#### I affirm the resolution - The appropriation of outer space by private entities is unjust

#### Because the resolution poses the question of what is unjust, I value justice

#### My value criterion is maximizing expected well being

#### You should prefer this for two reasons

#### 1] Only consequentialism can explain degrees of wrongness - The only reason why we can say that breaking a promise to take a dying person to the promise is worse than breaking a promise to meet up for lunch is the questions of those actions

#### 2] Substitutability -- only consequentialism explains why actions are necessary to achieve an endgoal must be taken

Sinnott-Armstrong 92 [Walter, professor of practical ethics. “An Argument for Consequentialism” Dartmouth College Philosophical Perspectives. 1992.]

A moral reason to do an act is consequential if and only if the reason depends only on the consequences of either doing the act or not doing the act. For example, a moral reason not to hit someone is that this will hurt her or him. A moral reason to turn your car to the left might be that, if you do not do so, you will run over and kill someone. A moral reason to feed a starving child is that the child will lose important mental or physical abilities if you do not feed it. All such reasons are consequential reasons. All other moral reasons are non-consequential. Thus, a moral reason to do an act is non-consequential if and only if the reason depends even partly on some property that the act has independently of its consequences. For example, an act can be a lie regardless of what happens as a result of the lie (since some lies are not believed), and some moral theories claim that that property of being a lie provides amoral reason not to tell a lie regardless of the consequences of this lie. Similarly, the fact that an act fulfills a promise is often seen as a moral reason to do the act, even though the act has that property of fulfilling a promise independently ofits consequences. All such moral reasons are non-consequential. In order to avoid so many negations, I will also call them 'deontological'. This distinction would not make sense if we did not restrict the notion of consequences. If I promise to mow the lawn, then one consequence of my mowing might seem to be that my promise is fulfilled. One way to avoid this problem is to specify that the consequences of an act must be distinct from the act itself. My act of fulfilling my promise and my act of mowing are not distinct, because they are done by the same bodily movements.10 Thus, my fulfilling my promise is not a consequence of my mowing. A consequence of an act need not be later in time than the act, since causation can be simultaneous, but the consequence must at least be different from the act. Even with this clarification, it is still hard to classify some moral reasons as consequential or deontological,11 but I will stick to examples that are clear. In accordance with this distinction between kinds of moral reasons, I can now distinguish different kinds of moral theories. I will say that a moral theory is consequentialist if and only if it implies that all basic moral reasons are consequential. A moral theory is then non-consequentialist or deontological if it includes any basic moral reasons which are not consequential. 5. Against Deontology So defined, the class of deontological moral theories is very large and diverse. This makes it hard to say anything in general about it. Nonetheless, I will argue that no deontological moral theory can explain why moral substitutability holds. My argument applies to all deontological theories because it depends only on what is common to them all, namely, the claim that some basic moral reasons are not consequential. Some deontological theories allow very many weighty moral reasons that are consequential, and these theories might be able to explain why moral substitutability holds for some of their moral reasons: the consequential ones. But even these theories cannot explain why moral substitutability holds for all moral reasons, including the non-consequential reasons that make the theory deontological. The failure of deontological moral theories to explain moral substitutability in the very cases that make them deontological is a reason to reject all deontological moral theories. I cannot discuss every deontological moral theory, so I will discuss only a few paradigm examples and show why they cannot explain moral substitutability. After this, I will argue that similar problems are bound to arise for all other deontological theories by their very nature. The simplest deontological theory is the pluralistic intuitionism of Prichard and Ross. Ross writes that, when someone promises to do something, 'This we consider obligatory in its own nature, just because it is a fulfillment of a promise, and not because of its consequences.'12 Such deontologists claim in effect that, if I promise to mow the grass, there is a moral reason for me to mow the grass, and this moral reason is constituted by the fact that mowing the grass fulfills my promise. This reason exists regardless of the consequences of mowing the grass, even though it might be overridden by certain bad consequences. However, if this is why I have a moral reason to mow the grass, then, even if I cannot mow the grass without starting my mower, and starting the mower would enable me to mow the grass, it still would not follow that I have any moral reason to start my mower, since I did not promise to start my mower, and starting my mower does not fulfill my promise. Thus, a moral theory cannot explain moral substitutability if it claims that properties like this provide moral reasons.

#### My Sole Contention is Mining —

#### Private entities are increasing mining now – US is key

Robert Garcia 18, currently an LLM Candidate in Cornell Law School's Law, Entrepreneurship & Technology program at Cornell Tech in NYC., “Regulating International Space Mining, an Enormous Industry,” Pacific Council on International Policy, 10-23-2018, https://www.pacificcouncil.org/newsroom/regulating-international-space-mining-enormous-industry

In 2015, the United States passed the U.S. Commercial Space Launch Competitiveness Act. The law’s passage has caused some consternation in the international space exploration community, as it specifically contemplates U.S. citizens performing commercial recovery in what would be a clear appropriation of asteroid and space resources. The law in pertinent part states that such U.S. citizens: shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States (emphasis added). Luxembourg was quick to follow suit, and it passed its own national space mining law styled the Law of 20 July 2017 on the Exploration and Use of Space Resources. This law seeks to parallel U.S. law. However, according to a spokesman for the Luxembourg Ministry of Economy, there is one significant expansion over U.S. law, in that "in the U.S. law, a majority of a company's stakeholders must be in the United States, while the Luxembourg law places no restrictions on stakeholder locations." Critics state that the controlling international law is to be found in the United Nations treaties on space exploration. There are five major space treaties, but two specifically address exploitation of outer space resources. The first is the "Outer Space Treaty" (OST). One hundred nations, including the major spacefaring nations-the United States, China, Japan, and the Russian Federation-have ratified it. A subsequent treaty-the Moon Agreement-provides in a relevant part in Article 11, Paragraph 2, that "[t]he moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means." As of January 2018, relatively few states (18 total) had ratified the Moon Agreement and four additional states had signed but not ratified the agreement. However, of these 22 states, perhaps only Australia, France, and India have the capability to launch space vehicles. The Moon Agreement could have provided some guidance on exploitation of space resources, as it ostensibly prohibits claiming lunar natural resources for private ownership. However, the United States and Luxembourg are not parties to the Moon Agreement, and in consequence the treaty has no "governing effect." Nonetheless, some legal scholars contend that the United States would be in breach of its international obligations if it were to "unilaterally pretend" that its citizens may exercise ownership over extracted space resources, given the absence of recognition of such rights under international law. Clearly it is the stated aim of both the United States and Luxembourg to promote the commercial exploitation of space resources. The two nations’ respective pieces of legislation attempt to provide a legal basis for private citizens to engage in such activities, which some critics would characterize as prohibited "appropriation" under international law. The international community would be well-served by resolving the issue conclusively with an appropriate body of rules. As the technologies advance, we are inexorably headed toward space mining becoming a reality. Whether it will lead to increased resources, providing a net benefit for all people on earth, or serve to increase economic inequality by disproportionately favoring the spacefaring nations remains to be seen.

#### That causes a race to the bottom of deregulation

Edd Gent 20, freelance science and technology writer, “Space Mining Should Be a Global Project—But It's Not Starting Off That Way,” Singularity Hub, 10-12-2020, https://singularityhub.com/2020/10/12/the-us-is-trying-to-hijack-space-mining-and-there-could-be-disastrous-consequences/

Exploiting the resources of outer space might be key to the future expansion of the human species. But researchers argue that the US is trying to skew the game in its favor, with potentially disastrous consequences. The enormous cost of lifting material into space means that any serious effort to colonize the solar system will require us to rely on resources beyond our atmosphere. Water will be the new gold thanks to its crucial role in sustaining life, as well as the fact it can be split into hydrogen fuel and oxygen for breathing. Regolith found on the surface of rocky bodies like the moon and Mars will be a crucial building material, while some companies think it will eventually be profitable to extract precious metals and rare earth elements from asteroids and return them to Earth. But so far, there’s little in the way of regulation designed to govern how these activities should be managed. Now two Canadian researchers argue in a paper in Science that recent policy moves by the US are part of a concerted effort to refocus international space cooperation towards short-term commercial interests, which could precipitate a “race to the bottom” that sabotages efforts to safely manage the development of space. Aaron Boley and Michael Byers at the University of British Columbia trace back the start of this push to the 2015 Commercial Space Launch Competitiveness Act, which gave US citizens and companies the right to own and sell space resources under US law. In April this year, President Trump doubled down with an executive order affirming the right to commercial space mining and explicitly rejecting the idea that space is a “global commons,” flying in the face of established international norms. Since then, NASA has announced that any countries wishing to partner on its forthcoming Artemis missions designed to establish a permanent human presence on the moon will have to sign bilateral agreements known as Artemis Accords. These agreements will enshrine the idea that commercial space mining will be governed by national laws rather than international ones, the authors write, and that companies can declare “safety zones” around their operations to exclude others. Speaking to Space.com Mike Gold, the acting associate administrator for NASA’s Office of International and Interagency Relations, disputes the authors’ characterization of the accords and says they are based on the internationally-recognized Outer Space Treaty. He says they don’t include agreement on national regulation of mining or companies’ rights to establish safety zones, though they do assert the right to extract and use space resources. But given that they’ve yet to be released or even finalized, it’s not clear how far these rights extend or how they are enshrined in the agreements. And the authors point out that the fact that they are being negotiated bilaterally means the US will be able to use its dominant position to push its interpretation of international law and its overtly commercial goals for space development. Space policy designed around the exploitation of resources holds many dangers, say the paper authors. For a start, loosely-regulated space mining could result in the destruction of deposits that could hold invaluable scientific information. It could also kick up dangerous amounts of lunar dust that can cause serious damage to space vehicles, increase the amount of space debris, or in a worst-case scenario, create meteorites that could threaten satellites or even impact Earth. By eschewing a multilateral approach to setting space policy, the US also opens the door to a free-for-all where every country makes up its own rules. Russia is highly critical of the Artemis Accords process and China appears to be frozen out of it, suggesting that two major space powers will not be bound by the new rules. That potentially sets the scene for a race to the bottom, where countries compete to set the laxest rules for space mining to attract investment. The authors call on other nations to speak up and attempt to set rules through the UN Committee on the Peaceful Uses of Outer Space. Writing in The Conversation, Scott Shackelford from Indiana University suggests a good model could be the 1959 Antarctic Treaty, which froze territorial claims and reserved the continent for “peaceful purposes” and “scientific investigation.” But the momentum behind the US’ push might be difficult to overcome. Last month, the agency announced it would pay companies to excavate small amounts of regolith on the moon. Boley and Byers admit that if this went ahead and was not protested by other nations, it could set a precedent in international law that would be hard to overcome. For better or worse, it seems that US dominance in space exploration means it’s in the driver’s seat when it comes to setting the rules. As they say, to the victor go the spoils.

#### That massively increases the risk of space debris, destroying critical satellites

Sarah Scoles 15, “Dust from asteroid mining spells danger for satellites,” New Scientist, 5-27-2015, https://www.newscientist.com/article/mg22630235-100-dust-from-asteroid-mining-spells-danger-for-satellites/

NASA chose the second option for its Asteroid Redirect Mission, which aims to pluck a boulder from an asteroid’s surface and relocate it to a stable orbit around the moon. But an asteroid’s gravity is so weak that it’s not hard for surface particles to escape into space. Now a new model warns that debris shed by such transplanted rocks could intrude where many defence and communication satellites live – in geosynchronous orbit. According to Casey Handmer of the California Institute of Technology in Pasadena and Javier Roa of the Technical University of Madrid in Spain, 5 per cent of the escaped debris will end up in regions traversed by satellites. Over 10 years, it would cross geosynchronous orbit 63 times on average. A satellite in the wrong spot at the wrong time will suffer a damaging high-speed collision with that dust. The study also looks at the “catastrophic disruption” of an asteroid 5 metres across or bigger. Its total break-up into a pile of rubble would increase the risk to satellites by more than 30 per cent (arxiv.org/abs/1505.03800). That may not have immediate consequences. But as Earth orbits get more crowded with spent rocket stages and satellites, we will have to worry about cascades of collisions like the one depicted in the movie Gravity. Handmer and Roa want to point out the problem now so that we can find a solution before any satellites get dinged. “It is possible to quantify and manage the risk,” says Handmer. “A few basic precautions will prevent harm due to stray asteroid material.”

#### Clustered asteroids makes the risk of asteroid collisions far more likely than estimated by conventional algorithms

Dr. Darren McKnight 17, Ph.D., Technical Director for Integrity Applications, Previously Senior Vice President and Director of Science and Technology Strategy at Science Applications International Corporation, “Proposed Series of Orbital Debris Remediation Activities,” 3rd International Conference and Exhibition on Satellite & Space Missions, 5/13/2017, https://iaaweb.org/iaa/Scientific%20Activity/debrisminutes03166.pdf [graphics omitted]

In the future, this population will be added to primarily from collisions between large objects in orbit as the number of LNT produced is proportional to the mass involved in a collision (or explosion).2 Cataloged debris produced from a catastrophic collision will be liberated at about 1-3 fragments per kilogram of mass involved while LNT production is around 10-40 fragments per kilogram of mass involved. The Iridium/Cosmos collision involved a total mass of 2,000kg and produced over 3,000 trackable fragments and likely 10,000-15,0003 LNT debris. The Feng-Yun purposeful collision yielded over 2,200 trackable fragments and likely over 30,000 LNT from only ~850kg of mass involved. While it is important to prevent these types of events from occurring in the future, the consequence of a collision (based on number of LNT produced) will be proportional to the mass involved in the collision. The term “mass involved” implies a good coupling of the impactor mass with the target mass. For a large fragment (e.g., several kilograms) striking a typical payload (that is densely built) in its main satellite body (vice striking a solar array or other appendage) at hypervelocity speeds (i.e., above 6km/s) will result in all the mass being “involved” in the debris. However, a large fragment striking a derelict rocket body, due to the way that the mass is concentrated at the ends of a rocket body, will likely not result in all of the mass being “involved” in the liberated debris. However, it is likely that when two large derelicts, either rocket bodies or payloads, collide with each other, then all of the mass will be involved due to the likely direct physical interaction between the mass. The table below summarizes the mass involvement scenarios which highlight why the massive-on-massive collisions are the focus of our analyses. Therefore, it is best to prevent the collision of the most massive objects with each other (higher consequence) and the ones that are the most likely (higher probability) since risk is probability multiplied by consequence. Our ability to model and predict the rate of collisions is based empirically upon only one catastrophic accidental collision event and a model developed on the kinetic theory of gases (KTG). However, clusters of massive objects that have identical inclinations plus similar and overlapping apogees/perigees may indeed have a greater probability of collision than predicted by the KTG-based algorithms as they are not randomly distributed and their orbital element evolution (e.g., change in right ascension of ascending node and argument of perigee) is also similar. It is hypothesized that these similarities could result in resonances of collision dynamics that may lead to larger probability of collision values than predicted with current algorithms. The not well-known fact is that many of the most massive objects are in tightly clumped clusters that will likely produce greater probability of collision than estimated by the KTG approach (see attached paper) and with the much larger consequence (i.e., creation of catalogued LNT fragments). The attached paper that studied this possibility shows some initial indications that this may indeed be true but much more analysis is needed to provide this conclusively. This table of clusters represents well over 50% of the total derelict mass in LEO. However, no one is currently monitoring these potential events. It is proposed that it would be a prudent risk management approach for space flight safety to monitor and characterize this inter-cluster collision risk. The Massive Collision Monitoring Activity (MCMA) is proposed whereby the encounters between members of these clusters are constantly monitored and close encounter information collected, plotted, analyzed, and shared. This would provide a rich research base for scientists and a predictive service for spacefaring countries. I am currently executing a subset of this proposed activity in an ad hoc fashion in conjunction with JSpOC. I have been monitoring the interaction dynamics between the SL-16 population in the 820- 865km altitude region for the last nine months.

#### Those cascades would destroy early warning satellites, leaving countries in the dark, forcing them to strike

Les Johnson 13, Deputy Manager for NASA's Advanced Concepts Office at the Marshall Space Flight Center, Co-Investigator for the JAXA T-Rex Space Tether Experiment and PI of NASA's ProSEDS Experiment, Master's Degree in Physics from Vanderbilt University, Popular Science Writer, and NASA Technologist, Frequent Contributor to the Journal of the British Interplanetary Sodety and Member of the American Institute of Aeronautics and Astronautics, National Space Society, the World Future Society, and MENSA, Sky Alert!: When Satellites Fail, p. 9-12 [language modified]

Whatever the initial cause, the result may be the same. A satellite destroyed in orbit will break apart into thousands of pieces, each traveling at over 8 km/sec. This virtual shotgun blast, with pellets traveling 20 times faster than a bullet, will quickly spread out, with each pellet now following its own orbit around the Earth. With over 300,000 other pieces of junk already there, the tipping point is crossed and a runaway series of collisions begins. A few orbits later, two of the new debris pieces strike other satellites, causing them to explode into thousands more pieces of debris. The rate of collisions increases, now with more spacecraft being destroyed. Called the "Kessler Effect", after the NASA scientist who first warned of its dangers, these debris objects, now numbering in the millions, cascade around the Earth, destroying every satellite in low Earth orbit. Without an atmosphere to slow them down, thus allowing debris pieces to bum up, most debris (perhaps numbering in the millions) will remain in space for hundreds or thousands of years. Any new satellite will be threatened by destruction as soon as it enters space, effectively rendering many Earth orbits unusable. But what about us on the ground? How will this affect us? Imagine a world that suddenly loses all of its space technology. If you are like most people, then you would probably have a few fleeting thoughts about the Apollo-era missions to the Moon, perhaps a vision of the Space Shuttle launching astronauts into space for a visit to the International Space Station (ISS), or you might fondly recall the "wow" images taken by the orbiting Hubble Space Telescope. In short, you would know that things important to science would be lost, but you would likely not assume that their loss would have any impact on your daily life. Now imagine a world that suddenly loses network and cable television, accurate weather forecasts, Global Positioning System (GPS) navigation, some cellular phone networks, on-time delivery of food and medical supplies via truck and train to stores and hospitals in virtually every community in America, as well as science useful in monitoring such things as climate change and agricultural sustainability. Add to this the [destruction] ~~crippling~~ of the US military who now depend upon spy satellites, space-based communications systems, and GPS to know where their troops and supplies are located at all times and anywhere in the world. The result is a nightmarish world, one step away from nuclear war, economic disaster, and potential mass starvation. This is the world in which we are now perilously close to living. Space satellites now touch our lives in many ways. And, unfortunately, these satellites are extremely vulnerable to risks arising from a half-century of carelessness regarding protecting the space environment around the Earth as well as from potential adversaries such as China, North Korea, and Iran. No government policy has put us at risk. It has not been the result of a conspiracy. No, we are dependent upon them simply because they offer capabilities that are simply unavailable any other way. Individuals, corporations, and governments found ways to use the unique environment of space to provide services, make money, and better defend the country. In fact, only a few space visionaries and futurists could have foreseen where the advent of rocketry and space technology would take us a mere 50 years since those first satellites orbited the Earth. It was the slow progression of capability followed by dependence that puts us at risk. The exploration and use of space began in 1957 with the launch of Sputnik 1 by the Soviet Union. The United States soon followed with Explorer 1. Since then, the nations of the world have launched over 8,000 spacecraft. Of these, several hundred are still providing information and services to the global economy and the world's governments. Over time, nations, corporations, and individuals have grown accustomed to the services these spacecraft provide and many are dependent upon them. Commercial aviation, shipping, emergency services, vehicle fleet tracking, financial transactions, and agriculture are areas of the economy that are increasingly reliant on space. Telestar 1, launched into space in the year of my birth, 1962, relayed the world's first live transatlantic news feed and showed that space satellites can be used to relay television signals, telephone calls, and data. The modern telecommunications age was born. We've come a long way since Telstar; most television networks now distribute most, if not ali, of their programming via satellite. Cable television signals are received by local providers from satellite relays before being sent to our homes and businesses using cables. With 65% of US households relying on cable television and a growing percentage using satellite dishes to receive signals from direct-to-home satellite television providers, a large number of people would be cut off from vital information in an emergency should these satellites be destroyed. And communications satellites relay more than television signals. They serve as hosts to corporate video conferences and convey business, banking, and other commercial information to and from all areas of the planet. The first successful weather satellite was TIROS. Launched in 1960, TIROS operated for only 78 days but it served as the precursor for today's much more long-lived weather satellites, which provide continuous monitoring of weather conditions around the world. Without them, providing accurate weather forecasts for virtually any place on the globe more than a day in advance would be nearly impossible. Figure !.1 shows a satellite image of Hurricane Ivan approaching the Alabama Gulf coast in 2004. Without this type of information, evacuation warnings would have to be given more generally, resulting in needless evacuations and lost economic activity (from areas that avoid landfall) and potentially increasing loss of life in areas that may be unexpectedly hit. The formerly top-secret Corona spy satellites began operation in 1959 and provided critical information about the Soviet Union's military and industrial capabilities to a nervous West in a time of unprecedented paranoia and nuclear risk. With these satellites, US military planners were able to understand and assess the real military threat posed by the Soviet Union. They used information provided by spy satellites to help avert potential military confrontations on numerous occasions. Conversely, the Soviet Union's spy satellites were able to observe the United States and its allies, with similar results. It is nearly impossible to move an army and hide it from multiple eyes in the sky. Satellite information is critical to all aspects of US intelligence and military planning. Spy satellites are used to monitor compliance with international arms treaties and to assess the military activities of countries such as China, Russia, Iran, and North Korea. Figure 1.2 shows the capability of modem unclassified space-based imaging. The capability of the classified systems is presumed to be significantly better, providing much more detail. Losing these satellites would place global militaries on high alert and have them operating, literally, in the blind. Our military would suddenly become vulnerable in other areas as well. GPS, a network of 24-32 satellites in medium-Earth orbit, was developed to provide precise position information to the military, and it is now in common use by individuals and industry. The network, which became fully operational in 1993, allows our armed forces to know their exact locations anywhere in the world. It is used to guide bombs to their targets with unprecedented accuracy, requiring that only one bomb be used to destroy a target that would have previously required perhaps hundreds of bombs to destroy in the pre-GPS world (which, incidentally, has resulted in us reducing our stockpile of non-GPS-guided munitions dramatically). It allows soldiers to navigate in the dark or in adverse weather or sandstorms. Without GPS, our military advantage over potential adversaries would be dramatically reduced or eliminated.

#### Additionally, satellites are key to environmental monitoring technology, crucial to the stability of our planet

Ben Biggs 18, PhD Researcher in Computer Vision and Deep Learning at the University of Cambridge, “How Satellites Can Protect Planet Earth From Disaster”, HowItWorks Daily, 12/22/2018, https://www.howitworksdaily.com/how-satellites-can-protect-planet-earth-from-disaster/

It might not look it, but our planet is a fragile place. A delicate balance of pressure, temperature and gases keeps us alive, as our atmosphere lets in enough heat for us to thrive – but not too much that we get too toasty. For many years our planet has looked after itself with ease. Now, with humans on the scene, things are changing more than ever, from climate change to mass deforestation. If our planet is going to survive long into the future it’s going to need our help. Fortunately, we’ve got plenty of missions that are working for the benefit of our world already. Using observation satellites in orbit, scientists have been monitoring Earth for decades, watching how the planet pulsates and changes over time. From orbit we can watch how species migrate, identify and predict environmental changes and even fix problems. A great example of this was the global effort to repair a hole in the ozone above the Antarctic back in 1987. Two years prior, scientists had discovered that chemicals known as chlorofluorocarbons (CFCs) – produced by fridges and aerosols, among other things – were causing the hole to grow. As a result countries around the world agreed to phase out the use of CFC as part of the Montreal Protocol. In early 2018, NASA announced that its Aura satellite had watched the hole successfully close, with it expected to fully repair as early as 2060. It was proof that we could work together to change the planet for the better. Aura is part of a broader NASA project called the Earth Observing System (EOS). This programme, which began in 1997, has seen NASA launch missions and instruments into orbit. This has included the groundbreaking Landsat series of satellites, which have provided surface images of the whole globe. Then there’s the Terra mission that launched in 2009 and studies clouds, sea ice and more from orbit. Most of these satellites are in polar orbits, which means they orbit the planet from top to bottom so that it rotates underneath and gives them a global view. Planning for the EOS began back in the 1980s, with NASA keen to regularly fly instruments for at least 15 years. “Human activity has altered the condition of the Earth by reconfiguring the landscape, by changing the composition of the global atmosphere, and by stressing the biosphere in countless ways,” they noted in a handbook in 1993. “There are strong indications that natural change is being accelerated by human intervention.” More than two dozen missions have been launched as part of the EOS to date. Among the programme’s many accomplishments, scientists watched as an ice shelf collapsed on the Antarctic Peninsula in 2002 using the Terra satellite. The same satellite, along with the Aqua satellite launched in 2002, has provided a global view of how the vegetation cycle changes over the course of a year and the effect the climate has on it. Those same two satellites have also allowed us to see how summer sea ice in the Arctic is decreasing, which means that more of the Sun’s light is being absorbed rather than being reflected, raising global temperatures. The EOS has helped in other ways too, such as enabling scientists to keep a close eye on the levels of toxic gases like carbon monoxide being emitted from massive fires in the atmosphere. This allows people on the ground to be alerted to these dangers, and they can in turn be advised to limit their outdoor activity to protect their health. The EOS is even helping to track and monitor rare animals, such as chameleons in Madagascar. Here, scientists have been able to use satellite imagery, combined with known habitats of the animals, to map out where they are likely to be living. It would take survey teams on the ground thousands of years to replicate this information without satellites. It’s not just NASA that has been keeping a close eye on the planet. The European Space Agency (ESA) runs the Copernicus project, billed as the world’s largest single Earth observation campaign. Previously known as the Global Monitoring for Environment and Security (GMES) programme, it began with the launch of the Sentinel-1A satellite in April 2014. This radar imaging satellite provides images both day and night and during all weather conditions, and these are being used to map sea ice, track oil spills and more. This has been followed by half a dozen more missions, with the latest – Sentinel-3B – launching on 25 April 2018. This mission is focusing on monitoring the behaviour and health of the oceans, but it has a wide range of abilities. It flies in formation with its predecessor, Sentinel-3A, and together the two of them can provide global data for Earth across an entire day. The satellites can measure the temperature over oceans, as well as the colour and height of the sea. They can also monitor wildfires from space, check the health of vegetation and map the way that land is being used around the world. And there are more Sentinel satellites on the way. In the coming years we’ll see the Sentinel-4 and Sentinel-5 missions launch, studying the composition of our planet’s atmosphere, while Sentinel-6 will measure global sea surface height for ocean and climate studies. “Copernicus will help shape the future of our planet for the benefit of all,” said the ESA, also noting that it isthe “most ambitious Earth observation programme to date,” one that will provide accurate and timely data on the environment, climate change and more. All of this data is vital for directing climate policy and other human activities on Earth. By observing our planet around the clock from space we can see the direct effect that humans are having on it. These are not the only climate-monitoring missions run by NASA and the ESA. The former has a number of other missions, including the Deep Space Climate Observatory, which observes the sunlit side of Earth. The latter has eight missions on the books in its Earth Explorer programme, including a mission to study how Earth’s gravity field varies over the surface of the planet, called the Gravity field and steady-state Ocean Circulation Explorer (GOCE), which ended in 2013. In 2016, countries of the world came together to sign the Paris Climate Agreement, a global effort to reduce carbon emissions to prevent the global average temperature rising by two degrees Celsius above pre-industrial levels. While the US later infamously reneged from this agreement, it was proof that with enough level-headed minds, minds that can see the data from missions showing how the planet is changing, we can take action. Humans continue to have a major effect on the planet, for better or worse, and monitoring that change is vital to our planet’s survival.

#### Finally, unregulated mining causes space war

Fengna Xu 20, Law School, Xi’an Jiaotong University, “The approach to sustainable space mining: issues, challenges, and solutions,” Fengna Xu 2020 IOP Conf. Ser.: Mater. Sci. Eng. 738 012014

3.1. Conflicts between multiple States Space resources, as res communis [3], can be appropriated to some extent on the basis of freedom of exploration and use of the outer space. However, it is likely to follow a ‘first come, first served’ approach to space resources activities. In fact, the ‘first come, first served’ approach drove early and rapid development of oil industry of the US in the 19th century, although a frenetic race among surface owners followed and led to an extraordinary waste of oil and gas. Given that so far there are no agreement or property rights on space resources, they are essentially in a ‘state of nature’. Allocation by the ‘first come, first served’ approach is simple and requires very little government involvement to deter another one (called a ‘junior’) from displacing the rightful first comer (called a ‘senior’). However, overprotecting the senior by priority rights could run the risk of disorder, waste, inequality, and even monopoly. The Outer Space Treaty, requires State parties to conduct all their activities in outer space ‘with due regard to the corresponding interests of all other States Parties’. Without specific coordinating rules, conflicts between multiple States are likely to happen. Private entities may choose to arm themselves to safeguard their own interests. In extreme cases, States may also protect them by placing weapons of mass destruction in outer snpace if necessary [4]. As a result, priority rights should not be absolute but subjected to some arrangements. 7

#### Those conflicts ensure escalation -- Space is a fragile and offense dominant regime which ensures that countries will go up the escalation ladders

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Why space is a particular problem for crisis stability

For a number of reasons, space poses particular challenges in preventing a crisis from starting or from being managed well. Some of these are to do with the physical nature of space, such as the short timelines and difficulty of attribution inherent in space operations. Some are due to the way space is used, such as the entanglement of strategic and tactical missions and the prevalence of dual-use technologies. Some are due to the history of space, such the absence of a shared understanding of appropriate behaviors and consequences, and a dearth of stabilizing personal and institutional relationships. While some of these have terrestrial equivalents, taken together, they present a special challenge.

The vulnerability of satellites and first strike incentives

Satellites are inherently fragile and difficult to protect; in the language of strategic planners, space is an “offense-dominant” regime. This can lead to a number of pressures to strike first that don‘t exist for other, better-protected domains. Satellites travel on predictable orbits, and many pass repeatedly over all of the earth‘s nations. Low-earth orbiting satellites are reachable by missiles much less capable than those needed to launch satellites into orbit, as well as by directed energy which can interfere with sensors or with communications channels. Because launch mass is at a premium, satellite armor is impractical. Maneuvers on orbit need costly amounts of fuel, which has to be brought along on launch, limiting satellites‘ ability to move away from threats. And so, these very valuable satellites are also inherently vulnerable and may present as attractive targets.

Thus, an actor with substantial dependence on space has an incentive to strike first if hostilities look probable, to ensure these valuable assets are not lost. Even if both (or all) sides in a conflict prefer not to engage in war, this weakness may provide an incentive to approach it closely anyway.

A RAND Corporation monograph commissioned by the Air Force15 described the issue this way:

First-strike stability is a concept that Glenn Kent and David Thaler developed in 1989 to examine the structural dynamics of mutual deterrence between two or more nuclear states.16 It is similar to crisis stability, which Charles Glaser described as ―a measure of the countries‘ incentives not to preempt in a crisis, that is, not to attack first in order to beat the attack of the enemy,‖17 except that it does not delve into the psychological factors present in specific crises. Rather, first strike stability focuses on each side‘s force posture and the balance of capabilities and vulnerabilities that could make a crisis unstable should a confrontation occur.

For example, in the case of the United States, the fact that conventional weapons are so heavily dependent on vulnerable satellites may create incentives for the US to strike first terrestrially in the lead up to a confrontation, before its space-derived advantages are eroded by anti-satellite attacks.18 Indeed, any actor for which satellites or space-based weapons are an important part of its military posture, whether for support missions or on-orbit weapons, will feel “use it or lose it” pressure because of the inherent vulnerability of satellites.

Short timelines and difficulty of attribution

The compressed timelines characteristic of crises combine with these “use it or lose it” pressures to shrink timelines. This dynamic couples dangerously with the inherent difficulty of determining the causes of satellite degradation, whether malicious or from natural causes, in a timely way.

Space is a difficult environment in which to operate. Satellites orbit amidst increasing amounts of debris. A collision with a debris object the size of a marble could be catastrophic for a satellite, but objects of that size cannot be reliably tracked. So a failure due to a collision with a small piece of untracked debris may be left open to other interpretations. Satellite electronics are also subject to high levels of damaging radiation. Because of their remoteness, satellites as a rule cannot be repaired or maintained. While on-board diagnostics and space surveillance can help the user understand what went wrong, it is difficult to have a complete picture on short timescales. Satellite failure on-orbit is a regular occurrence19 (indeed, many satellites are kept in service long past their intended lifetimes).

In the past, when fewer actors had access to satellite-disrupting technologies, satellite failures were usually ascribed to “natural” causes. But increasingly, even during times of peace operators may assume malicious intent. More to the point, in a crisis when the costs of inaction may be perceived to be costly, there is an incentive to choose the worst-case interpretation of events even if the information is incomplete or inconclusive.

Entanglement of strategic and tactical missions

During the Cold War, nuclear and conventional arms were well separated, and escalation pathways were relatively clear. While space-based assets performed critical strategic missions, including early warning of ballistic missile launch and secure communications in a crisis, there was a relatively clear sense that these targets were off limits, as attacks could undermine nuclear deterrence. In the Strategic Arms Limitation Treaty, the US and Soviet Union pledged not to interfere with each other‘s ―national technical means‖ of verifying compliance with the agreement, yet another recognition that attacking strategically important satellites could be destabilizing.20 There was also restraint in building the hardware that could hold these assets at risk.

However, where the lines between strategic satellite missions and other missions are blurred, these norms can be weakened. For example, the satellites that provide early warning of ballistic missile launch are associated with nuclear deterrent posture, but also are critical sensors for missile defenses. Strategic surveillance and missile warning satellites also support efforts to locate and destroy mobile conventional missile launchers. Interfering with an early warning sensor satellite might be intended to dissuade an adversary from using nuclear weapons first by degrading their missile defenses and thus hindering their first-strike posture. However, for a state that uses early warning satellites to enable a “hair trigger” or launch-on-attack posture, the interference with such a satellite might instead be interpreted as a precursor to a nuclear attack. It may accelerate the use of nuclear weapons rather than inhibit it.

Misperception and dual-use technologies

Some space technologies and activities can be used both for relatively benign purposes but also for hostile ones. It may be difficult for an actor to understand the intent behind the development, testing, use, and stockpiling of these technologies, and see threats where there are none. (Or miss a threat until it is too late.) This may start a cycle of action and reaction based on misperception. For example, relatively low-mass satellites can now maneuver autonomously and closely approach other satellites without their cooperation; this may be for peaceful purposes such as satellite maintenance or the building of complex space structures, or for more controversial reasons such as intelligence-gathering or anti-satellite attacks.

Ground-based lasers can be used to dazzle the sensors of an adversary‘s remote sensing satellites, and with sufficient power, they may damage those sensors. The power needed to dazzle a satellite is low, achievable with commercially available lasers coupled to a mirror which can track the satellite. Laser ranging networks use low-powered lasers to track satellites and to monitor precisely the Earth‘s shape and gravitational field, and use similar technologies. 21

Higher-powered lasers coupled with satellite-tracking optics have fewer legitimate uses. Because midcourse missile defense systems are intended to destroy long-range ballistic missile warheads, which travel at speeds and altitudes comparable to those of satellites, such defense systems also have inherent ASAT capabilities. In fact, while the technologies being developed for long-range missile defenses might not prove very effective against ballistic missiles—for example, because of the countermeasure problems associated with midcourse missile defense— they could be far more effective against satellites. This capacity is not just theoretical. In 2007, China demonstrated a direct-ascent anti-satellite capability which could be used both in an ASAT and missile defense role, and in 2009, the United States used a ship-based missile defense interceptor to destroy a satellite, as well. US plans indicated a projected inventory of missile defense interceptors with capability to reach all low earth orbiting satellites in the dozens in the 2020s, and in the hundreds by 2030.22

Discrimination

The consequences of interfering with a satellite may be vastly different depending on who is affected and how, and whether the satellite represents a legitimate military objective.

However, it will not always be clear who the owners and operators of a satellite are, and users of a satellite‘s services may be numerous and not public. Registration of satellites is incomplete23 and current ownership is not necessarily updated in a readily available repository. The identification of a satellite as military or civilian may be deliberately obscured. Or its value as a military asset may change over time; for example, the share of capacity of a commercial satellite used by military customers may wax and wane. A potential adversary‘s satellite may have different or additional missions that are more vital to that adversary than an outsider may perceive. An ASAT attack that creates persistent debris could result in significant collateral damage to a wide range of other actors; unlike terrestrial attacks, these consequences are not limited geographically, and could harm other users unpredictably.

In 2015, the Pentagon‘s annual wargame, or simulated conflict, involving space assets focused on a future regional conflict. The official report out24 warned that it was hard to keep the conflict contained geographically when using anti-satellite weapons:

As the wargame unfolded, a regional crisis quickly escalated, partly because of the interconnectedness of a multi-domain fight involving a capable adversary. The wargame participants emphasized the challenges in containing horizontal escalation once space control capabilities are employed to achieve limited national objectives.

Lack of shared understanding of consequences/proportionality

States have fairly similar understandings of the implications of military actions on the ground, in the air, and at sea, built over decades of experience. The United States and the Soviet Union/Russia have built some shared understanding of each other‘s strategic thinking on nuclear weapons, though this is less true for other states with nuclear weapons. But in the context of nuclear weapons, there is an arguable understanding about the crisis escalation based on the type of weapon (strategic or tactical) and the target (counterforce—against other nuclear targets, or countervalue—against civilian targets).

Because of a lack of experience in hostilities that target space-based capabilities, it is not entirely clear what the proper response to a space activity is and where the escalation thresholds or “red lines” lie. Exacerbating this is the asymmetry in space investments; not all actors will assign the same value to a given target or same escalatory nature to different weapons.