# **Space AC V1 - Peninsula**

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### **Advantage 1: Orbital Debris**

#### **Private company satellites become defunct trash**

Therese **Wood, 20** - ("Who owns our orbit: Just how many satellites are there in space?," World Economic Forum, 10-23-2020, 12-8-2021, https://www.weforum.org/agenda/2020/10/visualizing-easrth-satellites-sapce-spacex)

There are nearly 6,000 satellites circling the Earth, but only 40%areoperational. Satellites are a vital part of our infrastructure, helping us to use GPS, access the internet and support studies of the Earth. Out of the 2,666 operational satellites circling the globe in April 2020, 1,007 were for communication services. 446 are used for observing the Earth and 97 for navigation/ GPS purposes. Over half of satellites in space are non-operational. For centuries, humans have looked to space and the stars for answers. The fascination is more than philosophical—it’s coupled with the need to solve problems here on Earth. Today, there are seemingly countless benefits and applications of space technology. Satellites, for instance, are becoming critical for everything from internet connectivity and precision agriculture, to border security and archaeological study. Right now, there are nearly 6,000 satellites circling our tiny planet. About 60% of those are defunct satellites—space junk—and roughly 40% are operational. As highlighted in the chart above, The Union of Concerned Scientists (UCS), determined that 2,666 operational satellites circled the globe in April of 2020. Over the coming decade, it’s estimated by Euroconsult that 990 satellites will be launched every year. This means that by 2028, there could be 15,000 satellites in orbit. Nearly 10,000 satellites will be launched form 2019-2028. Image: Visual Capitalist With SpaceX’s planned Starlink constellation of 12,000 satellites and Amazon’s proposed constellation in the works, the new space race continues its acceleration. Let’s take a closer look at who operates those satellites and how they apply their technology. Technology with a purpose Humans have long used space for navigation. While sailors once relied on the stars, today we use satellites for GPS, navigation, and various other applications. More than half of Earth’s operational satellites are launched for commercial purposes. About 61% of those provide communications, including everything from satellite TV and Internet of Things (IoT) connectivity to global internet. Over 1,000 satellites are for communication purposes. Image: Visual Capitalist Second to communications, 27% of commercial satellites have been launched for Earth Observation (EO) purposes, including environmental monitoring and border security. Commercial satellites, however, can serve multiple purposes. One week, a satellite may be ‘tasked’ to image a contested border. It could later be tasked to monitor the reclamation of a mining site or even the aftermath of a natural disaster. 54% of operational satellites are for commercial use. Image: Visual Capitalist Government and civil purposes make up 21% of all of Earth’s operational satellites, and military purposes come in at 13%. Who owns Earth’s orbit? Space operators SpaceX—founded by Elon Musk—is not only a disruptive launch provider for missions to the International Space Station (saving NASA millions). It’s also the largest commercial operator of satellites on the planet. With 358 satellites launched as of April, part of SpaceX’s mission is to boost navigation capabilities and supply the world with space-based internet. While the company operated 22% of the world’s operational satellites as of April, it went on to launch an additional 175 satellites in the span of one month, from August to September 2020

#### **Space debris makes LEO too crowded; causes runaway collisions**

Leonard **David, 21** – (“Space Junk Removal Is Not Going Smoothly,” Scientific American, 4-14-2021, https://www.scientificamerican.com/article/space-junk-removal-is-not-going-smoothly/)

After so many decades of the buildup of high-speed clutter in the form of spent rocket stages, stray bolts and paint chips, solid-rocket-motor slag, dead or dying satellites and the scattered fragments from antisatellite tests—all of which could individually damage or destroy other assets—low-Earth orbit is finally on the verge of becoming too crowded for comfort. And the problem is now poised to get much worse because of the rise of satellite “mega constellations” requiring thousands of spacecraft, such as SpaceX’s Starlink, a broadband Internet network. Starlink is but one of many similar projects: Another mega constellation from a company called OneWeb is already being deployed. And Amazon’s Project Kuiper is seeking to create a mega constellation of up to 3,200 satellites in the near future. As the congestion has grown, so too have close calls between orbiting assets. The International Space Station, for instance, regularly tweaks its orbit to avoid potentially hazardous debris. Worse yet, there has been an uptick in the threat of full-on collisions that generate menacing refuse that exacerbates the already bad situation. Consider the February 2009 run-in between a dead Russian Cosmos satellite and a commercial Iridium spacecraft, which produced an enormous amount of debris. Finding ways to remove at least some of all that space junk should be a top global priority, says Donald Kessler, a retired NASA senior scientist for orbital debris research. In the late 1970s he foretold the possibility of a scenario that has been dubbed the Kessler syndrome: as the density of space rubbish increases, a cascading, self-sustaining runaway cycle of debris-generating collisions can arise that might ultimately make low-Earth orbit too hazardous to support most space activities. “There is now agreement within the community that the debris environment has reached a ‘tipping point’ where debris would continue to increase even if all launches were stopped,” Kessler says. “It takes an Iridium-Cosmos-type collision to get everyone’s attention. That’s what it boils down to.... And we’re overdue for something like that to happen.” As for the Kessler syndrome, “it has already started,” the debris expert says. “There are collisions taking place all the time—less dramatic and not at the large size scale,” Kessler adds.

#### **Space debris destroys modern existence and takes us back to the pre-digital age**

George **Dvorsky, 15** - ("What Would Happen If All Our Satellites Were Suddenly Destroyed?," 6-4-2015, 12-10-2021, https://gizmodo.com/what-would-happen-if-all-our-satellites-were-suddenly-d-1709006681)

Lastly, there’s the 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. 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. Compromised Communications Almost immediately we’d notice a dramatic reduction in our ability to communicate, share information, and conduct transactions. A visualization from the Opte Project showing the various routes through a portion of the Internet (Opte/cc) “If our communications satellites are lost, then bandwidth is also lost,” Jonathan McDowell tells io9. He’s an astrophysicists and Chandra Observatory scientist who works out of the Harvard-Smithsonian Center for Astrophysics. 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, 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. Submarine cable map (TeleGeography) “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. 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. Lockheed-Martin’s GPS-III-AHI satellite “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. A somewhat alarmist video produced by the Marshall Institute, but one that raises some relevant points. In the report, “A Day Without Space: Economic and National Security Ramifications,” 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, TV, radio, ATM access, credit cards, and possibly even your electricity. [...] Wireless services, especially those built to CDMA standard, 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. Useless without GPS: The U.S. Navy’s Harpoon missile (U.S. Navy) 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 from New America Foundation 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. Hurricane Ivan (NOAA) 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. Without satellites, you can say goodbye to maps like this (NOAA) “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.” Cubesats in orbit (NASA) 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.

### **Advantage 2: Cybersecurity**

**Private space development wrecks cyber security**

Lospinoso, January 13, 2022, Josh Lospinoso is an ex-Army sergeant and Oxford-educated cybersecurity expert who is CEO and co-founder of Shift5, which protects planes, trains and tanks from cyber threats, Space race needs better cybersecurity, https://thehill.com/opinion/cybersecurity/589542-space-race-needs-better-cybersecurity

**The rise in satellites, rockets and shuttles is creating an expanded attack surface. Just like transportation, energy, and other vital industries,** space systems need protection. And while we probably won’t see civilians launching into space anytime soon, Blue Origin and Virgin Galactic are making such travel more feasible by the day. A proposed bill in the U.S. House of Representatives — the Space Infrastructure Act — would designate space as a critical infrastructure sector. It would be a good first step. Given how much equipment is in space and how dependent we are on it, it makes sense to classify it as critical infrastructure. There are more than 6,500 satellites in orbit; a record 1,283 launched in 2020 alone**. They are integral to cellular communications, Global Positioning System (GPS) navigation, monitoring weather and climate**, managing Internet of Things systems for agriculture, and keeping energy and other critical infrastructure running. And this infrastructure is disconcertingly fragile. **Outages have widespread, cascading, and potentially catastrophic consequences. One disabled satellite can affect vast networks on earth, leaving regions without cellular and other services.** ***This makes them attractive targets for malicious attackers***. The risk is so great that the director of the Defense Department’s Space Development Agency has cited cyber attacks against satellites as a greater threat than missiles. The threat is not theoretical Attacks have been going on for many years and have recently ramped up. In 2018, hackers infected U.S. computers that control satellites. Iranian hacking groups tried to trick satellite companies into installing malware in 2019. And one report concluded that Russia has been hacking the global navigation satellite system (GNSS) and sending spoofed navigation data to thousands of ships, throwing them off course**. While there haven’t been any public reports of direct hacks on satellites, vulnerabilities in ground stations have been exploited to try to alter satellite flight paths**, among other aims. **There are a number of ways satellites can be attacked. Hackers could compromise ground control systems to take control of space equipment remotely or inject malware into communications between terrestrial computers and satellites. They can spoof, or snoop on communications for espionage purposes, or disrupt signals.** Imagine a weather data outage during a hurricane or data glitches that lead to power blackouts or supply chain delays. The economic costs would be vast. A cyber attack on the Global Positioning System alone could cost the U.S. $1 billion a day, according to Brian Scott, director of critical infrastructure cybersecurity for the National Security Council. Federal initiatives are a good starting point Lawmakers in Washington, D.C., are taking notice of this fast-growing threat. The 2020 National Defense Authorization Act established a new military branch — Space Force. Meanwhile, President Biden is reviewing the first comprehensive cybersecurity policy for space systems, dubbed Space Policy Directive 5. It requires capabilities to prevent jamming and spoofing of communications and unauthorized access of equipment in orbit. The Space Infrastructure Act, proposed by U.S. Reps. Ted Lieu (D-Calif.) and Ken Calvert (R-Calif.) this summer, is another key measure that would put space on par with other industries by classifying it as a critical infrastructure domain. This move would enable more private and public collaboration on cybersecurity for space assets. One critical infrastructure sector that has dealt with similar cybersecurity concerns is transportation. Transportation operators that have invested in IT security measures have taken first steps, but efforts are on the rise to bolster proactive risk management that demonstrate a more complete understanding of infrastructure security. Under DHS Secretary Alejandro Mayorkas, the TSA has introduced regulations that urge operators to appoint a cybersecurity coordinator, report incidents to CISA within 24 hours, complete vulnerability assessments within information technology (IT) and operational technology (OT) systems, and develop an incident response plan based on security issues discovered. Another critical infrastructure that has work to do is the U.S. military. The Government Accountability Office released reports in 2018 and 2021 chiding the DOD for the poor to non-existent cybersecurity protection on its most critical fleet assets, ranging from fighter jets to tanks to aircraft carriers. These systems were never designed with cybersecurity requirements. As these systems have become more networked and interconnected, the DOD has an enormous, latent problem on its hands that it’s only beginning to grapple with. Fix the technology gaps. Satellite systems were not designed with security in mind. They have weak encryption and use legacy systems that are not easily patched or updated. And some of the navigation protocols are broken — I’ve built systems that spoof some of those protocols and discovered that it’s pretty trivial to do so with a few thousand dollars of investment. Traditional IT security solutions don’t protect the OT layers that satellites rely on. These security lapses make satellites vulnerable to hacking. Learn from IT security. Securing space assets is achievable, especially if we lean on the decades of hard lessons in securing IT networks. These include basics such as setting best practices like understanding your assets and observing what’s happening there to help detect attacks. Vendors should harden the code running on space systems and use the principle of least privilege for accessing the systems. These same lessons have been applied to transportation OT systems successfully. It shouldn’t take as long to get there with space systems. Agree on standards. This includes establishing reasonable security measures and sharing threat information, as well as developing a common cybersecurity architecture. The U.S. is in the early stages of devising cybersecurity rules for other critical infrastructure — like freight and passenger rail systems — and should get started with space now too. Realign incentives. Vendors and customers need more motivation to adopt risk mitigation approaches. When critical infrastructure goes out of service, millions of people can be affected. The total economic loss from these outages is orders of magnitude higher than the expenses incurred by the infrastructure operator. For example, Colonial Pipeline paid a $6.5 million ransom to get their gas pipelines flowing again, but that pales in comparison to the net effect of millions of people on the eastern seaboard who couldn’t pump gas. After the attack, we saw efforts from the U.S. government to apply regulations regarding breach reporting for pipeline systems, and we’re seeing similar efforts in the transportation sector. Federal regulations and the risk of bottom-line impact compel most companies to improve cybersecurity practices — which would benefit space technology as well. W***ith SpaceX, Amazon, and others launching new satellites weekly and commercial space travel on the horizon, the stakes will only get higher if we don’t work to secure these systems.*** Satellites aren’t just communication equipment; they are infrastructure we rely on to keep our hospitals open, streets lit, internet on, food delivered and emergency systems working. It’s time to make security for these systems a national priority before a disaster strikes.

**Grid vulnerability risks cascading systems collapse**

**CNA** Military Advisory Board, advisory group of retired flag and general officers from the

Army, Navy, Air Force, and Marine Corps, November, 20**15**, National Security and

Assured U.S. Electrical Power, https://www.cna.org/CNA\_files/PDF/National-Security-Assured-Electrical-Power.pdf

A Stacked Deck: Grid Susceptibility and Heightened Threats

Today’s grid is built on the model that power comes from **large stationary** power-generation facilities, flows through hundreds of thousands of miles of transmission lines and high-voltage transformers, and finally reaches consumers (see Figure 1).1

As the grid has evolved incrementally to meet the needs of our growing and increasingly urban population, power plants have grown in size and distance from consumers, and they have decreased in number [3]. Today’s grid—actually comprising three grids: the Eastern, Western, and Texas Interconnects—**is rigid**. It is designed for power to flow in one direction. It has **little flexibility** and many **vulnerable points of failure** that can result in the **collapse of large segments**. Within the transmission portion of the grid, there are 55,000 transmission substations,2 and according to a Federal Energy Regulatory Commission study, the loss of just nine of these nodes could result in a regional or nationwide outage that could last for weeks or possibly months, with restoration delayed by lack of available replacements [6]. Power utilities are prepared to address events that take one or even two transformers offline, but a **natural disaster** or **coordinated attack** that severely damages or fully disables more than two transformers could result in cascading blackouts [8]. No federal rules require utilities to protect these substations unless they are connected to nuclear power plants.

In our 2009 report, Powering America’s Defense: Energy and the Risks to National Security [9], we linked the vulnerability of the fragile domestic electricity grid to **weather**, **accidents**, and **attacks**, with the associated impacts on military installations. In the six years since the release of the report, the risks associated with attacks—such as those by transnational **terrorist groups** (e.g., al Qaeda, ISIL/ISIS), adversarial governments, and **“lonewolf” perpetrators,** as well as **cyberattacks**—have **increased dramatically**. Several recent incidents give us growing **cause for concern**, since they may be precursors of **future threats**.

Physical attacks

The design of the grid and its **inherent vulnerabilities** are **known to our enemies**—foreign and domestic. In 2013, the Pacific Gas and Electric (PG&E) Metcalf Transmission Substation located outside San Jose, CA, was the target of a sophisticated sniper attack. The Metcalf Substation supplies power to Silicon Valley, an American landmark of innovation. During the attack, gunmen fired on and disabled 17 transformers, causing $15 million worth of damage. The attackers have not been apprehended and their ultimate purpose remains unknown. The Federal Bureau of Investigation ruled out terrorism, but various independent investigations of the attack have pointed to its high degree of “sophistication.” Some investigators concluded that the Metcalf Substation incident was a “dress rehearsal” for other attacks on a much larger portion of the grid [10] [11].

Although the Metcalf incident was one of the most coordinated attacks on a substation to date, attacks on substations are **not isolated**. In 2013, shots were fired at grid infrastructure in eastern Colorado, while two years earlier an individual broke into a critical hydro-electric converter station in Vermont with threatening intent. The individuals involved in all of these incidents **remain at large** [12].

**Causes extinction**

**Friedemann 16** [Alice. Transportation expert, founder of EnergySkeptic.com and author of “When Trucks Stop Running, Energy and the Future of Transportation,” worked at American Presidential Lines for 22 years, where she developed computer systems to coordinate the transit of cargo between ships, rail, trucks, and consumers, Jan 24, 2016, “Electromagnetic pulse threat to infrastructure (U.S. House hearings),” Energy Skeptic, http://energyskeptic.com/2016/the-scariest-u-s-house-session-ever-electromagnetic-pulse-and-the-fall-of-civilization]

Modern civilization **cannot exist** for a protracted period without electricity. Within days of a blackout across the U.S., a blackout that could **encompass the entire planet**, emergency generators would run out of fuel, telecommunications would cease as would transportation due to **gridlock**, and eventually **no fuel**. Cities would have no running water and soon, within a few days, exhaust their food supplies. Police, Fire, Emergency Services and **hospitals cannot** long **operate in a blackout**. **Government and Industry** also need electricity in order to operate. The EMP Commission warns that a natural or nuclear EMP event, given current **unpreparedness**, would likely result in **societal collapse**.

**AND nuclear lashout**

**Tilford 12** [Robert Tilford, Writer for The Examiner, July 27, 2012, “Cyber Attackers Could Easily Shut Down the Electric Grid for the Entire East Coast,” http://www.examiner.com/article/cyber-attackers-could-easily-shut-down-the-electric-grid-for-the-entire-east-coa]

“Cyber attackers could all too easily **shut down** the **electric grid** for the entire east coast, the west coast, and the middle part of our country”, said Senator Grassley on July 26, 2012. “Any **one attack** could leave dozens of major cities and tens of millions of Americans without power. We know, because we were shown in a room here in the Capitol, how an attack could take place and what damage it would do, so we know this is not just make believe”, he said. So what would a cyber attack look like anyway? The Senator explained: “Without ATMs or debit card readers, commerce would immediately **grind to a halt.** My daughter, who lives here in the DC area, lost power when the storm hit. They waited for a number of hours, and then they took all the food out of their freezer, they gave away what they could, and they threw the rest away. And that was the way it was all over. Their power was out for about a week, and it made it very difficult. They are fortunate enough to have a basement, and the heat wasn’t oppressive down there. Without refrigeration, food would rot on the shelves, the freezers would have to be emptied, and people could actually go hungry. Without gas pumps, transportation arteries would clog with abandoned vehicles. Without cell phones or computers, whole regions of the country would be cut off from communication and families would be unable to reach each other. Without air conditioning and without lifesaving technology and the service of hospitals and nursing homes, the elderly and sick would become much sicker and die. Most major hospitals have backup power, but it is only for a limited amount of time. It depends on how much fuel they can store, and that is very limited”, Senator Grassley said. The devastation that the Senator describes is truly unimaginable. To make matters worse a cyber attack that can take out a civilian power grid, for example could also **~~cripple~~ harm the U.S. military**. The senator notes that is that the same power grids that supply cities and towns, stores and gas stations, cell towers and heart monitors also power “**every military base** in our country.” “Although bases would be prepared to weather a short power outage with backup diesel generators, within hours, not days, **fuel supplies would run out**”, he said. Which means military command and control centers could go dark. Radar systems that detect air threats to our country would shut Down completely. “Communication between commanders and their troops would also go silent. And many weapons systems would be left without either fuel or electric power”, said Senator Grassley. “So in a few short hours or days, the mightiest military in the world would be **left scrambling** to maintain base functions”, he said. We contacted the Pentagon and officials confirmed the threat of a cyber attack is something **very real**. Top national security officials—including the Chairman of the Joint Chiefs, the Director of the National Security Agency, the Secretary of Defense, and the CIA Director— have said, “preventing a cyber attack and improving the nation’s electric grids is among the most **urgent priorities** of our country” (source: Congressional Record). So how serious is the Pentagon taking all this? **Enough to start**, or end **a war over it**, for sure (see video: Pentagon declares war on cyber attacks http://www.youtube.com/watch?v=\_kVQrp\_D0kY&feature=relmfu ). A cyber attack today against the US could very well be seen as an “Act of War” and could be met with a “**full scale” US military response**. That could include the use of “**nuclear weapons**”, if authorized by the President.

### **Plan**

#### **The appropriation of outer space by private entities is unjust.**

#### **Plan text: Outer space ought to be recognized as a global commons.**

John S. **Goehring, 21** – (“Why Isn’t Outer Space a Global Commons?,” Journal of National Security Law and Policy, 2021, https://jnslp.com/wp-content/uploads/2021/09/Why\_Isnt\_Outer\_Space\_a\_Global\_Commons\_2.pdf)

B. Global Commons as a Constraining Concept In an economic context, as opposed to a military or geopolitical context, “global commons” is typically used to convey a constraining concept. The concept of a “commons” may be thought of as constraining because it is often associated with notions of shared ownership, public governance, or limitations on use. Whether these constraints are viewed positively or negatively is a subjective assessment. The constraining concept is more complicated than the enabling concept because it can reflect two distinct meanings. This is likely a function of its history. “The ‘commons,’ of course, has a long historical and intellectual lineage ranging from the enclosure movement in England, to Garret Hardin’s famous Tragedy of the Commons parable, to Elinor Ostrom’s Nobel-prize winning work on governing common pool resources,” observe Professors Foster and Iaione.30 Applying rational-choice theory, Hardin postulated that individual actors “automatically tend to over-exploit and plunder common-pool resources that are freely available to everyone.”31 The only possible solution to this dilemma, according to Hardin, was “the enclosure of resources through private property, or, failing that, public regulation.”32 Ostrom’s work later “turned [Hardin’s] conventional wisdom upside down: complex socio-ecological systems (in which goods are extractable and beneficiaries are hard to exclude) can prove to be sustainable resource domains granted that its stakeholders adopt a polycentric and self-regulated mode of governance.”33 As this brief summary suggests, one meaning of “commons” is simply to describe a category of goods.34 This usage was typical prior to Ostrom’s influence.35 In this meaning, a common is a resource to which access is shared, such as an open hunting ground. Some common resources may offer more than one type of benefit. For example, a hunting ground may offer open space for recreation, game to hunt, and trees for building. Some common resources may be subtractable, meaning that use of the resource subtracts from the ability of others to use the resource, while others remain plentiful. Describing a resource in this manner, as a common resource, does not necessarily imply any particular property regime or use limitations.36 A common hunting ground, for instance, may be publicly owned or privately owned. Ostrom helped popularize the term “common pool resource” to describe this general category of resources.37 As Dr. Tepper argues, “[i]t is crucial to differentiate between resources and the legal regime that governs them.”38 This is because the term “global commons” – or simply “commons” – can also be used in an economic sense to refer to a form of collective ownership and governance rather than to the economic goods themselves.39 As Professors Cogolati and Woulters observe, “[u]nder Ostrom’s influence, the commons have become more closely connected with the collective self-governance and participatory mechanisms they imply, than with the strict category of (rivalrous and non-excludable) economic goods they used to refer to.”40 This may account for the notion held by some that “the commons is less a description of the resource and its characteristics and more of a normative claim to the resource” (emphasis original).41 Used in this way, a commons is a category of property rights based on collective ownership.42 Put simply, “commons” is sometimes used to refer to common property, meaning a resource with more than one owner, and which therefore should be governed collectively. This notion of a commons is sometimes associated with the common heritage of mankind concept, particularly in the context of outer space. As expressed in Article 11(3) of the 1979 Moon Agreement, the common heritage of mankind concept creates a new type of territorial status in which the moon and celestial bodies “are not only in themselves not subject to national appropriation in a territorial sense, but the fruits and resources of which are also deemed to be the property of mankind at large,” according to Professor Cheng.43 This principle, as characterized by Professor Christol, not only “protects the proposition what [sic] given areas and their resources are open to inclusive use and that there may not be exclusive use,” but also “goes farther: it asserts that there must be a sharing of the benefits and of the values derived from the indicated commons.”44 In other words, status as the common heritage of mankind does not permit full private property rights in space resources. It should be noted that the concept of the common heritage of mankind is not limited to the outer space domain. In 1970, the United Nations (UN) General Assembly passed a non-binding resolution declaring “[t]he sea-bed and ocean floor, and the subsoil thereof, beyond the limits of national jurisdiction (hereinafter referred to as the area), as well as the resources of the area, are the common heritage of mankind.”45 Years later – after the completion of the Moon Agreement – this principle was codified in Article 136 of the 1982 UN Convention on the Law of the Sea (UNCLOS).46 Importantly, while the area is the common heritage of mankind according to the Convention, the high seas above the area remains free.47 Hence, some may refer to the high seas as a global commons (in the enabling sense), while others may refer to the deep sea bed as a global commons (in the constraining sense) – a clear example of why the term is fraught with misunderstanding. While the concept of common heritage of the seabed and of the Moon and other celestial bodies are linked, the Moon Agreement declares that the content of the common heritage of mankind concept as it applies to States Parties “finds its expression in the provisions of this Agreement” and nowhere else.48 In general, the concept “lacks a precise definition” but “basically wishes to convey the idea that management, exploitation and distribution of the natural resources of the area in question are matters to be decided upon by the international community and are not to be left to the initiative and discretion of individual States and their nationals.”49 The United States has not signed the Moon Agreement and rejects the notion that outer space resources are the common heritage of mankind, a position clearly reiterated in Executive Order 13914.50 The last of the five international space treaties to have been negotiated in the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), the Moon Agreement is regarded as a failed treaty with only 18 nations having signed on, none of which is China, Russia, or the United States, the three most prominent space-faring States.51 VISITED STATUS OF INTERNATIONAL AGREEMENTS RELATING TO ACTIVITIES IN OUTER SPACE, UNITED NATIONS OFFICE FOR OUTER SPACE AFFAIRS, https://perma.cc/8VA5-4UW8 (last July 11, 2020). The 1967 Outer Space Treaty, by contrast, has over 100 States Parties.52 Context is essential for discerning the distinction between the constraining concept and the enabling concept. By themselves, “global commons” or “commons” do not necessarily convey one concept or the other. Describing a resource as a “global commons” in an economic context implies a focus on an open access resource and the consumption of that resource; it suggests a resource allocation problem in need of a solution and inevitably invites questions about ownership. In contrast, referring to a global commons in a military or geopolitical context implies a focus on the use of an open access domain and, when used accurately, the lack of ownership is a settled question. Indeed, the distinction between a focus on a thing (res) itself and a focus on the right to use and explore a domain is among the reasons the term “res communis” is not interchangeable with “global commons” when used in a military or geopolitical sense.53

### **Solvency**

#### **Treating space as a commons solves orbital debris**

**Silverstein & Panda, 21** – (“Space Is a Great Commons. It’s Time to Treat It as Such.” *Carnegie Endowment for International Peace*, 3-9-21, https://carnegieendowment.org/2021/03/09/space-is-great-commons.-it-s-time-to-treat-it-as-such-pub-84018)

The failure to manage Earth orbits as a commons undermines safety and predictability, exposing space operators to growing risks such as collisions with other satellites and debris. The long-standing debris problem has been building for decades and demands an international solution.¶ Competing states need to coalesce behind a commons-based understanding of Earth orbits to set the table for a governance system to organize space traffic and address rampant debris. New leadership in the United States can spur progress on space governance by affirming that Earth orbits are a great commons. So far, President Joe Biden and his administration have focused on major space projects, but a relatively simple policy declaration that frames Earth orbits as a great commons can support efforts to negotiate space governance models for issues like debris mitigation and remediation. The Biden administration can set the stage to pursue broad space policy goals by establishing a consensus among states, particularly those with the most invested in Earth orbits, that space is a great commons.¶ THE PRESSING NEED FOR SPACE GOVERNANCE¶ The Earth orbits that provide the majority of benefits to states and commercial ventures represent only a tiny fraction of outer space as a whole. Competition for the limited volume of these Earth orbits is especially fierce since two satellites cannot be in the same place at the same time and not all orbits are equally useful for all missions. The number of objects residing in Earth orbits is now at an all-time high, with most new objects introduced into orbits at altitudes of between 400 and 700 kilometers above sea level. Millions of pieces of debris in Earth orbits pose a threat to continuing space operations. For instance, the final U.S. space shuttle missions faced 1-in-300 odds of losing a space vehicle or crew member to orbital debris or micrometeoroid impacts.¶ Collisions with fragments of orbital litter as small as a few millimeters across can ruin satellites and end missions. Current technologies cannot track all of these tiny pieces of debris, leaving space assets at the mercy of undetectable, untraceable, and unpredictable pieces of space junk. Some researchers have determined that the debris population in low Earth orbit is already self-sustaining, meaning that collisions between space objects will produce debris more rapidly than natural forces, like atmospheric drag, can remove it from orbit.¶ States—namely the United States, Russia, China, and India—have exacerbated this debris accumulation trend by testing kinetic anti-satellite capabilities or otherwise purposefully fragmenting their satellites in orbit. These states, along with the rest of the multilateral disarmament community, are currently at an impasse on establishing future space governance mechanisms that can address the debris issue. A portion of this impasse may be attributable to disparate views of the nature of outer space in the international context. Establishing a clear view among negotiating parties that Earth orbits should be treated as a great commons would establish a basis for future agreements that reduce debris-related risks.¶ Beyond debris-generating, kinetic anti-satellite weapons tests, revolutionary operating concepts challenge existing space traffic management practices. For instance, commercial ventures are planning networks of thousands of satellites to provide low-latency connectivity on Earth and deploying them by the dozens. States are following this trend. Some are considering transitioning away from using single (or few) exquisite assets in higher orbits and toward using many satellites in low Earth orbits. These new operational concepts could lead to an increase in collision risks.¶ Without new governance agreements, problems related to debris, heavy orbital traffic, and harmful interference will only intensify. Debris in higher orbits can persist for a century or more. The costs of adapting to increasingly polluted orbits would be immense, and the opportunity costs would be even higher. For instance, all else being equal, hardening satellites against collisions increases their mass and volume, in turn raising launch costs per satellite. These costs, rooted in a failure to govern space as a commons, will be borne by all space actors, including emerging states and commercial entities.¶ EXISTING FORMS OF SPACE GOVERNANCE¶ A well-designed governance system, founded on a widespread understanding of Earth orbits as a great commons, could temper these risks. Currently, space is not wholly unregulated, but existing regulations are limited both in scope and implementation. Many operators pledge to follow national regulations and international guidelines, but decentralized accountability mechanisms limit enforcement. These guidelines also do not cover the full range of potentially risky behaviors in space. For example, while some space operators can maneuver satellites to avoid collisions, there are no compulsory rules or standards on who has the right of way.¶ At the interstate level, seminal multilateral agreements provide some more narrow guidance on what is and is not acceptable in space. Most famously, the Outer Space Treaty affirms that outer space “shall be free for exploration and use by all states without discrimination of any kind” and that “there shall be free access to all areas of celestial bodies.” Similar concepts of Earth orbits being a great commons arise in subsequent international texts. Agreements like the Liability Convention impose fault-based liability for debris-related collisions in space, but it is difficult to prove fault in this regime in part because satellite owners and operators have yet to codify a standard of care in space, and thus the regime does not clearly disincentivize debris creation in orbit. Other rules of behavior in Earth orbits have been more successful in reducing harmful interference between satellite operations, but even these efforts are limited in scope.¶ States have acceded to supranational regulations of the most limited (and thus most valuable) Earth orbits. The International Telecommunication Union (ITU) coordinates, but does not authorize, satellite deployments and operations in geosynchronous orbits and manages radiofrequency spectrum assignments in other regions of space to reduce interference between satellites. These coordination activities are underpinned by the ITU’s constitution, which reminds states “that radio frequencies and any associate orbits . . . are limited natural resources,” indicating a commons-based approach to governing the radiofrequency spectrum. However, the union’s processes are still adapting to new operational realities in low Earth orbit, and these rules were never designed to address issues like debris

#### **Space resources must be distributed democratically—requires challenging private control**

Nick **Levine, 15** – (“Democratize the Universe,” Jacobin, 3-21-15, https://jacobinmag.com/2015/03/space-industry-extraction-levine)

The privatization of the Milky Way has begun. Last summer, the bipartisan ASTEROIDS Act was introduced in Congress. The legislation’s aim is to grant US corporations property rights over any natural resources — like the platinum-group metals used in electronics — that they extract from asteroids. The bill took advantage of an ambiguity in the United Nations’ 1967 Outer Space Treaty. That agreement forbade nations and private organizations from claiming territory on celestial bodies, but was unclear about whether the exploitation of their natural resources would be allowed, and if so, on what terms. The legal framework governing the economic development of outer space will have enormous effects on the distribution of wealth and income in the Milky Way and beyond. We could fight for a galactic democracy, where the proceeds of the space economy are distributed widely. Or we could accept the trickle-down astronomics anticipated by the ASTEROIDS Act, which would allow for the concentration of vast amounts of economic and political power in the hands of a few corporations and the most technologically developed nations. Given the pressing problems of inequality and climate change on Earth, the US left has been understandably uninterested in or largely dismissive of any space pursuits. For this reason, it remains unprepared to organize around extraterrestrial economic justice. The Left’s rejection of space has effectively ceded the celestial commons to the business interests who would literally universalize laissez-faire. Organizing around extraterrestrial politics wasn’t always treated as an escapist distraction. In the 1970s, fighting for a celestial commons was a pillar of developing countries’ struggle to create a more equitable economic order. Starting in the 1960s, a coalition of underdeveloped nations, many recently decolonized, asserted their strength in numbers in the United Nations by forming a caucus known as the Group of 77. In the early 1970s, this bloc announced its intention to establish a “new international economic order,” which found its expression in a series of UN treaties governing international regions, like sea beds and outer space, that they hoped would spread the economic benefits of the commons more equitably, with special attention to less developed nations. For these countries — as well as for the nervous US business interests that opposed them — their plan to “socialize the moon,” as some put it at the time, was the first step toward a more egalitarian distribution of wealth and power in human society. It will be years before the industrialization of outer space is economically viable, if it ever is. But the legal framework that would shape that transition is being worked out now. The ASTEROIDS Act was submitted on behalf of those who would benefit most from a laissez-faire extraterrestrial system. If we leave the discussion about celestial property rights to the business interests that monopolize it now, any dream of economic democracy in outer space will go the way of jetpacks, flying cars, and the fifteen-hour workweek. As Below, So Above Left critics of space proposals make the same mistakes as the most techno-utopian starry-eyed industrialists. From the point of view of the latter, celestial development will provide ultimate salvation to the human race by making us a multi-planetary species; the former see outer space as an infinite void essentially antagonistic to human life, interest in which is only orchestrated for cynical political ends. Each side misconceives extraterrestrial pursuits as qualitatively different from economic activities on Earth. Venturing into space may be a greater technical challenge; it may cost more, be more dangerous, or be a mistaken use of resources. But to understand these prospects in existential terms rather than as a new episode in the familiar history of industrial development and resource extraction — with all the political-strategic dangers and organizing opportunities that come with them — is to be blinded by the space romanticism that is a peculiar vestige of Cold War geopolitics. Whether and how we should go to space are not profound philosophical questions, at least not primarily. What’s at stake is not just the “stature of man,” as Hannah Arendt put it, but a political-economic struggle over the future of the celestial commons, which could result in a dramatic intensification of inequality — or a small step for humankind toward a more egalitarian state of affairs on our current planet. Undoubtedly, there are good reasons to be skeptical about going to space. Some have argued that it shifts attention away from solving the difficult problems of economic and environmental justice on Earth — think of Gil Scott-Heron’s spoken-word poem “Whitey on the Moon,” which juxtaposes the deprivation of the American underclass with the vast resources diverted to space. Scott-Heron’s critique is powerful, but it’s important to remember that he was denouncing an unjust economic system. He wasn’t issuing a timeless condemnation of space pursuits as such. Whether the aims of providing for all and developing outer space are mutually exclusive depends on the political forces on the ground. We might also question whether mining asteroids would be detrimental to our current planet’s environment in the medium term. If we don’t find a renewable way to blast off into outer space, the exploitation of these resources could lead to an intensification of, not a move away from, the fossil-fuel economy. If the environmental impact of space mining turns out to be large, it would be analogous to fracking — a technological development that gives us access to new resources, but with devastating ecological side effects — and ought to be opposed on similar grounds. On the other hand, some speculate that mining the Moon’s Helium-3 reserves, for example, could provide an abundant source of clean energy. The terrestrial environmental impact of space activity remains an open question that must be explored before we stake our hopes on the economic development of outer space. Philosophers have suggested that we might have ethical duties to preserve the “natural” states of celestial bodies. Others fear that our activities might unknowingly wipe out alien microbial life. We should remain sensitive to the aesthetic and cultural value of outer space, as well as the potential for extinction and the exhaustion of resources misleadingly proclaimed to be limitless. But if the Left rejects space on these grounds we abandon its fate to the will of private interests. These concerns shouldn’t cause us to write off space altogether — rather, they should motivate us even more to fight for the careful, democratic use of celestial resources for the benefit of all. There is also reason to be cautiously optimistic about extending economic activity to outer space. For one, the resources there — whether platinum-group metals useful in electronics, or fuels that could be central to the semi-independent functioning of an outer space economy — have the potential to raise our standards of living. Imagine, a superabundance of asteroid metals that are scarce on Earth, like platinum, driving the sort of automation that could expand output and reduce the need to work. Of course, there’s nothing inevitable about the benefits of productivity gains being distributed widely, as we’ve seen in the United States over the past forty years. This is a problem not limited to space, and the myth of the “final frontier” must not distract us from the already existing problems of wealth and income distribution on Earth. While the industrialization of the solar system isn’t a panacea for all economic ills, it does offer a significant organizing opportunity, since it will force a confrontation over the future of the vast celestial commons. The democratic possibilities of such a struggle have been recognized before: one conservative American citizens’ group in the 1970s called a progressive UN space treaty a “vital component of Third World demands for massive redistribution of wealth so as ultimately to equate the economic positions of the two hemispheres.” Many in the 1970s identified the egalitarian potential in the development of outer space, and the Left must not overlook it today. Back to the Future One of the Group of 77’s major goals was to apply some of the redistributive functions of the welfare state on a global scale. In 1974, that coalition issued a “Declaration on the Establishment of a New International Economic Order,” which called for a fairer system of global trade and resource distribution, one that could alleviate historical inequality. One of the battlegrounds for the Group of 77 was the negotiation over extraterrestrial property rights. The Outer Space Treaty of 1967, signed by over ninety countries in the heat of the first sprint to the moon, rejected the notion that celestial bodies fell under the legal principle of res nullius — meaning that outer space was empty territory that could be claimed for a nation through occupation. It forbade the “national appropriation by claim of sovereignty, by means of use or occupation, or by any other means” of outer space. But the treaty was not just restrictive. It also had a positive requirement for extraterrestrial conduct: “The exploration and use of outer space,” it declared, “shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.” However, nobody knew what this would mean in practice: was it a call for egalitarian economics, or an empty proclamation of liberal benevolence? Complicating matters, it was unclear whether the extraction and sale of natural resources from outer space fell under the category of “appropriation,” which had been forbidden. And what exactly was this benefit to all countries that our outer space pursuits were supposed to bring? How would its distribution be enforced? Which interpretation would win out was more a question of political power than of esoteric legal maneuvers. The Group of 77 took an activist approach to these issues, proposing amendments to the Outer Space Treaty regime that would spread the economic benefits of the celestial commons to less developed countries that did not have the resources to get to space, let alone mine it. Thus in 1970, the Argentine delegate to the UN Committee on the Peaceful Uses of Outer Space proposed to legally designate outer space and its resources “the common heritage of mankind.” First applied in negotiations over maritime law a few years earlier, the “common heritage” concept was intended to give legal grounding to the peaceful international governance of the commons. As an alternative to the laissez-faire approach advocated by many private interests, the “common heritage” principle also provided a legal framework for the democratic distribution of revenues derived from the international commons. In 1973, the Indian delegation to the Committee on the Peaceful Uses of Outer Space tried to put this idea into celestial practice, proposing an amendment to the Outer Space Treaty that called for equitable sharing of space benefits, particularly with developing countries. The Brazilian delegate to the committee summarized the group’s position: “It does not seem justifiable . . . that space activities . . . should evolve in a climate of total laissez-faire, which would conceal under the cloak of rationality new ways for an abusive exercise of power by those who exert control over technology.” Despite opposition from both the Soviet Union and the United States, the final draft of this new outer space agreement included a version of the “common heritage of mankind” doctrine. When the finalized treaty was brought to the US in 1979 for ratification, business groups balked. The vision of egalitarian galactic democracy suggested by the document was rightly seen as contrary to narrow American interests. The United Technologies Corp­oration, a designer and manufacturer of aircrafts and other heavy machinery (including the Black Hawk helicopter) took out a large advertisement in the Washington Post and a number of other newspapers, warning that the treaty would establish an “OPEC-like monopoly, require mandatory transfer of technology, and impose high international taxes on profits as a way of shifting wealth from the developed to the less developed countries.” The president of the corporation, Alexander Haig, also testified against the treaty in Congress in 1979, warning that “the common heritage concept expressed in the treaty underlies Third World efforts directed at a fundamental redistribution of global wealth.” Haig was hired as Ronald Reagan’s secretary of state in 1981, and political opposition to the bill forced NASA’s chief counsel to abandon defense of the treaty. In the end, the Moon Treaty, as the 1979 document came to be known, failed to gain more than a few signatories, leaving open the question of how the benefits of outer space were to be shared. In 1988, a different coalition of developing countries added the question of space benefits to the UN outer space committee’s agenda. But they failed to gain traction, and by 1993 they had to concede, as two long-time delegates to the outer space committee put it, that “their attempt [at] a redistributive revolution in international space cooperation had failed.” The conversation had shifted from the distribution of economic benefits to a narrower emphasis on international scientific coordination and development aid. This retreat culminated in a 1996 declaration that limited the interpretation of the “benefit” clause of the Outer Space Treaty to vague promises to help less developed countries improve their space technologies. The ultimate failure of the Moon Treaty was representative of broader developments in international politics, as the influence of the Group of 77 declined. The fact that the structural adjustment policies of the Washington Consensus won out over the Third World’s redistributive goals was the result of contingent factors — the oil shock’s exacerbation of debt crises, for instance — but it also indicated the limits of the power the Group of 77 had wielded in the first place. In October 2014, the UN outer space committee issued a press release summarizing its most recent session. Its headline: “Outer Space Benefits Must Not Be Allowed to Widen Global Gap between Economic, Social Inequality, Fourth Committee Told.” Despite paying lip service to its past concerns, the outer space committee now emphasizes equal access, voluntary technology transfers, and modest development aid over the direct redistributive approach it took in the 1970s. This shift from struggling for equality of outcome to equality of opportunity, with no accountability mechanism in place to ensure even the latter, represents a striking regression. The egalitarian dreams of the “revolution of the colonized” in the UN, as it was called at the time, have been forgotten. The Empire Strikes Back Recent US plans for outer space development, shaped overwhelmingly by Silicon Valley’s intuitions and capital, stand in stark contrast to the futuristic democratic dreams of the Group of 77. The most prominent of these entrepreneurial visions has been Elon Musk’s plan to colonize Mars. For now, international law seems to unequivocally forbid territorial claims on Mars and other celestial bodies. The legal status of resource extraction, on the other hand, remains an open question. A vocal group of entrepreneurs is hoping to set a precedent for the private appropriation of natural resources from asteroids, without internationally redistributive obligations. Planetary Resources, an asteroid-mining company whose backers include Larry Page, Eric Schmidt, and James Cameron, plans to launch satellites to prospect for valuable asteroids in the next two years. Another US firm, Deep Space Industries, will launch exploratory satellites as soon as next year. These entrepreneurs hope to extract the valuable platinum-group metals, essential for manufacturing electronics, that are rare on Earth. Sensationalist articles on space mining will tell you about an asteroid worth $20 trillion. Investors also believe that asteroids might provide water that could be broken down into oxygen and hydrogen in space, yielding air for astronauts and fuel for their ships. This could facilitate a dramatic acceleration in the economic development of outer space. The CEO of Deep Space Industries said he hopes asteroids near Earth will be “like the Iron Range of Minnesota was for the Detroit car industry last century — a key resource located near where it was needed. In this case, metals and fuel from asteroids can expand the in-space industries of this century. That is our strategy.” Another entrepreneur called the industrialization of outer space the “biggest wealth-creation opportunity in modern history.” Before this value can be generated, however, the legal wrinkles have to be ironed out. And so in the summer of 2014, the ASTEROIDS Act was introduced in the House of Representatives to “promote the right of United States commercial entities to explore and utilize resources from asteroids in outer space, in accordance with the existing international obligations of the United States, free from harmful interference, and to transfer or sell such resources.” The legislation was intended to clarify US interpretations of international space law, explicitly granting American companies the right to extract asteroid resources and bring them to market. The conclusion of Congress’s last session means that the bill will have to be reintroduced for it to move forward, and it is uncertain exactly when and how this will happen. But its appearance marked another clear attempt to unilaterally push international norms toward the free extraction of outer space resources, with limited democratic responsibilities attached — and it will not be the last. Joanne Gabrynowicz, editor emerita of the Journal of Space Law, said that an adviser to Planetary Resources had drafted the bill. Deep Space Industries also sent a letter supporting it directly to the space subcommittee of the House of Representatives. Moreover, Congressman Bill Posey, a cosponsor of the act, represents Florida, a state that Gabrynowicz pointed out has recently been forced to try to attract commercial space business — a direct response to the economic hardship caused by the decommissioning NASA’s space shuttle program. Such extraterrestrial special interests will no doubt continue to exert legislative pressure. In addition to asteroids, companies are investing millions in mining the moon, despite legal uncertainties. One such company, Moon Express, has already received a $10 million data-sharing contract from NASA. One of that company’s founders, a former dot-com billionaire, told the Los Angeles Times: There is strong legal precedent and consensus of “finders, keepers” for resources that are liberated through private investment, and the same will be true on the moon. You don’t have to own land to have ownership of resources you unlock from it. Moon Express will use existing precedents of peaceful presence and exploration set by the US government forty years ago. This redeployment of the finders-keepers principle is anathema to the redistributive regime imagined by the Group of 77. Private companies like Planetary Resources and Moon Express, with support from the federal government, are betting not only on the viability of space industrialization, but also on their ability to push through a legal regime that will validate their property claims on their terms. But the universalization of laissez-faire is not inevitable. Final Frontier Thesis The history of the Moon Treaty serves as a reminder that outer space is not just a screen onto which we project techno-utopian fantasies or existential anxieties about the infinite void. It has been, and will continue to be, a site of concrete struggle over economic power. The politics of the present are undoubtedly different from those of the 1970s. The egalitarian project of the Group of 77 has given way to BRICS-style market liberalism. Global capital has gained power where international labor efforts have stagnated. Domestic inequalities have skyrocketed. The rapid proliferation of information technologies has temporarily masked the reality that the future, to paraphrase William Gibson, is not being very evenly distributed. Without international political organization to challenge galactic market fundamentalism, a twenty-first century space odyssey could mean the concentration of even more wealth and income in the hands of a few powerful corporations and the most technologically advanced countries. At the same time, and for the same reasons, the prospect of preserving the final frontier as a celestial commons presents an opportunity to fight for a more democratic political economy. Sharing the benefits of the celestial commons is key to expanding democracy to a galactic scale. One time-tested means of distributing the benefits of natural-resource extraction universally is the sovereign wealth fund, which Alaska uses to deliver oil revenue to its residents. As an international commons, outer space offers an opportunity to experiment with such redistributive mechanisms beyond the traditional confines of the nation-state. Organizing around an issue of such scale may seem utopian, but it’s also necessary. From regulating capital to mitigating climate change, the problems that confront us are inherently global in scope and require commensurate strategies. At the very least, the global left ought to demand the creation of an independent Galactic Wealth Fund to manage the proceeds of outer space resources on behalf of all human beings. At first, it would amount to little, divided up among all of us. But as the space economy grows relative to the terrestrial one, social dividends from the Galactic Wealth Fund could provide the basis for a truly universal basic income. This is just one component of a broader platform for galactic democracy that must be developed collectively. Extraterrestrial economic justice — not just shiny technological advances — will be central to any truly egalitarian politics in the twenty-first century. It’s time to start building a democratic futurism.

#### **States can extend existing models to govern space; recognition of space as commons is key.**

**Silverstein & Panda, 21** – (“Space Is a Great Commons. It’s Time to Treat It as Such.,” *Carnegie Endowment for International Peace*, 3-9-21, https://carnegieendowment.org/2021/03/09/space-is-great-commons.-it-s-time-to-treat-it-as-such-pub-84018)

BUILDING ON PRIOR MODELS FOR MANAGING COMMONS¶ The histories of other great commons provide lessons on how to manage shared space resources meaningfully and effectively. Efforts to minimize damage to other great commons—like the Convention on Long-Range Transboundary Air Pollution and subsequent protocols—offer guidance on how to resolve compliance issues. Notably, the negotiations on the original convention on air pollution involved, among others, the United States and the Soviet Union. This suggests that states can pursue mutual benefits in areas considered great commons even under competitive conditions. More recent negotiations on the convention’s accompanying protocols show that these competing states can even agree on financing a monitoring regime to support progress.¶ Existing conventions and implementing agreements indicate that states can reach valuable commitments to manage the Earth’s great commons. These governance models protect state interests and preserve the commons themselves. These principles apply to space, but progress on establishing more encompassing space governance principles, enforcement mechanisms, and dispute resolution procedures hinges on states sharing the fundamental view that space is a great commons. Reaching such a consensus is an important first step.¶ New leadership in prominent spacefaring states can revitalize efforts to recognize space as a commons and can build on established legal standards to pursue commons-related principles for governing Earth orbits. Space actors do not have to resolve all their competing interests based on the debris problem. But negligence, mismanagement, or poorly designed rules may spell disaster for Earth orbits. As a more diverse range of actors with space-based interests emerges, no single actor will be able to unilaterally impose universal rules. States can, however, negotiate agreements to manage commons areas to better pursue national objectives. The only way to effectively govern state and commercial space activities is to settle on and abide by common norms or rules.¶ New conventions or regulatory mechanisms for governing Earth orbits will not appear overnight, but states can build toward these goals by clarifying their commitments to treat space as a commons and pursuing governance arrangements that reflect this commitment. New policies in the United States should reflect that Earth orbits are a great commons.

#### **Treating space as commons is key to ethical exploration and human survival.**

LA **Fisk, N.D.** –(“Space as a Global Commons,” UNOOSA., ND. Accessed 1-19-21, https://www.unoosa.org/documents/pdf/hlf/1st\_hlf\_Dubai/Presentations/26.pdf)

Space as a Global Commons It follows therefore that, given the centrality of space for the future of our civilization, we need to have policies and practices in place, which are shared by all spacefaring nations, that will allow and encourage each and every nation that desires to and has the capability to use and to explore space for peaceful purposes, to do so. We thus need to recognize, encourage, and enable space as a global commons. A ‘commons’ in the English language is a piece of land owned by and used by all members of a community, as in a pasture used by all residents of a village. Many nations of the world view space as a global commons, a resource not owned by any one nation but crucial to the future of all humankind.

### **Framework**

### **1AC: Framing**

#### **The standard is maximizing expected wellbeing.**

#### **Prefer:**

#### **1] Pleasure and pain *are* intrinsic value and disvalue – everything else *regresses* – robust neuroscience.**

**Blum et al. 18** – (“Our evolved unique pleasure circuit makes humans different from apes: Reconsideration of data derived from animal studies,” US Department of Veterans Affairs, 2-28-18, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6446569/)

**Pleasure** is not only one of the three primary reward functions but it also **defines reward.** As homeostasis explains the functions of only a limited number of rewards, the principal reason why particular stimuli, objects, events, situations, and activities are rewarding may be due to pleasure. This applies first of all to sex and to the primary homeostatic rewards of food and liquid and extends to money, taste, beauty, social encounters and nonmaterial, internally set, and intrinsic rewards. Pleasure, as the primary effect of rewards, drives the prime reward functions of learning, approach behavior, and decision making and provides the **basis for hedonic theories** of reward function. We are attracted by most rewards and exert intense efforts to obtain them, just because they are enjoyable [10].

Pleasure is a passive reaction that derives from the experience or prediction of reward and may lead to a long-lasting state of happiness. The word happiness is difficult to define. In fact, just obtaining physical pleasure may not be enough. One key to happiness involves a network of good friends. However, it is not obvious how the higher forms of satisfaction and pleasure are related to an ice cream cone, or to your team winning a sporting event. Recent multidisciplinary research, using both humans and detailed invasive brain analysis of animals has discovered some critical ways that the brain processes pleasure [14].

Pleasure as a hallmark of reward is sufficient for defining a reward, but it may not be necessary. A reward may generate positive learning and approach behavior simply because it contains substances that are essential for body function. When we are hungry, we may eat bad and unpleasant meals. A monkey who receives hundreds of small drops of water every morning in the laboratory is unlikely to feel a rush of pleasure every time it gets the 0.1 ml. Nevertheless, with these precautions in mind, we may define any stimulus, object, event, activity, or situation that has the potential to produce pleasure as a reward. In the context of reward deficiency or for disorders of addiction, homeostasis pursues pharmacological treatments: drugs to treat drug addiction, obesity, and other compulsive behaviors. The theory of allostasis suggests broader approaches - such as re-expanding the range of possible pleasures and providing opportunities to expend effort in their pursuit. [15]. It is noteworthy, the first animal studies eliciting approach behavior by electrical brain stimulation interpreted their findings as a discovery of the brain’s pleasure centers [16] which were later partly associated with midbrain dopamine neurons [17–19] despite the notorious difficulties of identifying emotions in animals.

Evolutionary theories of pleasure: The love connection BO:D

Charles Darwin and other biological scientists that have examined the biological evolution and its basic principles found various mechanisms that steer behavior and biological development. Besides their theory on natural selection, it was particularly the sexual selection process that gained significance in the latter context over the last century, especially when it comes to the question of what makes us “what we are,” i.e., human. However, the capacity to sexually select and evolve is not at all a human accomplishment alone or a sign of our uniqueness; yet, we humans, as it seems, are ingenious in fooling ourselves and others–when we are in love or desperately search for it.

It is well established that modern biological theory conjectures that **organisms are** the **result of evolutionary competition.** In fact, Richard Dawkins stresses gene survival and propagation as the basic mechanism of life [20]. Only genes that lead to the fittest phenotype will make it. It is noteworthy that the phenotype is selected based on behavior that maximizes gene propagation. To do so, the phenotype must survive and generate offspring, and be better at it than its competitors. Thus, the ultimate, distal function of rewards is to increase evolutionary fitness by ensuring the survival of the organism and reproduction. It is agreed that learning, approach, economic decisions, and positive emotions are the proximal functions through which phenotypes obtain other necessary nutrients for survival, mating, and care for offspring.

Behavioral reward functions have evolved to help individuals to survive and propagate their genes. Apparently, people need to live well and long enough to reproduce. Most would agree that homo-sapiens do so by ingesting the substances that make their bodies function properly. For this reason, foods and drinks are rewards. Additional rewards, including those used for economic exchanges, ensure sufficient palatable food and drink supply. Mating and gene propagation is supported by powerful sexual attraction. Additional properties, like body form, augment the chance to mate and nourish and defend offspring and are therefore also rewards. Care for offspring until they can reproduce themselves helps gene propagation and is rewarding; otherwise, many believe mating is useless. According to David E Comings, as any small edge will ultimately result in evolutionary advantage [21], additional reward mechanisms like novelty seeking and exploration widen the spectrum of available rewards and thus enhance the chance for survival, reproduction, and ultimate gene propagation. These functions may help us to obtain the benefits of distant rewards that are determined by our own interests and not immediately available in the environment. Thus the distal reward function in gene propagation and evolutionary fitness defines the proximal reward functions that we see in everyday behavior. That is why foods, drinks, mates, and offspring are rewarding.

There have been theories linking pleasure as a required component of health benefits salutogenesis, (salugenesis). In essence, under these terms, pleasure is described as a state or feeling of happiness and satisfaction resulting from an experience that one enjoys. Regarding pleasure, it is a double-edged sword, on the one hand, it promotes positive feelings (like mindfulness) and even better cognition, possibly through the release of dopamine [22]. But on the other hand, pleasure simultaneously encourages addiction and other negative behaviors, i.e., motivational toxicity. It is a complex neurobiological phenomenon, relying on reward circuitry or limbic activity. It is important to realize that through the “Brain Reward Cascade” (BRC) endorphin and endogenous morphinergic mechanisms may play a role [23]. While natural rewards are essential for survival and appetitive motivation leading to beneficial biological behaviors like eating, sex, and reproduction, crucial social interactions seem to further facilitate the positive effects exerted by pleasurable experiences. Indeed, experimentation with addictive drugs is capable of directly acting on reward pathways and causing deterioration of these systems promoting hypodopaminergia [24]. Most would agree that pleasurable activities can stimulate personal growth and may help to induce healthy behavioral changes, including stress management [25]. The work of Esch and Stefano [26] concerning the link between compassion and love implicate the brain reward system, and pleasure induction suggests that social contact in general, i.e., love, attachment, and compassion, can be highly effective in stress reduction, survival, and overall health.

Understanding the role of neurotransmission and pleasurable states both positive and negative have been adequately studied over many decades [26–37], but comparative anatomical and neurobiological function between animals and homo sapiens appear to be required and seem to be in an infancy stage.

Finding happiness is different between apes and humans

As stated earlier in this expert opinion one key to happiness involves a network of good friends [38]. However, it is not entirely clear exactly how the higher forms of satisfaction and pleasure are related to a sugar rush, winning a sports event or even sky diving, all of which augment dopamine release at the reward brain site. Recent multidisciplinary research, using both humans and detailed invasive brain analysis of animals has discovered some critical ways that the brain processes pleasure.

Remarkably, there are pathways for ordinary liking and pleasure, which are limited in scope as described above in this commentary. However, there are **many brain regions**, often termed hot and cold spots, that significantly **modulate** (increase or decrease) our **pleasure or** even produce **the opposite** of pleasure— that is disgust and fear [39]. One specific region of the nucleus accumbens is organized like a computer keyboard, with particular stimulus triggers in rows— producing an increase and decrease of pleasure and disgust. Moreover, the cortex has unique roles in the cognitive evaluation of our feelings of pleasure [40]. Importantly, the interplay of these multiple triggers and the higher brain centers in the prefrontal cortex are very intricate and are just being uncovered.

Desire and reward centers

It is surprising that many different sources of pleasure activate the same circuits between the mesocorticolimbic regions (Figure 1). Reward and desire are two aspects pleasure induction and have a very widespread, large circuit. Some part of this circuit distinguishes between desire and dread. The so-called pleasure circuitry called “REWARD” involves a well-known dopamine pathway in the mesolimbic system that can influence both pleasure and motivation.

In simplest terms, the well-established mesolimbic system is a dopamine circuit for reward. It starts in the ventral tegmental area (VTA) of the midbrain and travels to the nucleus accumbens (Figure 2). It is the cornerstone target to all addictions. The VTA is encompassed with neurons using glutamate, GABA, and dopamine. The nucleus accumbens (NAc) is located within the ventral striatum and is divided into two sub-regions—the motor and limbic regions associated with its core and shell, respectively. The NAc has spiny neurons that receive dopamine from the VTA and glutamate (a dopamine driver) from the hippocampus, amygdala and medial prefrontal cortex. Subsequently, the NAc projects GABA signals to an area termed the ventral pallidum (VP). The region is a relay station in the limbic loop of the basal ganglia, critical for motivation, behavior, emotions and the “Feel Good” response. This defined system of the brain is involved in all addictions –substance, and non –substance related. In 1995, our laboratory coined the term “Reward Deficiency Syndrome” (RDS) to describe genetic and epigenetic induced hypodopaminergia in the “Brain Reward Cascade” that contribute to addiction and compulsive behaviors [3,6,41].

Furthermore, ordinary “liking” of something, or pure pleasure, is represented by small regions mainly in the limbic system (old reptilian part of the brain). These may be part of larger neural circuits. In Latin, hedus is the term for “sweet”; and in Greek, hodone is the term for “pleasure.” Thus, the word Hedonic is now referring to various subcomponents of pleasure: some associated with purely sensory and others with more complex emotions involving morals, aesthetics, and social interactions. The capacity to have pleasure is part of being healthy and may even extend life, especially if linked to optimism as a dopaminergic response [42].

Psychiatric illness often includes symptoms of an abnormal inability to experience pleasure, referred to as anhedonia. A negative feeling state is called dysphoria, which can consist of many emotions such as pain, depression, anxiety, fear, and disgust. Previously many scientists used animal research to uncover the complex mechanisms of pleasure, liking, motivation and even emotions like panic and fear, as discussed above [43]. However, as a significant amount of related research about the specific brain regions of pleasure/reward circuitry has been derived from invasive studies of animals, these cannot be directly compared with subjective states experienced by humans.

In an attempt to resolve the controversy regarding the causal contributions of mesolimbic dopamine systems to reward, we have previously evaluated the three-main competing explanatory categories: “liking,” “learning,” and “wanting” [3]. That is, dopamine may mediate (a) liking: the hedonic impact of reward, (b) learning: learned predictions about rewarding effects, or (c) wanting: the pursuit of rewards by attributing incentive salience to reward-related stimuli [44]. We have evaluated these hypotheses, especially as they relate to the RDS, and we find that the incentive salience or “wanting” hypothesis of dopaminergic functioning is supported by a majority of the scientific evidence. Various neuroimaging studies have shown that anticipated behaviors such as sex and gaming, delicious foods and drugs of abuse all affect brain regions associated with reward networks, and may not be unidirectional. Drugs of abuse enhance dopamine signaling which sensitizes mesolimbic brain mechanisms that apparently evolved explicitly to attribute incentive salience to various rewards [45].

Addictive substances are voluntarily self-administered, and they enhance (directly or indirectly) dopaminergic synaptic function in the NAc. This activation of the brain reward networks (producing the ecstatic “high” that users seek). Although these circuits were initially thought to encode a set point of hedonic tone, it is now being considered to be far more complicated in function, also encoding attention, reward expectancy, disconfirmation of reward expectancy, and incentive motivation [46]. The argument about addiction as a disease may be confused with a predisposition to substance and nonsubstance rewards relative to the extreme effect of drugs of abuse on brain neurochemistry. The former sets up an individual to be at high risk through both genetic polymorphisms in reward genes as well as harmful epigenetic insult. Some Psychologists, even with all the data, still infer that addiction is not a disease [47]. Elevated stress levels, together with polymorphisms (genetic variations) of various dopaminergic genes and the genes related to other neurotransmitters (and their genetic variants), and may have an additive effect on vulnerability to various addictions [48]. In this regard, Vanyukov, et al. [48] suggested based on review that whereas the gateway hypothesis does not specify mechanistic connections between “stages,” and does not extend to the risks for addictions the concept of common liability to addictions may be more parsimonious. The latter theory is grounded in genetic theory and supported by data identifying common sources of variation in the risk for specific addictions (e.g., RDS). This commonality has identifiable neurobiological substrate and plausible evolutionary explanations.

Over many years the controversy of dopamine involvement in especially “pleasure” has led to confusion concerning separating motivation from actual pleasure (wanting versus liking) [49]. We take the position that animal studies cannot provide real clinical information as described by self-reports in humans. As mentioned earlier and in the abstract, on November 23rd, 2017, evidence for our concerns was discovered [50]

In essence, although nonhuman primate brains are similar to our own, the disparity between other primates and those of human cognitive abilities tells us that surface similarity is not the whole story. Sousa et al. [50] small case found various differentially expressed genes, to associate with pleasure related systems. Furthermore, the dopaminergic interneurons located in the human neocortex were absent from the neocortex of nonhuman African apes. Such differences in neuronal transcriptional programs may underlie a variety of neurodevelopmental disorders.

In simpler terms, the system controls the production of dopamine, a chemical messenger that plays a significant role in pleasure and rewards. The senior author, Dr. Nenad Sestan from Yale, stated: “Humans have evolved a dopamine system that is different than the one in chimpanzees.” This may explain why the behavior of humans is so unique from that of non-human primates, even though our brains are so surprisingly similar, Sestan said: “It might also shed light on why people are vulnerable to mental disorders such as autism (possibly even addiction).” Remarkably, this research finding emerged from an extensive, multicenter collaboration to compare the brains across several species. These researchers examined 247 specimens of neural tissue from six humans, five chimpanzees, and five macaque monkeys. Moreover, these investigators analyzed which genes were turned on or off in 16 regions of the brain. While the differences among species were subtle, **there was** a **remarkable contrast in** the **neocortices**, specifically in an area of the brain that is much more developed in humans than in chimpanzees. In fact, these researchers found that a gene called tyrosine hydroxylase (TH) for the enzyme, responsible for the production of dopamine, was expressed in the neocortex of humans, but not chimpanzees. As discussed earlier, dopamine is best known for its essential role within the brain’s reward system; the very system that responds to everything from sex, to gambling, to food, and to addictive drugs. However, dopamine also assists in regulating emotional responses, memory, and movement. Notably, abnormal dopamine levels have been linked to disorders including Parkinson’s, schizophrenia and spectrum disorders such as autism and addiction or RDS.

Nora Volkow, the director of NIDA, pointed out that one alluring possibility is that the neurotransmitter dopamine plays a substantial role in humans’ ability to pursue various rewards that are perhaps months or even years away in the future. This same idea has been suggested by Dr. Robert Sapolsky, a professor of biology and neurology at Stanford University. Dr. Sapolsky cited evidence that dopamine levels rise dramatically in humans when we anticipate potential rewards that are uncertain and even far off in our futures, such as retirement or even the possible alterlife. This may explain what often motivates people to work for things that have no apparent short-term benefit [51]. In similar work, Volkow and Bale [52] proposed a model in which dopamine can favor NOW processes through phasic signaling in reward circuits or LATER processes through tonic signaling in control circuits. Specifically, they suggest that through its modulation of the orbitofrontal cortex, which processes salience attribution, dopamine also enables shilting from NOW to LATER, while its modulation of the insula, which processes interoceptive information, influences the probability of selecting NOW versus LATER actions based on an individual’s physiological state. This hypothesis further supports the concept that disruptions along these circuits contribute to diverse pathologies, including obesity and addiction or RDS.

#### **2] Death is bad and outweighs – a) agents can’t act if they fear for their bodily security which constrains every ethical theory, b) it destroys the subject itself – kills any ability to achieve value in ethics since life is a prerequisite which means it’s a side constraint since we can’t reach the end goal of ethics without life**

#### **3] Actor spec—governments must use util because they don’t have intentions and are constantly dealing with tradeoffs—outweighs since different agents have different obligations—takes out calc indicts since they are empirically denied.**