# R2 – PALM CLASSIC – 1NC

## 1

#### Interpretation – Unjust refers to a negative action – it means contrary.

Black Laws ND "What is Unjust?" <https://thelawdictionary.org/unjust/> //Elmer

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

#### Violation – The Aff is a positive action – \_\_\_\_\_\_

#### Standards –

#### 1 - Limits – making the topic bi-directional explodes predictability – it means that Aff’s can both increase non-exist property regimes in space AND decrease appropriation by private actors – makes the topic untenable.

#### 2 - Ground – wrecks Neg Generics – we can’t say appropriation good since the 1AC can create new views on Outer Space Property Rights that circumvent our Links since they can say “Global Commons” approach solves.

#### 3 - TVA – just defend that space appropriation is bad and spec.

#### Paradigm:

#### Fairness – Debate is a competitive activity governed by rules. You can’t evaluate who did better debating if the round is structurally skewed, so fairness is a gateway to substantive debate.

#### DTD – Time spent on theory cant be compensated for, the 1nc was already skewed, and its key to deterring abuse.

#### Prefer Competing interps -

#### 1. reasonability is arbitrary and invites judge intervention.

#### 2. it Causes a race to the bottom where debaters push the limit as to how reasonably abusive, they can be.

#### No RVI’s -

#### 1. Chills some debaters from reading theory against abusive postions.

#### 2. incentivizes theory baiting where you can just bait theory to win.

## 2

#### CP Text: The Committee on the Peaceful use of Outer Space should establish an application system for property rights on celestial bodies. Applications and approval of property rights should be granted upon the condition of

#### open disclosure of data gathered in the exploration of a celestial body

#### Applications must be publicly announced

#### Property Rights will be made tradeable between private entities

#### Property Rights will be set to expire on the conclusion of a successful extraction mission

#### Private Entities will only be allowed one property right grant per celestial body and cannot have more than one grant at a time

#### Ban the militarization of outer space

#### The CP establishes international norms for safe extraction of resources on celestial bodies while increasing R&D in outer space.

**Steffen 21** [Olaf Steffen, Olaf is a scientist at the Institute of Composite Structures and Adaptive Sytems at the German Aerospace Center. 12-2-2021, "Explore to Exploit: A Data-Centred Approach to Space Mining Regulation," Institute of Composite Structures and Adaptive Systems, German Aerospace Center, [https://www.sciencedirect.com/science/article/pii/S0265964621000515 accessed 12/12/21](https://www.sciencedirect.com/science/article/pii/S0265964621000515%20accessed%2012/12/21)] Adam

The data gathered in the exploration of a [celestial body](https://www.sciencedirect.com/topics/social-sciences/astronomical-systems) is not only of value for space mining companies for informing them whether, where and how to exploit resources from the body in question, but also for science. The irretrievability of information relating to the solar system contained in the body that will be lost during resource exploitation carries a value for humanity and future generations and can thus be assigned the characteristic of a common heritage for all mankind as invoked in the Moon Agreement. This characteristic makes exploration data an exceptional and unique candidate for use in a mechanism for acquiring mining rights because its preservation is of public interest and its disclosure in exchange for exclusive mining rights does not place any additional burden on the mining company. The following principles would form the cornerstones of the proposed regulatory regime and rights acquisition mechanism based on exploration data: Without preconditions, no entity has a right to mine the resources of a celestial body. An international regulatory body administers the existing rights of companies for mining a specific celestial body. Mining rights to such bodies can be applied for from this international regulatory body, with applications made public. The application expires after a pre-set period. Mining rights are granted on the provision and disclosure of exploration data on the celestial body within the pre-set period, proposedly gathered in situ, characterising this body and its resources in a pre-defined manner. The explorer's mining right to the resources of the celestial body is published by the regulatory body in a mining rights grant. The data concerning the celestial body are made public as part of the rights grant within the domain of all participating members of the regulatory regime. The exclusive mining rights to any specific body are tradeable. The scope of the regulatory body with respect to the granting of mining rights is not revenue-oriented. The international regulatory body would thus act as a curator of a rights register and an attached database of exploration data. The concept is superficially comparable to patent law, where exclusive rights are granted following the disclosure of an invention to incentivise the efforts made in the development process. In the following section, the characteristics of such a regulatory regime are further discussed with respect to the formation of [monopolies](https://www.sciencedirect.com/topics/social-sciences/monopolies), market dynamics, conflict avoidance, inclusivity towards less developed countries and the viability of implementation. 4.2. Discussion and means of implementation The proposed regulatory mechanism has advantages both from a business/investor and society perspective. First, it prevents already highly capitalised companies from acquiring exploitation rights in bulk to deny competitors those objects that are easiest to exploit or most valuable, which would otherwise be possible in any kind of pay-for-right mechanism and could result in preventing market access to smaller, emerging companies. Thus, early monopoly formation can be avoided. The use of data disclosure for the granting of mining rights ensures the scientific community has access to this invaluable source of information. In this way, space mining prospecting missions can lead to a boost in research on small celestial bodies at a speed unmatchable by pure government/agency funded science probes. This usefulness to the scientific community could lead to sustained partnerships between prospecting companies and scientific institutions and could even provide a source of funding for the companies through R&D grants and public-private partnerships. The results of the exploration efforts contribute to research on the formation of planets and the history of the solar system and provide valuable insight for space defence against asteroids. The transition of exploration from a tailored mission profile with a purpose-built spacecraft to a standard task in space flight would also lead to a cost reduction of the respective exploration spacecraft through [economies of scale](https://www.sciencedirect.com/topics/social-sciences/economies-of-scale). This describes the very benefits Elvis [[24](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib24)] and Crawford [[25](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib25)] imagined as possible effects of a space economy. Thus, there is an immediate return for society from the exploitation rights grant. It also reconciles the adverse interests of space development and [space science](https://www.sciencedirect.com/topics/social-sciences/space-sciences) as laid out by Schwartz [[26](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib26)]. It ensures that, by exploitation, information contained in celestial bodies is not lost for future generations.The application period should not be set in a manner that creates a situation that can be abused through the potential for stockpiling inventory rights. Rather, it is intended to prevent conflict in the phase before exploration data gathered by a mission, as a prerequisite to the mining rights grant, is available. In other words, only one exploration effort at a time can be permitted for a specific body. The time frame between the application and the granting of mining rights (meaning: availability of the required exploration data set) should be tight and should only consider necessary exploration time on site, transit time and possibly a reasonable launch preparation and data processing markup. These contributors to the application period make it clear that the time frame could be dynamic and individualistic, depending on the exploration target (transit time and duration of exploration) and the technology of the exploration probe (transit time). After the expiration of the application period, applications for the exploration target would again be permissible. To prevent the previously mentioned stockpiling of inventory rights, credible proof of an imminent exploration intention would need to be part of the application process, for example, a fixed launch contract or the advanced build status of the exploration probe. Such a mechanism would not contradict the statement in the OST that outer space shall be free for both exploration and scientific investigation. Applications would not apply to purely scientific exploration. An application would only be necessary as a prerequisite for mining. Even resource prospecting could take place without an application (for whatever reason), with a subsequent application comprising in situ data already gathered. For such cases, the application process would need to provide a short period for objections to enable the secretive explorer to make their efforts public. The publication of the application for the mining rights, which is nothing more than a statement of intention to explore, thus provides a strong measure for avoiding conflict. The transparency of where exploration spacecraft are located and, at a later stage, where mining activities take place, provides additional benefits for the sustainable use of space, trust building and deterrence against malign misuse of mining technology. Involuntary spacecraft collisions of competitors in deep space are prevented by the reduction of exploration efforts at the same destination through the application for mining rights by one applicant at a time. As pointed out by Newman and Williamson [[20](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib20)], this is relevant because space debris does not de-orbit in deep space as in the case of LEO. Deep space may be vast, but the velocities involved mean that small debris particles are no less dangerous. Considering NEO mining with fleets of small spacecraft, malfunctions and/or destructive events could create debris clouds crossing Earth's orbit around the sun on a regular basis, presenting another danger to satellites in Earth's own orbit. Thus, by effectively preventing the collision of two spacecraft, one source of debris creation can be mitigated through this regulation mechanism. With respect to Deudney's [[11](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib11)] scepticism of asteroid mining and the dual-use character of technology to manipulate orbits of celestial bodies, it has to be stated that this potential is truly inherent to asteroid mining. An asteroid redirect mission for scientific purposes was pursued by NASA [[49](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib49)] before reorientation towards a manned lunar mission. In one way or another, each type of asteroid mining will require the delivery of the targeted resource to a destination via a comparable technology as formerly envisioned by NASA, be it as a raw material or a useable resource processed in situ, even if this is not necessarily done through redirecting the whole asteroid and placing it in a lunar orbit. However, to be misused as a weapon, space mined resources would have to surpass a certain mass threshold to survive atmospheric entry at the target. This seems unfeasible for currently discussed mining concepts using small-scale spacecraft as described in this article. Redirecting larger masses or whole asteroids would require far more powerful mining vessels or small amounts of thrust over long periods of time. The continuous, (for a mining activity) untypical change in the orbit of an asteroid would make a redirect attempt with hostile intent easily identifiable, effectively deterring such an activity in the first place by ensuring the identification of the aggressor long before the projectile hits its target. The proposed database would provide a catalogue of asteroids with exploration and mining activities in place that should be tracked more closely because of their interaction with spacecraft. This would, in fact, be necessary per se as a precaution to avoid catastrophic mishaps, such as the accidental change of a NEO's orbit to intercept Earth by changing its mass through mining.

#### Space mining fails now due to profitability and unsafe tech which only the CP solves.

**Steffen 21** [Olaf Steffen, Olaf is a scientist at the Institute of Composite Structures and Adaptive Sytems at the German Aerospace Center. 12-2-2021, "Explore to Exploit: A Data-Centred Approach to Space Mining Regulation," Institute of Composite Structures and Adaptive Systems, German Aerospace Center, [https://www.sciencedirect.com/science/article/pii/S0265964621000515 accessed 12/12/21](https://www.sciencedirect.com/science/article/pii/S0265964621000515%20accessed%2012/12/21)] Adam

* answers timeframe deficits
* creates solvency vs inequality/developing nation affs

The data-driven mechanism also addresses another potential risk of an emerging space-based resource economy: the reinforcing of the incontestable market positions of the market leaders based on an advantage in knowledge unattainable by new competitors. Explorations of celestial bodies will have a likelihood of failing from the perspective of the actual value of the explored object vs. the expected value. In this case, the costs of exploration would be a loss for the company, which could be significant and possibly ruinous considering the budgets needed for contemporary space agency-led exploration missions. Sanchez and McInnes [[5](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib5)] explicitly mention the uncertainties in object distribution models used in their asteroid distribution study and for the conclusions drawn concerning reachable object masses with certain delta-v capabilities of spacecraft. With an increasing number of exploration missions led by a company, the data collected may lead to better in-house models and a higher probability of exploring the ‘right’ body for the value/resources aimed at. This may even provide information on the best spacecraft designs for matching the targeted objects’ orbit distribution. This risk is known from the digital platform economy, where the companies that are now leading have an uncatchable advantage in user data compared with market newcomers, translatable to a more refined and comfortable user experience, attracting additional users and thus offering superior services to business customers. This also holds true for space mining companies. Through their lack of legacy mission data, market newcomers would have a higher risk of misallocating exploration missions, making investments in those companies riskier than in established companies. To avoid the preferred investment in a single or a few companies, the risk of the investment in emerging companies is reduced by the proposed mechanism by ensuring the equal access to data for market newcomers and established companies alike. From a prospecting risk perspective, the market entrance of a new company becomes progressively less risky for investors with increasing amounts of publicly available exploration data, promoting progressive and dynamic development.

The long lead times of asteroid mining ventures coincide with a long time frame for an ROI. The exclusive mining rights granted after the exploration phase give investors security half-way into their space mining endeavours. The proposed tradability of the rights offers an early chance of gaining investment proceeds. It also offers the possibility of new business models: the classical asteroid mining system concept, as shown by Andrews et al. [[43](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib43)], for example, covers exploration, exploitation and resource transfer. This maximises the investment needed to develop the technologies required for the entire process chain. Giving exploration a value could lead to a division of labour. Dedicated prospecting companies could emerge, providing mining companies with the data and mining rights to a body with the specific resource profile they are seeking. In this way, the investment needed for a successful mining endeavour is divided between different specialised companies. This considerably reduces the risk for investors as well as the investment needed for a company to meet their business goals, which are now aimed at just a particular part of the overall space mining endeavour. Third-party applications for mining rights should be possible to allow a mining company to subcontract to exploration companies. Such a regulatory mechanism design would also be more easily inclusive of less developed countries. They could simply contract exploration missions made affordable through economies of scale to become part of the emerging space mining economy as holders of tradeable mining rights. Through a wise selection of such missions’ targets, they could gain powerful positions of influence.

#### Commercial mining solves extinction from scarcity, climate, terror, war, and disease.

Pelton 17—(Director Emeritus of the Space and Advanced Communications Research Institute at George Washington University, PHD in IR from Georgetown).. Pelton, Joseph N. 2017. The New Gold Rush: The Riches of Space Beckon! Springer. Accessed 8/30/19.

Are We Humans Doomed to Extinction? What will we do when Earth’s resources are used up by humanity? The world is now hugely over populated, with billions and billions crammed into our overcrowded cities. By 2050, we may be 9 billion strong, and by 2100 well over 11 billion people on Planet Earth. Some at the United Nations say we might even be an amazing 12 billion crawling around this small globe. And over 80 % of us will be living in congested cities. These cities will be ever more vulnerable to terrorist attack, natural disaster, and other plights that come with overcrowding and a dearth of jobs that will be fueled by rapid automation and the rise of artifi cial intelligence across the global economy. We are already rapidly running out of water and minerals. Climate change is threatening our very existence. Political leaders and even the Pope have cautioned us against inaction. Perhaps the naysayers are right. All humanity is at tremendous risk. Is there no hope for the future? This book is about hope. We think that there is literally heavenly hope for humanity. But we are not talking here about divine intervention. We are envisioning a new space economy that recognizes that there is more water in the skies that all our oceans. Th ere is a new wealth of natural resources and clean energy in the reaches of outer space—more than most of us could ever dream possible. There are those that say why waste money on outer space when we have severe problems here at home? Going into space is not a waste of money. It is our future. It is our hope for new jobs and resources. The great challenge of our times is to reverse public thinking to see space not as a resource drain but as the doorway to opportunity. The new space frontier can literally open up a “gold rush in the skies.” In brief, we think there is new hope for humanity. We see a new a pathway to the future via new ventures in space. For too long, space programs have been seen as a money pit. In the process, we have overlooked the great abundance available to us in the skies above. It is important to recognize there is already the beginning of a new gold rush in space—a pathway to astral abundance. “New Space” is a term increasingly used to describe radical new commercial space initiatives—many of which have come from Silicon Valley and often with backing from the group of entrepreneurs known popularly as the “space billionaires.” New space is revolutionizing the space industry with lower cost space transportation and space systems that represent significant cost savings and new technological breakthroughs. “New Commercial Space” and the “New Space Economy” represent more than a new way of looking at outer space. These new pathways to the stars could prove vital to human survival. If one does not believe in spending money to probe the mysteries of the universe then perhaps we can try what might be called “calibrated greed” on for size. One only needs to go to a cubesat workshop, or to Silicon Valley or one of many conferences like the “Disrupt Space” event in Bremen, Germany, held in April 2016 to recognize that entrepreneurial New Space initiatives are changing everything [ 1 ]. In fact, the very nature and dimensions of what outer space activities are today have changed forever. It is no longer your grandfather’s concept of outer space that was once dominated by the big national space agencies. The entrepreneurs are taking over. The hopeful statements in this book and the hard economic and technical data that backs them up are more than a minority opinion. It is a topic of growing interest at the World Economic Forum, where business and political heavyweights meet in Davos, Switzerland, to discuss how to stimulate new patterns of global economic growth. It is even the growing view of a group that call themselves “space ethicists.” Here is how Christopher J. Newman, at the University of Sunderland in the United Kingdom has put it: Space ethicists have offered the view that space exploration is not only desirable; it is a duty that we, as a species, must undertake in order to secure the survival of humanity over the longer term. Expanding both the resource base and, eventually, the habitats available for humanity means that any expenditure on space exploration, far from being viewed as frivolous, can legitimately be rationalized as an ethical investment choice. (Newman) On the other hand there are space ethicists and space exobiologists who argue that humans have created ecological ruin on the planet—and now space debris is starting to pollute space. Th ese countervailing thoughts by the “no growth” camp of space ethicists say we have no right to colonize other planets or to mine the Moon and asteroids—or at least no right to do so until we can prove we can sustain life here on Earth for the longer term. However, for most who are planning for the new space economy the opinion of space philosophers doesn’t really fl oat their boat. Legislators, bankers, and aspiring space entrepreneurs are far more interested in the views of the super-rich capitalists called the space billionaires. A number of these billionaires and space executives have already put some very serious money into enterprises intent on creating a new pathway to the stars. No less than five billionaires with established space ventures—Elon Musk, Paul Allen, Jeff Bezos, Sir Richard Branson, and Robert Bigelow—have invested millions if not billions of dollars into commercializing space. They are developing new technologies and establishing space enterprises that can bring the wealth of outer space down to Earth. This is not a pipe dream, but will increasingly be the economic reality of the 2020s. These wealthy space entrepreneurs see major new economic opportunities. To them space represents the last great frontier for enterprising pioneers. Th us they see an ever-expanding space frontier that offers opportunities in low-cost space transportation, satellite solar power satellites to produce clean energy 24h a day, space mining, space manufacturing and production, and eventually space habitats and colonies as a trajectory to a better human future. Some even more visionary thinkers envision the possibility of terraforming Mars, or creating new structures in space to protect our planet from cosmic hazards and even raising Earth’s orbit to escape the rising heat levels of the Sun in millennia to come. Some, of course, will say this is sci-fi hogwash. It can’t be done. We say that this is what people would have said in 1900 about airplanes, rocket ships, cell phones and nuclear devices. The skeptics laughed at Columbus and his plan to sail across the oceans to discover new worlds. When Thomas Jefferson bought the Louisiana Purchase from France or Seward bought Alaska, there were plenty of naysayers that said such investment in the unknown was an extravagant waste of money. A healthy skepticism is useful and can play a role in economic and business success. Before one dismisses the idea of an impending major new space economy and a new gold rush, it might useful to see what has already transpired in space development in just the past five decades. The world’s first geosynchronous communications satellite had a throughput capability of about 500 kb / s. In contrast, today’s state of the art Viasat 2 —a half century later— has an impressive throughput of some 140 Gb/s. Th is means that the relative throughput is nearly 300,000 greater, while its lifetime is some ten times longer (Figs. 1.1 and 1.2 ). Each new generation of communications satellite has had more power, better antenna systems, improved pointing and stabilization, and an extended lifetime. And the capabilities represented by remote sensing satellites , meteorological satellites , and navigation and timing satellites have also expanded their capabilities and performance in an impressive manner. When satellite applications first started, the market was measured in millions of dollars. Today commercial satellite services exceed a quarter of a billion dollars. Vital services such as the Internet, aircraft traffi c control and management, international banking, search and rescue and much, much more depend on application satellites. Th ose that would doubt the importance of satellites to the global economy might wish to view on You Tube the video “If Th ere Were a Day Without Satellites?” [ 2 ]. Let’s check in on what some of those very rich and smart guys think about the new space economy and its potential. (We are sorry to say that so far there are no female space billionaires, but surely this, too, will come someday soon.) Of course this twenty-fi rst century breakthrough that we call the New Space economy will not come just from new space commerce. It will also come from the amazing new technologies here on Earth. Vital new terrestrial technologies will accompany this cosmic journey into tomorrow. Information technology, robotics, artificial intelligence and commercial space travel systems have now set us on a course to allow us humans to harvest the amazing riches in the skies—new natural resources, new energy, and even totally new ways of looking at the purpose of human existence. If we pursue this course steadfastly, it can be the beginning of a New Space renaissance. But if we don’t seek to realize our ultimate destiny in space, Homo sapiens can end up in the dustbin of history—just like literally millions of already failed species. In each and every one of the five mass extinction events that have occurred over the last 1.5 billion years on Earth, some 50–80 % of all species have gone the way of the T. Rex, the woolly mammoth, and the Dodo bird along with extinct ferns, grasses and cacti. On the other hand, the best days of the human race could be just beginning. If we are smart about how we go about discovering and using these riches in the skies and applying the best of our new technologies, it could be the start of a new beginning for humanity. Konstantin Tsiokovsky, the Russian astronautics pioneer, who fi rst conceived of practical designs for spaceships, famously said: “A planet is the cradle of mankind, but one cannot live in a cradle forever.” Well before Tsiokovsky another genius, Leonardo da Vinci, said, quite poetically: “Once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return.” The founder of the X-Prize and of Planetary Resources, Inc., Dr. Peter Diamandis, has much more brashly said much the same thing in quite diff erent words when he said: “The meek shall inherit the Earth. The rest of us will go to Mars.” The New Space Billionaires Peter Diamandis is not alone in his thinking. From the list of “visionaries” quoted earlier, Elon Musk, the founder of SpaceX; Sir Richard Branson, the founder of Virgin Galactic; and Paul Allen, the co-founder of Microsoft and the man who financed SpaceShipOne, the world’s first successful spaceplane have all said the future will include a vibrant new space economy. Th ey, and others, have said that we can, we should and we soon shall go into space and realize the bounty that it can offer to us. Th e New Space enterprise is today indeed being led by those so-called space billionaires , who have an exciting vision of the future. They and others in the commercial space economy believe that the exploitation of outer space may open up a new golden age of astral abundance. They see outer space as a new frontier that can be a great source of new materials, energy and various forms of new wealth that might even save us from excesses of the past. Th is gold rush in the skies represents a new beginning. We are not talking about expensive new space ventures funded by NASA or other space agencies in Europe, Japan, China or India. No, these eff orts which we and others call New Space are today being forged by imaginative and resourceful commercial entrepreneurs. Th ese twenty-fi rst century visionaries have the fortitude and zeal to look to the abundance above. New breakthroughs in technology and New Space enterprises may be able to create an “astral life raft” for humanity. Just as Columbus and the Vikings had the imaginative drive that led them to discover the riches of a new world, we now have a cadre of space billionaires that are now leading us into this New Space era of tomorrow. These bold leaders, such as Paul Allen and Sir Richard Branson, plus other space entrepreneurs including Jeff Bezos of Amazon and Blue Origin, and Robert Bigelow, Chairman of Budget Suites and Bigelow Aerospace, not only dream of their future in the space industry but also have billions of dollars in assets. These are the bright stars of an entirely new industry that are leading us into the age of New Space commerce. These space billionaires, each in their own way, are proponents of a new age of astral abundance. Each of them is launching new commercial space industries. They are literally transforming our vision of tomorrow. These new types of entrepreneurial aerospace companies—the New Space enterprises—give new hope and new promise of transforming our world as we know it today. The New Space Frontier What happens in space in the next few decades, plus corresponding new information technologies and advanced robotics, will change our world forever. These changes will redefi ne wealth, change our views of work and employment and upend almost everything we think we know about economics, wealth, jobs, and politics. Th ese changes are about truly disruptive technologies of the most fundamental kinds. If you thought the Internet, smart phones, and spandex were disruptive technologies, just hang on. You have not seen anything yet. In short, if you want to understand a transition more fundamental than the changes brought to the twentieth century world by computers, communications and the Internet, then read this book. There are truly riches in the skies. Near-Earth asteroids largely composed of platinum and rare earth metals have an incredible value. Helium-3 isotopes accessible in outer space could provide clean and abundant energy. There is far more water in outer space than is in our oceans. In the pages that follow we will explain the potential for a cosmic shift in our global economy, our ecology, and our commercial and legal systems. These can take place by the end of this century. And if these changes do not take place we will be in trouble. Our conventional petro-chemical energy systems will fail us economically and eventually blanket us with a hydrocarbon haze of smog that will threaten our health and our very survival. Our rare precious metals that we need for modern electronic appliances will skyrocket in price, and the struggle between “haves” and “have nots” will grow increasingly ugly. A lack of affordable and readily available water, natural resources, food, health care and medical supplies, plus systematic threats to urban security and systemic warfare are the alternatives to astral abundance. The choices between astral abundance and a downward spiral in global standards of living are stark. Within the next few decades these problems will be increasingly real. By then the world may almost be begging for new, out of- the-box thinking. International peace and security will be an indispensable prerequisite for exploitation of astral abundance, as will good government for all. No one nation can be rich and secure when everyone else is poor and insecure. In short, global space security and strategic space defense, mediated by global space agreements, are part of this new pathway to the future.

#### Unregulated mining of asteroids triggers space conflicts.

Thompson 16 [Clive, Writer for Wired, “Space Mining Could Set Off a Star War”, *Wired*, 01/14/2016, <https://www.wired.com/2016/01/clive-thompson-11/>]

SPACE IS LOUSY with profits. Consider the asteroid Ryugu: It’s made of so many tons of nickel, iron, cobalt, and water, it’s worth an estimated $95 billion. Venture into deeper space and there’s even richer plunder—like Davida, an asteroid that the wanna-be space mining company Planetary Resources values at more than $100 trillion. That’s more than five times the GDP of the US. These jaw-dropping payloads are why extraterrestrial mining is becoming an increasingly serious endeavor. Companies like Planetary Resources, backed by the likes of Googlers Larry Page and Eric Schmidt, are already launching satellites to scan for the most promising asteroids. Space experts say some firm could be ready to launch a mission within 10 years. But are they allowed to? Of course, anyone can reach an asteroid—NASA already has. But can you own one? Let’s start with existing space law. The big one on the books is the 1967 Outer Space Treaty. Ratified by 103 countries, including the spacefaring ones, it prohibits anyone from “appropriating” territory in space. (There’s an even more restrictive 1979 Moon Treaty as well, but the spacegoing countries haven’t signed, so it’s probably less relevant.) The upshot, most space-law scholars agree, is that nobody can claim a celestial body for their own. But what about just extracting resources and bringing them home? The issue hasn’t been litigated, but extraction is probably legally OK. Indeed, there’s precedent: The US brought 842 pounds of rocks back from the moon, and they’re designated as property of the US. No other country has disputed that ownership; in fact, the US and USSR traded moon rocks and regolith. “Russia has even sold some commercially,” says James Dunstan, a spacelaw expert with the Mobius Legal Group. The big wrinkle may not be whether it’s legal to mine an asteroid but how to figure out who has permission and who owns what claims. The US has no agency or process to issue licenses for space mining. “The politics can’t be known, but there will be politics,” says Joanne Gabrynowicz, a spacelaw expert at the University of Mississippi. Licenses give clarity not only to would-be miners but also to investors and governments starting their own operations. “If you don’t have that license, the investors are taking a big chance,” she says. The US is now drawing up a law. Problem is, it’s unilateral and incomplete. The Commercial Space Launch Competitiveness Act of 2015 says citizens can “possess, own, transport, use, and sell” an asteroid resource once they obtain it. But the bill doesn’t establish an agency or process for issuing licenses. Worse, it says your ownership claim begins as soon as you detect the existence of metals on an asteroid. You don’t even have to plant a flag. But what if China and Russia have different ideas—and different laws for their own citizens? Commercial activity in distant space could easily cause seething international strife here on our home planet. Luckily, there are precedents for working together. When satellites became big business in the 1960s, the major industrialized countries decided to use a multistate body—the International Telecommunication Union—to approve the orbits. It’s almost like domain-name registration. Fully 193 countries abide by these rules. Something similar could work for asteroid mining: an international body with local laws written in sync. Or, says Dunstan, countries could adopt bilateral agreements to recognize each other’s legislation and then build treaties. There’s a chance the spacefaring nations could get this right. I hope they do. Otherwise it’ll be Star Wars for real—with trillions in nickel and cobalt in the balance.

#### That goes nuclear.

Grego 18 [Laura, Senior Scientist in the Global Security Program at the Union of Concerned Scientists, Postdoctoral Researcher at the Harvard-Smithsonian Center for Astrophysics, PhD in Experimental Physics at the California Institute of Technology, Space and Crisis Stability, Union of Concerned Scientists, 3-19-18, <https://www.law.upenn.edu/live/files/7804-grego-space-and-crisis-stabilitypdf>]

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.

#### Normal means has the plan implemented through COPUOS.

Halstead 10—(B.S., Psychology, The University of Alabama; J.D., The University of Alabama School of Law; LL.M., Institute of Air and Space Law, McGill University; Lieutenant Colonel, U.S. Air Force Judge Advocate General's Corps). C. Brandon Halstead. 2010. "Prometheus Unbound - Proposal for a New Legal Paradigm for Air Law and Space Law: Orbit Law," Journal of Space Law 36, no. 1, 143-206

The debate on how to distinguish airspace from outer space is as old as the space age itself. The problems emerging from space exploration first entered the agenda of the United Nations in 1957, and were later placed on the agenda before the General Assembly through the establishment of an Ad Hoc Committee on the Peaceful Uses of Outer Space (COPUOS) in 1958.' Although this Committee initially focused on the debate of disarmament, its status was later made permanent in 1961 while its charter was expanded to include examination of all issues relating to the field of exploration and use of outer space by governmental and non-governmental organizations.16 In 1962 the Scientific and Technical Sub-Committee and Legal Sub-Committee began their true substantive work and became the main center of international cooperation and coordination for exploration of peaceful uses of outer space." Successive sessions focused on general and specific issues of space law, including the establishment of a frontier between outer space and atmospheric space18.

## 3

#### Korean denuclearization talks now – diplomatic pressure is key

Je-hun 19 2019 Lee Je-hun, senior staff writer [News analysis] How will the N. Korea-US working-level talks play out? Posted on : Sep.11,2019 16:59 KST Modified on : Sep.11,2019 16:59 KST http://english.hani.co.kr/arti/english\_edition/e\_northkorea/909361.html

North Korean leader Kim Jong-un, who has been pondering the conditions and timing of negotiations with the US, has finally suggested that they be held in late September, at a mutually acceptable time and place. This proposal comes 71 days after he reached a verbal agreement with US President Donald Trump during their meeting at Panmunjom on June 30 to resume working-level talks. Shortly after North Korea’s proposal, Trump responded positively, noting that “having meetings is a good thing.” These developments mean that the two sides could hold working-level talks this month. Trump and Kim are expected to take action as they maneuver toward a third summit and try to arrange a major compromise before the end of the year. There are hopeful predictions that working-level negotiations between the two sides will open a “window of opportunity” for inter-Korean relations, which ground to a halt after the second North Korea-US summit, held in Hanoi, ended without a deal. Seoul and Pyongyang have been deadlocked ever since. North Korea’s dramatic volte-face occurred late on the evening of Sept. 9. “We have willingness to sit with the US side for comprehensive discussions of the issues we have so far taken up at the time and place to be agreed late in September,” North Korean First Vice Foreign Minister Choe Son-hui said in a statement released on Monday morning (US time). “I gave heed to the recent repeated remarks of high-ranking US officials leading the negotiations with the DPRK [North Korea] that they are ready for the DPRK-US working negotiation,” Choe said. Importance of US’ “new calculations” in upcoming negotiations Choe also brought up the fact that Kim had called for the US to make “new calculations” in a policy speech at the Supreme People’s Assembly on Apr. 12. “I think the US has since had enough time to find the calculation method that it can share with us,” Choe said, in a remark that was at once hopeful and intimidating. It’s widely thought that Kim’s decision to resume negotiations is informed by criticism that he meant to publicly humiliate Trump, who announced following a meeting in Panmunjom on June 30 that working-level talks would resume within two or three weeks, as well as by concerns that Kim’s “relationship of trust” with Trump might be seriously harmed. During an interview with ABC on Sept. 6, Pompeo put pressure on Kim, remarking that Trump would be very disappointed if Kim didn’t return to the negotiating table. But even after resolving to resume working-level talks, Kim still seems worried that the US might not have budged as much as he’d hoped. That’s evidenced by the bravado that concludes Choe’s statement: “If the US side fingers again the worn-out scenario which has nothing to do with the new calculation method at the DPRK-US working negotiation to be held with so much effort, the DPRK-US dealings may come to an end.” North Korea’s launch of two unidentified projectiles from South Pyongan Province toward the East Sea early in the morning on Sept. 10, a few hours after the statement was published, appears to be a show of force underlining that this threat was not just empty words. The projectile launch also appears aimed at backing up Pyongyang’s claim that its development and test launches of new short-range ballistic missiles and multiple rocket launchers (10 such test have been carried out since the Hanoi summit) are routine defensive measures designed to compensate for its inferior spending on conventional weaponry. Trump has signaled that he won’t take issue with the North’s launches of short-range projectiles, dismissing them as something that many other countries do. Roadmap for denuclearization vs. Pyongyang’s regime security guarantee We’re already seeing the outlines of the major issues to be tackled in the working-level negotiations. The US’ primary demands are a freeze on nuclear activity, a roadmap to denuclearization, and a definition of its “end state,” or ultimate goal. Along with easing or lifting sanctions, which was the North’s main demand during the Hanoi summit, Pyongyang is also expected to put security on the agenda. In recent weeks, the US has made overture about rewarding North Korea for progress on denuclearization. On Aug. 27, Trump described North Korea as a country with incredible potential and unexpectedly brought up the idea of traveling to North Korea via the railroad. Trump appears to have been thinking of a proposal made by South Korean President Moon Jae-in during a phone call on Feb. 19, shortly before the Hanoi summit. During that call, Moon had asked Trump to let South Korea play a major role in providing incentives for denuclearization, mentioning that Seoul was prepared to connect roads and railways and to run economic cooperation projects with the North. The US has also addressed North Korea’s security concerns, with Trump remarking on Sept. 4 that the US doesn’t seek regime change in North Korea and US Secretary of State Mike Pompeo saying on Sept. 6 that all sovereign countries have the right to defend themselves. Also on Sept. 6, Stephen Biegun, the US State Department’s special representative for North Korea, brought up the possibility of a strategic review of US Forces Korea, presuming North Korea’s complete denuclearization. That review could include reducing the number of troops on the peninsula or adjusting their mission. Success of working-level talks depends on changes in Washington’s attitude “The success of the working-level talks depends on how much the American attitude has changed. The key here isn’t making glib claims about security or the economy, but giving North Korea something tangible,” said a venerable figure in South Korea’s foreign policy and security establishment.

#### Plan burns diplomatic capital.

Salter 16, Alexander William Salter, Assistant Professor of Economics, Rawls College of Business, Texas Tech University. alexander.w.salter@ttu.edu Space Debris: A Law and Economics Analysis of the Orbital Commons Cite as: 19 stan. Tech. L. Rev. 221 (2016) https://law.stanford.edu/wp-content/uploads/2017/11/19-2-2-salter-final\_0.pdf

A global effort to remediate debris would, by necessity, involve the three major spacefaring nations: the United States, Russia, and China.53 However, any effort would also require—at a minimum—a significant clarification and—at most —a complete overhaul of existing space law.54 One cannot assume that parties to the necessary political bargains would limit parleying to space-related issues. Agreements between sovereign nation-states must be self-enforcing.55 To secure consent, various parties to the change in the international legal-institutional framework may bargain strategically and may hold out for unrelated concessions as a way of maximizing private surplus. The costs, especially the decision-making costs, of changing the legal framework to secure a global response to a global commons problem are potentially quite high.

#### Diplomatic resources are key to a deal.

Akimoto 19 2019 Satohiro Akimoto, Contributing Writer @ Japan Times. U.S. leader's chaotic diplomacy offers chance with Kim https://www.japantimes.co.jp/news/2019/08/29/asia-pacific/politics-diplomacy-asia-pacific/u-s-leaders-chaotic-diplomacy-offers-chance-kim/#.XXmmmShKjtQ

And yet, we should be careful not to write off Trump’s approach to Kim. Washington Post columnist David Ignatius is right in saying that “Trump’s bad qualities shouldn’t blind us to this good achievement (reopening a path to denuclearization and normalization of relations). The fact that this achievement comes wrapped in Trump’s gaudy, dictator-friendly bunting doesn’t diminish its value.” Previous U.S. presidents have failed to prevent North Korea from acquiring nuclear weapons — in spite of carefully crafted multilateral diplomacy. Trump’s personal summitry with Kim, while saying “nobody knows how things turn out,” has at least got the North Koreans back to the negotiating table — something they refused to do throughout the Obama administration. It is also worth noting that the international community does not have a viable alternative to communicate with the North Korean leader. More broadly in the past, breakthroughs in intractable diplomatic problems were made by leaders who engaged in theatrical handshake diplomacy at the highest level, as a result of thinking creatively. One prominent example is former President Richard Nixon’s handshake with Chinese leader Mao Zedong during his 1972 visit to China. While there was only one seemingly innocent meeting between the two leaders during Nixon’s week-long visit, the handshake symbolically cemented the historic change of course in Sino-U.S. relations. Interestingly, Winston Lord, who attended the meeting with his boss, Secretary of State Henry Kissinger, recalls that the exchange between the two leaders was “not one of the great conversations of all time.” While Nixon held several meetings with Premier Zhou Enlai during his stay, the most dramatic highlight of the visit was his handshake with Mao, which instantly indicated to the world that the two sides had begun a totally new chapter in the bilateral relationship. Although the geopolitical contexts are different, there are parallels in the handshakes — including Anwar Sadat and Menachem Begin, Ronald Reagan and Mikhail Gorbachev, Yasser Arafat and Yitzhak Rabin — to name a few. Kissinger, who was the central architect of Nixon’s overture to China, said Trump “has the possibility of going down in history as a very considerable president” in a television interview in December. He argued that, because of the combination of the partial vacuum in the world created by the American retreat from international politics by Barack Obama and the new questions independent of past norms asked by Trump, “one could imagine that something remarkable and new emerges.” The only significant achievement in the dramatic handshake at the DMZ between Trump and Kim was the resetting of the communication on denuclearization and the normalization of the bilateral relationship between the U.S. and North Korea. So what needs to happen for Trump to capitalize on the DMZ meeting? First, Washington needs a strong negotiator with the ability to deal with his North Korean counterpart to concretely advance negotiations. He must have the full support of Trump to take advantage of the communication channel, which Trump established through his unorthodox approach to Kim. It was a good move on the part of Trump to introduce Stephen Biegun, the State Department’s special representative for North Korea, to Kim, to show his full endorsement at the last summit. Obviously, it is not advisable to reassign Biegun as the next ambassador to Russia, even as the rumor mill churns. Additionally, Washington needs to assemble a core team of experts that can navigate the complicated talks with Pyongyang. These experts must consist not only of elite diplomats, but also scientists, engineers and military specialists. Additionally, they must be given clear attainable goals with Trump’s blessing. The actual negotiation of denuclearization with North Korea requires in-depth coordinated efforts among many branches of the government. Therefore, they must be given authority to lead such an effort within the U.S. government from the White House.

#### Extinction – only diplomacy can solve nuclear war

Khan 19 2019 Muhammad Haris Khan Research Assistant CGSS Nuclearization of North Korea: A Threat to Regional Stability https://cgss.com.pk/paper/pdf/Nuclearization-of-North-Korea-A-Threat-to-Regional-Stability.pdf

Despite the restrictions from international regimes and world powers, many countries have acquired nuclear weapons after World War Two. One of them is North Korea, whom nuclear weapons and missile program have developed over time despite tough economic and financial sanctions and international isolation. The nuclear capabilities of Pyongyang possess a grave threat to the regional security and stability of Northeast Asia. Thus, in order to denuclearize the regime, many international efforts were made. These efforts range from the hard economic sanctions and isolation to multilateral talks and negotiations. The world powers, particularly the US, have also made their efforts to denuclearize North Korea. But all these efforts proved to be unproductive until now. The aggressive behavior of North Korea for the survival of its regime can lead to a nuclear conflict in the region. Apart from this, the possible regime collapse in the DPRK may have severe consequences for regional and global security as nuclear weapons can be acquired by non-state actors. The possible proliferation of nuclear technology to other state and non-state actors by North Korea due to its miserable economic condition is another leaning sword on the head of the international community. Assessing these threats, the world powers and the international community has to work hard to denuclearize Pyongyang. The use of hard power can further deteriorate the security situation. The problem needs to solve politically and diplomatically to deter any threat that can emanate from the hostile relations in the region.

## Case

#### Extinction comes first under any framework.

Pummer 15 [Theron, Junior Research Fellow in Philosophy at St. Anne's College, University of Oxford. “Moral Agreement on Saving the World” Practical Ethics, University of Oxford. May 18, 2015] AT

There appears to be lot of disagreement in moral philosophy. Whether these many apparent disagreements are deep and irresolvable, I believe there is at least one thing it is reasonable to agree on right now, whatever general moral view we adopt: that it is very important to reduce the risk that all intelligent beings on this planet are eliminated by an enormous catastrophe, such as a nuclear war. How we might in fact try to reduce such existential risks is discussed elsewhere. My claim here is only that we – whether we’re consequentialists, deontologists, or virtue ethicists – should all agree that we should try to save the world. According to consequentialism, we should maximize the good, where this is taken to be the goodness, from an impartial perspective, of outcomes. Clearly one thing that makes an outcome good is that the people in it are doing well. There is little disagreement here. If the happiness or well-being of possible future people is just as important as that of people who already exist, and if they would have good lives, it is not hard to see how reducing existential risk is easily the most important thing in the whole world. This is for the familiar reason that there are so many people who could exist in the future – there are trillions upon trillions… upon trillions. There are so many possible future people that reducing existential risk is arguably the most important thing in the world, even if the well-being of these possible people were given only 0.001% as much weight as that of existing people. Even on a wholly person-affecting view – according to which there’s nothing (apart from effects on existing people) to be said in favor of creating happy people – the case for reducing existential risk is very strong. As noted in this seminal paper, this case is strengthened by the fact that there’s a good chance that many existing people will, with the aid of life-extension technology, live very long and very high quality lives. You might think what I have just argued applies to consequentialists only. There is a tendency to assume that, if an argument appeals to consequentialist considerations (the goodness of outcomes), it is irrelevant to non-consequentialists. But that is a huge mistake. Non-consequentialism is the view that there’s more that determines rightness than the goodness of consequences or outcomes; it is not the view that the latter don’t matter. Even John Rawls wrote, “All ethical doctrines worth our attention take consequences into account in judging rightness. One which did not would simply be irrational, crazy.” Minimally plausible versions of deontology and virtue ethics must be concerned in part with promoting the good, from an impartial point of view. They’d thus imply very strong reasons to reduce existential risk, at least when this doesn’t significantly involve doing harm to others or damaging one’s character. What’s even more surprising, perhaps, is that even if our own good (or that of those near and dear to us) has much greater weight than goodness from the impartial “point of view of the universe,” indeed even if the latter is entirely morally irrelevant, we may nonetheless have very strong reasons to reduce existential risk. Even egoism, the view that each agent should maximize her own good, might imply strong reasons to reduce existential risk. It will depend, among other things, on what one’s own good consists in. If well-being consisted in pleasure only, it is somewhat harder to argue that egoism would imply strong reasons to reduce existential risk – perhaps we could argue that one would maximize her expected hedonic well-being by funding life extension technology or by having herself cryogenically frozen at the time of her bodily death as well as giving money to reduce existential risk (so that there is a world for her to live in!). I am not sure, however, how strong the reasons to do this would be. But views which imply that, if I don’t care about other people, I have no or very little reason to help them are not even minimally plausible views (in addition to hedonistic egoism, I here have in mind views that imply that one has no reason to perform an act unless one actually desires to do that act). To be minimally plausible, egoism will need to be paired with a more sophisticated account of well-being. To see this, it is enough to consider, as Plato did, the possibility of a ring of invisibility – suppose that, while wearing it, Ayn could derive some pleasure by helping the poor, but instead could derive just a bit more by severely harming them. Hedonistic egoism would absurdly imply she should do the latter. To avoid this implication, egoists would need to build something like the meaningfulness of a life into well-being, in some robust way, where this would to a significant extent be a function of other-regarding concerns (see chapter 12 of this classic intro to ethics). But once these elements are included, we can (roughly, as above) argue that this sort of egoism will imply strong reasons to reduce existential risk. Add to all of this Samuel Scheffler’s recent intriguing arguments (quick podcast version available here) that most of what makes our lives go well would be undermined if there were no future generations of intelligent persons. On his view, my life would contain vastly less well-being if (say) a year after my death the world came to an end. So obviously if Scheffler were right I’d have very strong reason to reduce existential risk. We should also take into account moral uncertainty. What is it reasonable for one to do, when one is uncertain not (only) about the empirical facts, but also about the moral facts? I’ve just argued that there’s agreement among minimally plausible ethical views that we have strong reason to reduce existential risk – not only consequentialists, but also deontologists, virtue ethicists, and sophisticated egoists should agree. But even those (hedonistic egoists) who disagree should have a significant level of confidence that they are mistaken, and that one of the above views is correct. Even if they were 90% sure that their view is the correct one (and 10% sure that one of these other ones is correct), they would have pretty strong reason, from the standpoint of moral uncertainty, to reduce existential risk. Perhaps most disturbingly still, even if we are only 1% sure that the well-being of possible future people matters, it is at least arguable that, from the standpoint of moral uncertainty, reducing existential risk is the most important thing in the world. Again, this is largely for the reason that there are so many people who could exist in the future – there are trillions upon trillions… upon trillions. (For more on this and other related issues, see this excellent dissertation). Of course, it is uncertain whether these untold trillions would, in general, have good lives. It’s possible they’ll be miserable. It is enough for my claim that there is moral agreement in the relevant sense if, at least given certain empirical claims about what future lives would most likely be like, all minimally plausible moral views would converge on the conclusion that we should try to save the world. While there are some non-crazy views that place significantly greater moral weight on avoiding suffering than on promoting happiness, for reasons others have offered (and for independent reasons I won’t get into here unless requested to), they nonetheless seem to be fairly implausible views. And even if things did not go well for our ancestors, I am optimistic that they will overall go fantastically well for our descendants, if we allow them to. I suspect that most of us alive today – at least those of us not suffering from extreme illness or poverty – have lives that are well worth living, and that things will continue to improve. Derek Parfit, whose work has emphasized future generations as well as agreement in ethics, described our situation clearly and accurately: “We live during the hinge of history. Given the scientific and technological discoveries of the last two centuries, the world has never changed as fast. We shall soon have even greater powers to transform, not only our surroundings, but ourselves and our successors. If we act wisely in the next few centuries, humanity will survive its most dangerous and decisive period. Our descendants could, if necessary, go elsewhere, spreading through this galaxy…. Our descendants might, I believe, make the further future very good. But that good future may also depend in part on us. If our selfish recklessness ends human history, we would be acting very wrongly.” (From chapter 36 of On What Matters)

#### Russia and China say no OR the plan gets watered down.

**Bahney and Pearl 19** [Benjamin Bahney and Jonathan Pearl, 3-26-2019, "Why Creating a Space Force Changes Nothing," BENJAMIN BAHNEY and JONATHAN PEARL are Senior Fellows at the Lawrence Livermore National Laboratory’s Center for Global Security Research and contributing authors to [Cross Domain Deterrence: Strategy in an Era of Complexity](https://archive.md/o/Hlbi1/https:/www.amazon.com/Cross-Domain-Deterrence-Strategy-Era-Complexity/dp/0190908653). Foreign Affairs, [https://www.foreignaffairs.com/articles/space/2019-03-26/why-creating-space-force-changes-nothing accessed 12/10/21](https://www.foreignaffairs.com/articles/space/2019-03-26/why-creating-space-force-changes-nothing%20accessed%2012/10/21)] Adam

As Russia and China continue to push forward, U.S. policymakers may be tempted to use treaties and diplomacy to head off their efforts entirely. This option, although alluring on paper, is simply not feasible. Existing treaties designed to limit military competition in space have had little success in actually doing so. The 1967 Outer Space Treaty bans parties from placing nuclear weapons or other weapons of mass destruction in space, on the moon, or on other celestial bodies, but it has no formal mechanism for verifying compliance, and places no restrictions on the development or deployment in space of conventional antisatellite weapons. Even if it were possible to convince Moscow and Beijing of the benefits of comprehensive space arms control, existing technology makes it extremely difficult to verify compliance with the necessary treaty provisions—and without comprehensive and reliable verification, treaties are toothless. Moreover, regulating the development and deployment of antisatellite weapons is extremely difficult, both because they include such a broad and diverse range of technologies and because many types of antisatellite weapons can be concealed or explained away as having some other use. Unsurprisingly, Russia and China’s draft Treaty on the Prevention of Placement of Weapons in Space, which they have been pushing for several years now, has an unenforceable definition of what constitutes a “weapon” and does nothing at all to address ground-based antisatellite weapons development.

#### Interdependence checks ASAT attacks.

**Hall 15** [Luke Penn-Hall 15, Analyst at The Cipher Brief, M.A. from the Johns Hopkins School for Advanced International Studies, B.A. in International Relations and Religious Studies from Claremont McKenna College, “5 Reasons “Space War” Isn’t As Scary As It Sounds”, The Cipher Brief, 8/18/2015, <https://www.thecipherbrief.com/article/5-reasons-%E2%80%9Cspace-war%E2%80%9D-isn%E2%80%99t-scary-it-sounds>] recut Adam

1. An ASAT attack would likely be part of a larger, terrestrial attack. An attack on space assets would be no different than an attack on territory or other assets on earth. This means that no space war would stay limited to space. An ASAT campaign would be part of a larger conventional military conflict that would play out on earth.

2. Every country with ASAT capabilities also needs satellites. While the United States is the most dependent on military satellites, most other countries need satellites to participate in the global economy. All countries that have the technical ability to play in this space – the U.S., Russia, China and India - also have a vested interest in preventing the militarization of space and protecting their own satellites. If any of those countries were to attack U.S. satellites, it would likely hurt them far more than it would hurt the United States.

3. Destruction of satellites could create a damaging chain reaction. Scientists warn that the violent destruction of satellites could result in an effect called an ablation cascade. High-velocity debris from a destroyed satellite could crash into other satellites and create more high-velocity debris. If an ablation cascade were to occur, it could render certain orbital levels completely unusable for centuries.

4. Any country that threatened access to space would threaten the global economy. Even if a full-blown ablation cascade didn’t occur, an ASAT campaign would cause debris, making operating in space more hazardous. The global economy relies on satellites and any disruption of operations would be met with worldwide disapproval and severe economic ramifications.

5. International Prohibits the Use of ASAT Weapons. Several international treaties expressly prohibit signatory nations from attacking other countries’ space assets. It is generally accepted that space should be treated as a global common area, rather than a military domain.

While it remains necessary for military planners to create contingency plans for a, space war it is a highly unlikely scenario. All involved parties are incentivized against attacking. However, if a space war did occur, it would be part of a larger conflict on Earth. Those concerned about the potential for war in space should be more concerned about the potential for war, period.

#### Deterrence solves.

**Evanoff 19** [Kyle Evanoff, Kyle is a research associate in international economics and U.S. foreign policy at the Council on Foreign Relations “Big Bangs, Red Herrings, and the Dilemmas of Space Security”, Council on Foreign Relations, 6/27/2019, <https://www.cfr.org/blog/big-bangs-red-herrings-and-dilemmas-space-security> accessed 12/11/21] Adam

More important, U.S. policymakers should avoid making decisions on the basis of a possible, though highly improbable, space Pearl Harbor. They should recognize that latent counterspace capabilities—as exemplified in 2008’s Operation Burnt Frost, which saw the United States repurpose a ballistic missile interceptor to destroy a satellite—are more than sufficient to deter adversaries from launching a major surprise attack in almost all scenarios, especially in light of the aforementioned deep interdependence in the space domain. Adding to the deterrence effect are uncertain offensive cyber capabilities. The United States continues to launch incursions into geopolitical competitors’ critical systems, such as the Russian power grid, and has demonstrated a willingness to employ cyberattacks in the wake of offline incidents, as it did after Iran shot down a U.S. drone last week. Unlike in the nuclear arena, where anything short of the prospect of nuclear retaliation holds limited dissuasive power, space deterrence can stem from military capabilities in various domains. For this reason, an attack on a U.S. satellite could elicit any number of responses. The potential for cross-domain retaliation, combined with the high strategic value of space assets, means that any adversary risks extreme escalation in launching a major assault on American space architectures. Again, well-conceived diplomatic efforts are useful in averting such scenarios altogether.

#### **We won’t care about losing a satellite.**

Bleddyn Bowen 18, University of Leicester International Relations Lecturer, "The Art of Space Deterrence," European Leadership Network, 2-20-18, https://www.europeanleadershipnetwork.org/commentary/the-art-of-space-deterrence/

As consensus emerges on the possibility that, should a major war occur, satellites will mostly likely be attacked or harassed in one way or another, there is increasing deliberation on ‘space deterrence’, or how to prevent would-be aggressors from attacking satellites and other parts of space infrastructure on Earth. Reasoned analysis focuses on applying imagined thresholds of sensitivity and reaction based on the types of satellites attacked, how they are attacked, and when they are attacked in a crisis. For example, a Planet Labs imaging satellite being jammed outside of a crisis is a different incident compared to a Keyhole imagery satellite being destroyed during a Taiwan crisis. Indeed, it is crucial to think about what systems any space power may value above all others, which they may be able to suffer losing, and which losses may provoke a stern reaction. Most tools of space warfare today, of which America, China, and Russia lead, include jamming and Earth-based kinetic-kill capabilities that are ground, sea, or air missile based. Additionally, many Earth-based weapons such as missiles, attack aircraft, and naval vessels can bombard ground facilities if they are in range. However, as those narrow discussion tend to delve into the technical and tactical weeds, there are useful principles to remember when considering space deterrence on a more strategic level. With the tools of space warfare spreading, then, how does one deter an adversary from attacking one’s valuable and essential space infrastructure that is responsible for precision warfare as well as precision farming? This is a very difficult question to answer, and there are no direct and holistic ones to be given. But general ground rules for strategic thought can be provided. The difficulty is that any reason to think that space deterrence may be easier to achieve than equivalents on Earth has a counter that may highlight why, in some circumstances, space deterrence may be harder to impose in the mind of the adversary. First, politics, strategy, and deterrence relationships in space are extensions of those on Earth. Space deterrence remains an art of understanding the opponent’s psychology, valued possessions, and political objectives, as space deterrence is just a thematic or geographic variant of deterrence in general. Although space specialists are needed to understand spacepower, war in space is still subject to the same strategic logic as other terrestrial environments, and therefore deterrence in space cannot ignore events on Earth. Space warfare is merely the continuation of Terran politics by other means; a shooting war is space does not occur in a political vacuum. Additionally, some countries may have an ability to attack or disrupt satellites but possess no space-based assets of their own. Therefore, a tit-for-tat exchange of responding to a satellite attack with a satellite attack will not always be an option. Terrestrial threats and retaliation may be called for to deter attacks on space assets and space deterrence requires a joint approach, just as a joint approach to modern deterrence on Earth requires spacepower to function. Adhering too narrowly to the concept of ‘space deterrence’ can mislead analysis to isolate space from Earth. It is as misleading as speaking in terms of ‘air deterrence’ or ‘sea deterrence’. Deterring a state from taking a particular action in any environment requires more than one method of deterring by denial or punishment. Rather, modern deterrence relationships need to account for the role space systems play in building holistic deterrent and warfare capabilities in every environment, as well as the role satellites and space infrastructure may play in triggering, exacerbating, or resolving crises on Earth, as well as winning wars. Space is often an afterthought or a miscellaneous ancillary in the grand strategic views of top-level decision-makers. A president may not care that one satellite may be lost or go dark; it may cause panic and Twitter-based hysteria for the space community, of course. But the terrestrial context and consequences, as well as the political stakes and symbolism of any exchange of hostilities in space matters more. The political and media dimension can magnify or minimise the perceived consequences of losing specific satellites out of all proportion to their actual strategic effect.

#### No escalation from satellite attacks.

Dr. Eric J. Zarybnisky 18, MA in National Security Studies from the Naval War College, PhD in Operations Research from the MIT Sloan School of Management, Lt Col, USAF, “Celestial Deterrence: Deterring Aggression in the Global Commons of Space”, 3/28/2018, https://apps.dtic.mil/dtic/tr/fulltext/u2/1062004.pdf

While deterrence and the Cold War are strongly linked in the public’s mind through the nuclear standoff between the United States and the Soviet Union, the fundamentals of deterrence date back millennia and deterrence remains relevant. Thucydides alludes to the concept of deterrence in his telling of the Peloponnesian War when he describes rivals seeking advantages, such as recruiting allies, to dissuade an adversary from starting or expanding a conflict.6F6 Aggression in space was successfully avoided during the Cold War because both sides viewed an attack on military satellites as highly escalatory, and such an action would likely result in general nuclear war.7F7 In today’s more nuanced world, attacking satellites, including military satellites, does not necessarily result in nuclear war. For instance, foreign countries have used high-powered lasers against American intelligence-gathering satellites8F8 and the United States has been reluctant to respond, let alone retaliate with nuclear weapons. This shift in policy is a result of the broader use of gray zone operations, to which countries struggle to respond while limiting escalation. Beginning with the fundamentals of deterrence illuminates how it applies to prevention of aggression in space.

#### Squo debris thumps.

**Wall 21** [Mike Wall, Michael Wall is a Senior Space Writer with [Space.com](http://space.com/) and joined the team in 2010. He primarily covers exoplanets, spaceflight and military space. He has a Ph.D. in evolutionary biology from the University of Sydney, Australia, a bachelor's degree from the University of Arizona, and a graduate certificate in science writing from the University of California, Santa Cruz. 11/15/21, "Kessler Syndrome and the space debris problem," Space, [https://www.space.com/kessler-syndrome-space-debris accessed 12/10/21](https://www.space.com/kessler-syndrome-space-debris%20accessed%2012/10/21)] Adam

Earth orbit is getting more and more crowded as the years go by. Humanity has launched about 12,170 satellites since the dawn of the space age in 1957, [according to the European Space Agency](https://www.esa.int/Safety_Security/Space_Debris/Space_debris_by_the_numbers) (ESA), and 7,630 of them remain in orbit today — but only about 4,700 are still operational. That means there are nearly 3,000 defunct spacecraft zooming around Earth at tremendous speeds, along with other big, dangerous pieces of debris like upper-stage rocket bodies. For example, orbital velocity at 250 miles (400 kilometers) up, the altitude at which the ISS flies, is about 17,100 mph (27,500 kph). At such speeds, even a tiny shard of debris can do serious damage to a spacecraft — and there are huge numbers of such fragmentary bullets zipping around our planet. ESA estimates that Earth orbit harbors at least 36,500 debris objects that are more than 4 inches (10 centimeters) wide, 1 million between 0.4 inches and 4 inches (1 to 10 cm) across, and a staggering 330 million that are smaller than 0.4 inches (1 cm) but bigger than 0.04 inches (1 millimeter). These objects pose more than just a hypothetical threat. From 1999 to May 2021, for example, the ISS conducted 29 debris-avoiding maneuvers, including three in 2020 alone, [according to NASA officials](https://www.nasa.gov/mission_pages/station/news/orbital_debris.html). And that number continues to grow; the station performed [another such move in November 2021](https://www.space.com/space-station-dodging-chinese-space-junk-spacex-crew-3), for example. Many of the smaller pieces of space junk were spawned by the explosion of spent rocket bodies in orbit, but others were more actively emplaced. In January 2007, for instance, China intentionally destroyed one of its defunct weather satellites in a much-criticized test of anti-satellite technology that generated [more than 3,000 tracked debris objects](https://swfound.org/media/9550/chinese_asat_fact_sheet_updated_2012.pdf) and perhaps 32,000 others too small to be detected. The vast majority of that junk remains in orbit today, experts say. Spacecraft have also collided with each other on orbit. The most famous such incident occurred in February 2009, when Russia's defunct Kosmos 2251 satellite slammed into the operational communications craft Iridium 33, producing [nearly 2,000 pieces of debris](https://swfound.org/media/6575/swf_iridium_cosmos_collision_fact_sheet_updated_2012.pdf) bigger than a softball. That 2009 smashup might be evidence that the Kessler Syndrome is already upon us, though a cataclysm of "Gravity" proportions is still a long way off. "The cascade process can be more accurately thought of as continuous and as already started, where each collision or explosion in orbit slowly results in an increase in the frequency of future collisions," [Kessler told Space Safety Magazine in 2012](http://www.spacesafetymagazine.com/space-debris/kessler-syndrome/don-kessler-envisat-kessler-syndrome/).

**Probability – 0.1% chance of a collision.**

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

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

### 1NC – Colonization

#### Colonization’s impossible

**Levchenko 19**. Professors in the Plasma Sources and Applications Centre/Space Propulsion Centre, NIE, Nanyang Technological University. 2019. “Mars Colonization: Beyond Getting There.” Global Challenges, vol. 3, no. 1.

Settlement of Mars—is it a dream or a necessity? From scientific publications to public forms, there is certainly little consensus on whether colonization of Mars is necessary or even possible, with a rich diversity of opinions that range from categorical It is a necessity!20 to equally categorical Should Humans Colonize Other Planets? No.21 A strong proponent of the idea, Orwig puts forward five reasons for Mars colonization, implicitly stating that establishing a permanent colony of humans on Mars is no longer an option but a real necessity.20 Specifically, these arguments are: Survival of humans as a species; Exploring the potential of life on Mars to sustain humans; Using space technology to positively contribute to our quality of life, from health to minimizing and reversing negative aspects of anthropogenic activity of humans on Earth; Developing as a species; Gaining political and economic leadership. The first argument captures the essence of what most space colonization proponents feel—our ever growing environmental footprint threatens the survival of human race on Earth. Indeed, a large body of evidence points to human activity as the main cause of extinction of many species, with shrinking biodiversity and depleting resources threatening the very survival of humans on this planet. Colonization of other planets could potentially increase the probability of our survival. While being at the core of such ambitious projects as Mars One, a self‐sustained colony of any size on Mars is hardly feasible in the foreseeable future. Indeed, sustaining even a small number of colonists would require a continuous supply of food, oxygen, water and basic materials. At this stage, it is not clear whether it would be possible to establish a system that would generate these resources locally, or whether it would at least in part rely on the delivery of these resources (or essential components necessary for their local production) from Earth. Beyond the supply of these very basic resources, it would be quite challenging if not impossible for the colonists to independently produce hi‐tech but vitally important assets such as medicines, electronics and robotics systems, or advanced materials that provide us with a decent quality of life. In this case, would their existence become little more than the jogtrot of life, as compared with the standards expected at the Earth?22

### extra

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

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

The prediction of possible scenarios of the future evolution of the debris p o p ulation involves many uncertainties. Long-term forecasting means the prediction of the evolution of the future debris environment in time periods of decades or even centuries. Predictions are based on models84 that work with certain assumptions, and altering these parameters significantly influences the outcomes of the predictions. Assumptions on the future space traffic and on the initial object environment are particularly critical to the results of modeling efforts.85 A well-known pattern for the evolution of the debris population is the so-called Kessler effect’, which assumes that there is a certain collision probability among space objects because many satellites operate in similar orbital regions. These collisions create fragments, and thus additional objects in the respective orbits, which in turn enhances the risk of further collisions. Consequently, the num ber of objects and collisions increases exponentially and eventually results in the formation of a self-sustaining debris belt aroundthe Earth. While it has long been assumed that such a process of collisional cascading is likely to occur only in a very long-term perspective (meaning a time 1 n of several hundred years),87 a consensus has evolved in recent years that an uncontrolled growth of the debris population in certain altitudes could become reality much sooner.88 In fact, a recent cooperative study undertaken by various space agencies in the scope of i a d c shows that the current l e o debris population is unstable, even if current mitigation measures are applied. The study concludes: Even with a 90% implementation of the commonly-adopted mitigation measures [...] the l e o debris population is expected to increase by an average of **30% in the next 200 years.** The population growth is primarily driven by catastrophic collisions between 700 and 1000 km altitudes and such collisions are likely to occur every 5 to 9 years.89

**Status quo solves – mitigation and remediation compliance growing.**

**Colombo et. al 18**—Camilla Colombo, PhD, visiting academic in Spacecraft Engineering within Engineering and Physical Sciences at the University of Southampton; Francesca Letizia, PhD, Space Debris Engineer at ESA Space Debris Office; Mirko Trisolini, PhD, Postdoctoral researcher at the Politecnico di Milano Department of Aerospace Engineering; Hugh Lewis, PhD, Professor within Engineering and Physical Sciences at the University of Southampton (“Space Debris: Risk Mitigation,” from Frontiers of Space Risk: Natural Cosmic Hazards & Societal Challenges, Chapter 5, p 128-136)

5.4 MITIGATION MEASURES The space debris problem is nowadays internationally recognized, therefore mitigation measures are being taken and guidelines discussed. These can be divided into two classes: The avoidance or protection measures and the active and passive debris removal measures. The avoidance or protection measures include the design of satellites to withstand impacts by small debris, or the selection of safe procedures for operational spacecraft such as orbits with less debris, specific attitude configurations, or implementing active avoidance maneuvers to avoid collisions. On the other hand, measures for debris removal currently consist in limiting the creation of new debris (by prevention of in-orbit explosions and ensuring spacecraft subsystems reliability), to free some orbital implementing end-of-life disposal maneuvers protected regions, or to reenter in the atmosphere. Active debris removal is also being considered as a mean to stabilize the growth of space debris by removing from orbit some selected noncompliant objects. The e.Deorbit mission will target an ESA-owned derelict satellite in low orbit, capture it with a net or robotic arm technology, and reenter with a controlled atmospheric reentry (Biesbroek et al. 2014). Acknowledging the fact that the projected growth in the number of satellites orbiting the Earth will increase in the future, space agencies and international organizations have been discussing and building a set of guidelines to ensure the sustainability of future space activities. The InterAgency Debris Coordination Committee (IADC) was founded in 1993 by ESA (Europe), NASA (the United States), the Japan Aerospace Exploration Agency (JAXA, Japan), and the Roscosmos Russian Federation. As of January 2017, the IADC also includes the Italian Space Agency (ASI, Italy), the Centre National d'Études Spatiales (CNES, France), the China National Space Administration (CNSA, China), the Canadian Space Agency (CSA, Canada), the German Aerospace Centre (DLR, Germany), the Korea Aerospace Research Institute (KARI, South Korea), the Indian Space Research Organisation (ISRO, India), the National Space Agency of Ukraine (NSAU, Ukraine), and the UK Space Agency (UKSA, United Kingdom). This international cooperation decided a set of space debris mitigation measures (Inter-Agency Space Debris Coordination Commitee, 2002), which includes: 1. Limitation of debris released during normal operations. 2. Minimization of the potential for on-orbit breakups (resulting from stored energy after the completion of mission operations, or during the operational phases of the mission and by avoiding intentional destruction and other harmful activities). 3. Post Mission Disposal in particular in geosynchronous regions and for objects passing through the LEO region. 4. Prevention of on-orbit collisions. The IADC guidelines were presented to the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) and contributed to the creation of the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space to be considered for the mission planning, design, manufacture and operational phases of spacecraft and launch vehicle orbital stages” (United Nations Office for Outer Space Affairs 2010): 1. Limit debris released during normal operations. 2. Minimize the potential for breakups during operational phases. 3. Limit the probability of accidental collision in orbit. 4. Avoid intentional destruction and other harmful activities. 5. Minimize potential for post-mission breakups resulting from stored energy 6. Limit the long-term presence of spacecraft and launch vehicle orbital stages in the low Earth orbit region after the end of their mission. 7. Limit the long-term interference of spacecraft and launch vehicle orbital stages with the geosynchronous region after the end of their mission. 5.4.1 Mitigation Guidelines for Post Mission Disposal In this section we focus on the third of the measures dictated by the IADC, namely Post Mission Disposal. A “25-year rule” was defined to limit the presence of satellites in the LEO region to no more than 25 years after their decommissioning. The 25-year limit was selected to ensure that a reasonable reduction in lifetime could be achieved without greatly affecting satellite resources. After 25 years a satellite has to be removed from the LEO protected region by placing it in a graveyard orbit or by disposing of it through atmospheric reentry. According to the IADC Space Debris Mitigation Guidelines (Inter-Agency Space Debris Coordination Commitee 2002) if "a spacecraft or orbital stage is to be disposed of by re-entry into the atmosphere, debris that survives to reach the surface of the Earth should not pose an undue risk to people or property.” The low Earth orbit protected region (LEO region) is the spherical shell region that extends from the Earth's surface up to an altitude of 2000 km. The geosynchronous protected region (GEO region) is a segment of a spherical shell with a lower and upper altitude boundary of 200 km below and above the geostationary altitude of 35,786 km, and which is constrained by a latitude sector extending between plus and minus 15 degrees from south to north (Inter-Agency Space Debris Coordination Committee 2002; United Nations Office for Outer Space Affairs 2010). At altitudes below 600 kilometers, spacecraft with a conventional area-to-mass ratio (i.e., conventional satellites have a value of area-tomass ratio around 0.012 m?/kg) will reenter within a few years due to atmospheric drag. Intervention to remove and prevent further creation of debris above that altitude should therefore be the primary focus of passive mitigation measures. As described in the document on the “Requirements on Space Debris Mitigation for ESA Projects” (ESA 2008) and the "ESA Space Debris Mitigation Compliance Verification Guidelines” (ESA 2015), end-of-life measures can be distinguished in: (1) Disposal, (2) passivation, and (3) reentry. Required measures for disposal currently cover spacecraft in LEO and GEO through a series of Operational Requirements (OR) (ESA 2008): "OR-01. Space systems operating in the LEO protected region shall be disposed of by reentry into the Earth's atmosphere within 25 years after the end of the operational phase." "OR-02. Space systems operating in the GEO protected region shall be disposed of by permanently removing them from the GEO protected region.” The GEO disposal orbit should be almost circular (i.e., eccentricity less of equal to 0.005) and with a minimum perigee altitude above the geostationary altitude, which is given as a function of the solar radiation pressure coefficient of the space system at the beginning of its life and its cross-sectional area. This is done to take into account the eccentricity oscillation due to the effects of solar radiation pressure and to ensure that such oscillation would not make the orbit interfere with the GEO protected regions. "OR-03. Where practicable and economically feasible, space systems outside the LEO and GEO protected regions shall implement means of end-of-life orbit disposal to avoid long-term interference with operational orbit regions, such as the Galileo orbit." OR-04. Launcher stages shall also perform end-of-life disposal maneuvers by targeting "direct reentry as part of the launcher sequence.” Alternatively, they should be injected into a LEO orbit with a maximum reentry time of 25 years. As other space systems, they should be removed from LEO and GEO protecting region and orbit that interfere with other operational orbits such as the one of the Galileo orbit. OR-05. Passivation of the system (spacecraft or launcher stage) has to be completed within 2 months of the end of mission. End-of-life measures for reentry include: OR-06. "For space systems that are disposed of by reentry," an "analysis has to be performed to determine the characteristics of fragments surviving to ground impact, and assess the total casualty risk to the population on ground assuming an uncontrolled reentry.” OR-07. Such a casualty risk has to be lower than 10-4 if an uncontrolled reentry is targeted; otherwise if the casualty risk is higher than the threshold of 10-4, "a controlled reentry must be performed such that the impact footprint can be ensured over an ocean area, with sufficient clearance of landmasses and traffic routes." The rate of compliance of missions to the end-of-life mitigation guidelines was analyzed by the ESA Space Debris Office in 2017). Between 2006 and 2015, the rate of compliance of LEO missions (including naturally compliant missions and satellites performing end-of-life maneuvers) was 53.3% for the payloads (corresponding to 60.3% of the payload mass), reaching end of life in the LEO protected region (Frey and Lemmens 2017). The compliant objects, with a lifetime after decommissioning of less than 25 years, include naturally compliant objects due to their initial altitude well inside the Earth's atmosphere (this constitutes the biggest part of the compliant share), compliant objects after a deorbit maneuver, or spacecraft having performed a maneuver leading to a direct reentry. In terms of mass, this share is constantly sloping downward. Between 2007 and 2016, 71.6% of the rocket bodies reaching end of life in the LEO protected region was compliant, and this fraction has remained virtually unchanged for 8 years in a row despite an increase in end-of-life maneuver activity. 5.4.2 Passive End-of-Life Disposal In order to meet the mitigation guidelines LEO satellites at the end of their life would use the remaining propellant to perform either a perigeelowering maneuver (to decrease the orbit perigee well inside the Earth's atmosphere to guarantee a reentry within 25 years) or a direct reentry. Spacecraft in GEO are instead currently re-orbited to quasi circular orbits outside the GEO protected ring, with a perigee line aligned with the SunEarth direction (where possible) in order to bind the long-term oscillations in the eccentricity caused by solar radiation pressure. Recently, ESA funded projects on the design of disposal trajectories for medium Earth orbits (MEO) (Alessi et al. 2014; Rossi et al. 2015), highly elliptical orbits (HEO), and libration Earth orbits (LPO) (Armellin et al. 2014; Colombo et al. 2014; Colombo et al. 2015). These have demonstrated the possibility of exploiting natural orbit perturbations for designing passive mitigation strategies for debris disposal. Disposal strategies enhancing the effects of orbit perturbations have been further analyzed in LEO (Alessi et al. 2017), in MEO (Rosengren et al. 2015; Alessi et al. 2016; Armellin and San-Juan; Daquin et al. 2016; Gkolias et al. 2016), in GEO (Colombo and Gkolias 2017), and in HEO (Colombo et al. 2014; Armellin et al. 2015). Indeed, it was shown that, rather than performing an expensive maneuver to lower the perigee, the optimal maneuver should be given in a way to change the disposal orbit to another neighborhood orbit where the effect of orbit perturbations causes the orbit perigee to enter into the atmosphere. Indeed, the effects of luni-solar perturbation causes long-term oscillation on the eccentricity, which can be exploited so that the spacecraft's trajectory over a long period (from 5 to 70 years, depending on the initial orbit) could lead to natural reentry. This effect can be enhanced by solar radiation pressure, especially if considering a spacecraft equipped with large solar panels or a deployable reflective surface (Lücking et al. 2012, 2013). Moreover, resonances with the Earth's nonuniform potential can enhance the eccentricity growth effects. 5.4.2.1 An Example of End-of-Life Deorbiting Exploiting Luni-Solar Perturbations One of the most beautiful demonstrations of how natural dynamics can be enhanced is given by the INTEGRAL mission designed by ESA, the United States, Russia, the Czech Republic, and Poland. The INTErnational Gamma-Ray Astrophysics Laboratory, launched in 2002, gathered some of the most energetic radiation from space (Eismont et al. 2003). A reentry of this spacecraft with a pure impulsive maneuver would have not been possible due to the limited amount of propellant left onboard. In an ESA-funded study, the end-of-life disposal of INTEGRAL mission--expected to end in 2016-was designed with a time window for disposal between January 1, 2013 and January 1, 2029. Reentry solutions with a delta-velocity requirement below 40-50 m/s were found (Colombo et al. 2014). The main perturbations acting on the dynamics of the reentry were luni-solar perturbations, which affect the evolution of eccentricity, inclination, and anomaly of the perigee measured with respect to the Earth-Moon plane. It was shown that depending on the set of initial elements, which depends on the date the reentry maneuver is performed, the proposed maneuver would then aim at further increasing or decreasing the eccentricity. In particular, if we focus on the natural evolution of the eccentricity under luni-solar perturbation and Earth's oblateness, when the nominal eccentricity is low, the optimal reentry maneuver further decrease the eccentricity value; as a consequence, the following long-term propagation will reach a higher eccentricity, corresponding to a reentry. In this case, the maneuver is more efficient (i.e., lower delta velocity is required) (Colombo et al. 2014). Once the initial disposal maneuver is performed, the spacecraft evolves under natural perturbations and the reentry can then be semicontrolled. The high inclination of HEOs represents an advantage as the final reentry phase can target regions at higher latitudes on the Earth's surface thereby reducing the ground hazard. In the case of HEOs, reentry is caused by luni-solar perturbation (not air drag), therefore the orbit reenter with quite a high eccentricity (high apogee and low perigee) and does not circularize. Due to the oscillations in eccentricity, the next optimal window for injecting the spacecraft into a reentry trajectory is between 2013 and the first half of 2018 for a final reentry in 2028. After that, the required maneuver would increase until reaching a next window for performing the maneuver between the second half of 2021 and the first half of 2026, for a reentry in 2028. These analytical studies were used for high fidelity parametric analyses performed by the ESA (Merz et al. 2015) to investigate the effect of a maneuver at apogee to change the perigee altitude. The final maneuver sequence was given at the beginning of 2015 and split into three major burns plus a touch-up for final fine-tuning. The spacecraft is now on its course to reentry in 2028 (see Figure 5.11).

#### Space debris impact is hype

Albrecht 16 – Chairman of the board of USSpace LLC & fmr. head of the National Space Council Mark Albrecht, chairman of the board of USSpace LLC, head of the White House National Space Council from 1989 to 1992, and Paul Graziani, CEO and founder of Analytical Graphics, a company that develops software and provides mission assurance through the Commercial Space Operations Center (ComSpOC), Congested space is a serious problem solved by hard work, not hysteria, 2016, https://spacenews.com/op-ed-congested-space-is-a-serious-problem-solved-by-hard-work-not-hysteria/

Popular culture has embraced the risks of collisions in space in films like Gravity. Some participants have dramatized the issue by producing graphics of Earth and its satellites, which make our planet look like a fuzzy marble, almost obscured by a dense cloud of white pellets meant to conceptualize space congestion. Unfortunately, for the sake of a good visual, satellites are depicted as if they were hundreds of miles wide, like the state of Pennsylvania (for the record, there are no space objects the size of Pennsylvania in orbit). Unfortunately, this is the rule, not the exception, and almost all of these articles, movies, graphics, and simulations are exaggerated and misleading. Space debris and collision risk is real, but it certainly is not a crisis. So what are the facts? On the positive side, space is empty and it is vast. At the altitude of the International Space Station, one half a degree of Earth longitude is almost 40 miles long. That same one half a degree at geostationary orbit, some 22,000 miles up is over 230 miles long. Generally, we don’t intentionally put satellites closer together than one-half degree. That means at geostationary orbit, they are no closer than 11 times as far as the eye can see on flat ground or on the sea: That’s the horizon over the horizon 10 times over. In addition, other than minute forces like solar winds and sparse bits of atmosphere that still exist 500 miles up, nothing gets in the way of orbiting objects and they behave quite predictably. The location of the smallest spacecraft can be predicated within a 1,000 feet, 24 hours in advance. Since we first started placing objects into space there have been 11 known low Earth orbit collisions, and three known collisions at geostationary orbit. Think of it: 135 space shuttle flights, all of the Apollo, Gemini and Mercury flights, hundreds of telecommunications satellites, 1,300 functioning satellites on orbit today, half a million total objects in space larger than a marble, and fewer than 15 known collisions. Why do people worry?