Science One great thing satellites have done for us is improve our ability to forecast weather. Predicting a slight chance of cloudiness is all well and good, but some areas, like India, Pakistan, and Bangladesh, are dependent on such systems to predict potentially hazardous monsoons. And in the U.S., the NOAA has estimated that, during a typical hurricane season, weather satellites save as much as $3 billion in lives and property damage. There’s also the effect on science to consider. Much of what we know about climate change comes from satellites. As McDowell explains, the first couple of weeks without satellites wouldn’t make much of a difference. But over a ten-year span, the lack of satellites would preclude our ability to understand and monitor such things as the ozone layer, carbon dioxide levels, and the distribution of polar ice. Ground-based and balloon-driven systems would help, but much of the data we’re currently tracking would suddenly become much spottier. “We’re quite dependent on satellites for a global view of what’s happening on our planet — and at a time when we really, really need to know what’s happening,” says McDowell. It’s also worth pointing out that, without satellites, we also wouldn’t be able to monitor space weather, such as incoming space storms. Time to Recover With all the satellites gone, both governmental and private interests would work feverishly to restore space-based capabilities. Depending on the nature of the satellite-destroying event, it could take decades or more to get ourselves back to current operational standards. It would take a particularly long time to recover from a Carrington Event, which would zap many ground-based electronic systems as well. The U.S. military is already thinking along these lines, which is why it’s working on the ability to quickly send up emergency assets, such as small satellites parked in Low Earth Orbit (LEO). Cube satellites are increasingly favored, as an easy-to-launch, affordable, and effective solution — albeit a short-term one. The U.S. Operationally Responsive State Office is currently working on the concept of emergency replenishment and the ability to “rapidly deploy capabilities that are good enough to satisfy warfighter needs across the entire spectrum of operations, from peacetime through conflict.” As for getting full-sized, geostationary satellites back into orbit, that would prove to be a greater challenge. It can take years to built a new satellite, which typically requires a big, costly rocket to get it into space. Lastly, if a Kessler Syndrome wipes out the satellites, that would present an entirely different recovery scenario. According to McDowell, it would take a minimum of 11 years for LEO to clear itself of the debris cloud; any objects below 500 km (310 miles) would eventually fall back to Earth. Thus, we would only be able to start re-seeding LEO in a little over a decade following a Kessler event. Unfortunately, the area above 600 km (372 miles) would remain out of touch for a practically indefinite period of time; objects orbiting at that height tend to stay there for a long, long time. We’d probably lose this band for good — unless we manually removed the debris field, using clean-up satellites or other techniques. It’s worth noting that a single Kessler event could hit the LEO zone or the GEO zone (geosynchronous orbit) but realistically not both; LEO debris could never reach GEO, and vice versa — though a spent rocket in GTO (geosynchronous transfer orbit) or SSTO (supersynchronous transfer orbit) passes through or near both zones and could potentially affect either of them. The spent rockets in GTO do not stay too close to the GEO arc for long due to orbital perturbations, so a GEO Kessler event is very unlikely to be triggered by one of them. Suffice to say, we should probably take the prospect of a Kessler Syndrome more seriously, and be aware of what could happen if we’re no longer able to use these spaces.

#### 4. Even if a Kessler cascade doesn’t occur, debris massively harms our economy.

Tam 2015 - PhD candidate in Business Administration at Walden University [Walter “The Space Debris Environment and Satellite Manufacturing”. <https://pdfs.semanticscholar.org/a90d/20a5a824b639f0688bdbfd0ceb2e2120a37c.pdf>]

A fifth factor relates to business economics. Space debris has the potential to damage operational space assets and reduce the expected value of space systems. The increasing risk to high-value assets, combined with high volatility typical of the satellite insurance market (Manikowski & Weiss, 2012), have implications to higher insurance premiums (P. V. Anderson & Schaub, 2014) that lead to higher operating cost. The higher cost might reduce the competitiveness of the services provided by the satellite system, thus reducing their overall value in the marketplace. Space debris poses the greatest threat to the safe operations of satellites (Gopalaswamy & Kampani, 2014). The threat extends to the global economy, in which satellite technology is a deeply embedded, critical, and fragile component of the global economic infrastructure (Horsham, Schmidt, & Gilland, 2011; Percy & Landrum, 2014). To ensure economic stability and business growth on a global scale, it would be necessary to address the space debris problem in a meaningful way. Solutions to the space debris problem could come from technical, policy, organizational, and regulatory sources (Jakhu, 2010). The implementation of space debris remediation measures needs to start immediately to protect the space environment for future use (P. V. Anderson & Schaub, 2013). Satellite manufacturers could contribute to future economic stability by developing contingency plans that address and mitigate the space debris problem. Taking a business-as-usual or wait-and-see approach could lead to a situation of too little, too late (Eriksson & McConnell, 2011). Adopting a strategy with strategic intent to address the space debris problem could facilitate organizational focus, leverage resources, and secure market leadership positioning (Hamel & Prahalad, 2005).