### 1

#### Interpretation: Appropriation is permanently taking property for exclusive use. Gorove 69:

Stephen Gorove, Interpreting Article II of the Outer Space Treaty, 37 Fordham L. Rev. 349 (1969). Available at: https://ir.lawnet.fordham.edu/flr/vol37/iss3/2

With respect to the concept of appropriation the basic question is what constitutes "appropriation," as used in the Treaty, especially in contradistinction to casual or temporary use. The term "appropriation" is used most frequently to denote the taking of property for one's own or exclusive use with a sense of permanence. Under such interpretation the establishment of a permanent settlement or the carrying out of commercial activities by nationals of a country on a celestial body may constitute national appropriation if the activities take place under the supreme authority (sovereignty) of the state. Short of this, if the state wields no exclusive authority or jurisdiction in relation to the area in question, the answer would seem to be in the negative, unless, the nationals also use their individual appropriations as cover-ups for their state's activities.5 In this connection, it should be emphasized that the word "appropriation" indicates a taking which involves something more than just a casual use. Thus a temporary occupation of a landing site or other area, just like the temporary or nonexclusive use of property, would not constitute appropriation. By the same token, any use involving consumption or taking with intention of keeping for one's own exclusive use would amount to appropriation.

#### Space-based solar power is not appropriation since they respect free use, are consistent with existing precedent for non-appropriation, are not stationary, and do not reflect the intent to appropriate.

Johnson 20 [Christopher D. Johnson, “The Legal Status of MegaLEO Constellations and Concerns About Appropriation of Large Swaths of Earth Orbit,” Handbook of Small Satellites, 2020-09-13, p.1337-1358] CT

5.2 No, This Is Not Impermissible Appropriation

An opposite conclusion can also be reasonably arrived at when approached along the following lines. The counter argument would assert that the deployment and operation of these global constellations, such as SpaceX’s Starlink, OneWeb, Kepler, etc., are aligned with and in full conformity with the laws applicable to outer space. These constellations are merely the exercise and enjoyment of the freedom of exploration and use of outer space and do not constitute any impermissible appropriation of the orbits that they transit.

5.2.1 Freedom of Access and Use Permits Constellations

Rather than being a violation of other’s rights to access and explore outer space, the deployment of these constellations is more correctly viewed as the exercise and restrict or impinge on other users of the space domain. Because due regard is therefore displayed for the space domain, and to the interests of others, these constellations do not prejudice or infringe upon the freedoms of use and exploration of the space domain and are therefore not occupation, or possession, much less appropriation.

5.2.4 This Does Not Constitute Possession, or Ownership, or Occupation

The use of LEO by satellite constellations is substantially similar to the use of GSO, and therefore permissible. In each region, individual actors are given permission - either from a national administrator or from an international governing body (the ITU) via a national administer–to use precoordinated subsections of space. In a way that is overwhelmingly similar to the use of orbital slots in GSO, the placement of spacecraft into orbits in LEO or higher orbits does not constitute possession, ownership, or occupation of those orbits. This is because States (and their companies) have been occupying orbital slots in GSO for decades, and these uses of GSO have never been accused of “appropriating” GSO. The users have never claimed to be appropriating GSO, and their exercising of rights to use GSO is respected by other actors in the space domain. This is the same situation for other orbits, including LEO and other non-Geostationary orbits. And while GSO locations are relatively stable (subject to space weather and other perturbations, and require stationkeeping), spacecraft in LEO are actually moving through space and are not stationary, so it is even more difficult to see this use by constellations as occupation, much less appropriation. Moreover, Space Situational Awareness (SSA) and Space Traffic Management (STM) will allow other uses to use these orbits, and nothing about the use of any one user necessarily precludes others. Lastly, there is no intention by operators of constellations to exclusively occupy, must less possess or appropriate, these orbits. Would not the appropriation of outer space be an intentional, volutional act? No such intention can be found in the operators of global constellations.

#### Vote neg – two impacts:

#### Limits. Expanding the topic to anything that involves merely launching something into the atmosphere expands the topic into numerous new tech areas which undermines core neg prep.

#### Topic literature. Our definition has intent to define and exclude in the context of the OST, which is the core of all topic research and the only predictable source.

#### Drop the debater to preserve fairness and education – use competing interps – reasonability invites arbitrary judge intervention and a race to the bottom of questionable argumentation.

#### No RVI’s – they encourage abuse which destroys fairness and a good theory will just dump on the RVI in the 2AR, which crowds out substantive education. This turns the topic education standard and a good theory block will deter frivolous violations. Reciprocity doesn’t make sense – they don’t get to win for following the rules

### 2

#### Interpretation: Debaters may not fiat the acts of private actors or fiat changes in mindset. Violation: Reasons to prefer:

#### Real world decision-making. Their Aff waives a magic wand to make every individual coordinate their action and every person just change their mind. That is wishing away a problem, not solving it.

#### There is no neg against utopian fiat - they could fiat that everyone decides to no longer be racist.

#### Limits – there are thousands of companies and permutations of companies, which explodes the number of possible positions and forces a shift to cheaty CPs and theory debates

#### Cross-apply paradigm issues from T

### 3

#### CP: The United States and the People’s Republic of China ought to increase bilateral engagement on space issues by resuming the Civil Space Dialogue and the Space Security Exchange and cooperating to allow private companies to appropriate outer space for space-based solar power.

#### Cooperation over SBSP acts as an olive branch that moderates aggressive Chinese behavior and prevents miscalculation from a space arms race.

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As China’s interests continue to expand outward from its shores, it seeks to build a military capable of protecting its economic interests overseas. For example, China has participated in counterpiracy operations in the Gulf of Aden since 2008 and recently established a permanent base in Djibouti to aid in this effort and serve as a PLA logistics hub for the region. This base will assist the PLA Navy in extending its reach while also securing sea lines of communication, through which much of China’s imports and exports transit. Beijing also has grand ambitions in space, many of which are economical and also require protection. These ambitions include projects to start lunar and asteroid mining, bring the BeiDou-2 Navigation Satellite System network into global service by 2020 and establish a Chinese space station by 2022. Beijing even has preliminary plans for an ambitious space-based solar energy network that will use microwaves to transmit power back to Earth by 2050.10 In the Strategic Studies Quarterly 12, no. 1 edition, Dr. Namrata Goswami argues that Chinese space exploration must be viewed through the broader framework of the Chinese economy’s expanding need for resources.11 She explains that President Xi sees space Counter and Cooperate AIR & SPACE POWER JOURNAL  SPRING 2019 73 as an environment for scientific innovation as well as an opportunity to revitalize stagnant state-owned enterprises. She goes on to state that “. . . these goals are unique as they indicate a completely different view of space. Rather than just an arena for conquest and showing off, China views space as an environment in which to live, work, and create wealth through habitation and resource extraction.”12 This begs the question: how will China protect its interests in space? Leadership in Beijing will increasingly have to consider how it will secure these important economic assets in a realm where there are few laws or agreed upon codes of conduct. Although this analysis is not exhaustive, it provides a basis for understanding China’s current space initiatives and ambitions. So what kind of policy should Washington adopt to accommodate China’s interests, advance our own, and dissuade Beijing from extending a potential conflict into space? An intelligent approach will be two-fold. On one hand, we should foster cooperation where our interests with the Chinese overlap. On the other, we should develop a comprehensive approach for defending our interests, especially in the SCS. The latter issue is of great importance because we must first confront Beijing’s transgressions here on Earth to deter China’s militaristic expansionism in space. Proposals for US Policy Cooperate China’s economic and military rise during the last several decades was made possible by the post-World War II economic order established by the US. However, as a great power, China is unsatisfied with the current US-led order that it did little to help shape. Beijing and Washington are increasingly at odds internationally as their competing interests and visions for the future begin to collide. New avenues for cooperation are desperately needed to foster mutual trust and create an environment where the US and China can coexist with minimal friction. Space presents an excellent opportunity for cooperation between Washington and Beijing. Our two nations will compete in this realm—there is no avoiding that. However, both parties will benefit greatly from having a standardized set of rules governing military and economic activities in space. Hopefully, if these two great powers establish a framework of behaviors and norms for space, the rest of the world will follow suit. To start, the US should extend an olive branch. As Brian Wee den and Xiao He point out in their article for War on the Rocks, “Washington still hopes that Beijing can be a constructive partner for greater international space security. While China still chafes at the largely American constructed rules-based order, it likewise has a clear interest in using its development of space capabilities to promote bilateral cooperation and to play a role the formation of new international regimes.”13 While Russia seeks to undermine international space initiatives, Beijing and Washington should look toward the future and create a bold plan for space governance. This does not mean intimate cooperation, but there should be norms and codes for how government entities and private corporations 74 AIR & SPACE POWER JOURNAL  SPRING 2019 Loftus should act in space. Weeden and He go on to say that both sides should seek to establish confidence-building mechanisms to help build trust as well as processes for cooperation and deconfliction. On the economic front, private companies crave stability and clear rules. If the world’s two preeminent military and economic powers establish clear guidelines early on, potential financiers will have greater confidence to invest the large up-front costs for expensive space-based projects. This leads to the next point that both sides should promote: private sector cooperation in the space domain. It would be advantageous for both sides if private corporations in the US and China pursue space exploration together. Space-lift capabilities, space stations, asteroid mining, lunar stations, and other endeavors all require significant initial costs. By partnering, American and Chinese corporations could call upon the support of both the Chinese and US governments in seeking out new resources such as solar power, rare elements, and numerous other fields for scientific discovery that would be of great benefit to people everywhere. A private-sector partnership should be plausible as long as intellectual property rights are respected and the governments involved don’t micromanage the projects. Deep US–Chinese economic integration is often cited as one reason war between our two nations is unthinkable. Why would the same logic not extend to space? Despite the potential space holds for cooperation, there is plenty of room for conflict. While high-ranking military officials in both China and the US believe the militarization of space is inevitable, it would be beneficial to agree upon one rule up front: no kinetic strikes.14 In 2007, China tested an antisatellite missile against one of its failing weather satellites, projecting debris that continues to threaten space-based assets to this day. A kinetic battle involving satellites would create clouds of space junk for which there is no current remedy. Both Beijing and Washington have reason to limit space warfare to nonkinetic means. If a conflict were to occur, there are a number of different ways to neutralize or affect satellites short of kinetic strikes. These methods include radio frequency jamming and lasers that can temporarily incapacitate or even completely destroy satellite-based sensors. It should be added that spy satellites are important to building trust. Spy satellites allow nation-states to have an understanding of what their rivals are doing, at least partially allaying suspicion of the other party. A similar terrestrial example is the Treaty on Open Skies, which is primarily based around the US and Russia but claims 32 other signatories. According to the Department of State, “the Treaty is designed to enhance mutual understanding and confidence by giving all participants, regardless of size, a direct role in gathering information through aerial imaging on military forces and activities of concern to them.”15 Both sides must recognize the importance of this technology in allaying suspicions and preventing paranoia. An agreement to not target spy satellites (through a kinetic strike, jamming, lasers, or any other means) would be a bitter pill to swallow but would foster greater openness while also mitigating the militarization of space.

#### Solves:

#### Space war

#### Crisis escalation

#### Miscalc

#### Space debris

KAFURA 2/10 [CRAIG KAFURA (Assistant director for public opinion and foreign policy at the Chicago Council on Global Affairs, a security fellow with the Truman National Security Project), “RENEW SPACE DIALOGUE WITH CHINA” War on the Rocks, 2/10/2022. Accessed 2/11/2022. <https://warontherocks.com/2022/02/renew-space-dialogue-with-china/>] CT

In 2013, the United States needed to warn the People’s Republic of China about a potential satellite collision in low Earth orbit. Washington’s only way of doing so: sending a close approach notification to a fax number in China, which they hoped would be received, read, and acted upon in time to avoid disaster.

Fortunately, at the 2014 U.S.-China Strategic and Economic Dialogue, the United States and China were able to discuss the problem and find a better solution: email. Things improved further the following year, with the two sides establishing a direct link for both sides to share information about potential satellite collisions. That success was followed by launch of the U.S.-China Civil Space Dialogue in 2015 and two Space Security Exchanges chaired by the U.S. Department of State and the Chinese Ministry of Foreign Affairs in May and December of 2016. However, despite the increasing relevance of space to broader issues in the Sino-American relationship, neither group has met since 2017.

Renewing these space dialogues is an urgent priority because the stakes for strategic drift are catastrophic. Next time a potentially dangerous issue arises in space — and there will be a next time — in the absence of these regular points of contact, the two countries might not be so lucky. It’s thus high time to re-launch both the Civil Space Dialogue and the Space Security Exchange to prevent space accidents from inadvertently escalating into conflict.

Both the Civil Space Dialogue and the Space Security Exchange were born out of the Strategic and Economic Dialogue, the Obama administration’s flagship effort to engage China. The annual multi-day dialogue ran from 2008 to 2016, consisted of both economic and strategic dialogue tracks, and brought together American and Chinese heads of state and top policymakers from a wide range of departments across the U.S. and Chinese governments. And it was through the Strategic and Economic Dialogue that the United States and China were able to move from the fax era into the age of email.

As a recent report on the Strategic and Economic Dialogue from the National Committee on American Foreign Policy and the American Friends Service Committee shows, dialogue mechanisms like the Space Security Exchange and Civil Space Dialogue are key to managing the significant asymmetries in the relationship between the United States and China. The differences in the American and Chinese governance systems can easily create unintentional misunderstandings of both policy and intent. The substantive content of these dialogues can help reduce misperceptions and identify areas of potential cooperation, while consistent, repeated dialogues provide regular points of contact that can persist through the ups and downs inherent in Sino-American relations. With both sides seeking to put guardrails on the relationship,

and with a tentative agreement to engage in dialogue on strategic issues, the Biden administration should propose — and Beijing should accept — a renewal of the U.S.-China Civil Space Dialogue and Space Security Exchange. After years of silence, there is certainly a lot to talk about.

Military Uses of Space: Seizing the High Ground

China’s space security developments are long in the making. Beijing designated space as a new domain of warfare in its 2015 defense white paper, arguing that outer and cyber space had “become new commanding heights in strategic competition.” And as the Department of Defense’s 2021 report to Congress on China’s military and security developments highlights, space and counterspace operations are increasingly important for the People’s Liberation Army. Run out of the Strategic Support Force, the Space Systems Department is responsible for nearly all of China’s military operations in space, including launch, surveillance, and warfare. While many of their space capabilities are focused on command, control, and intelligence functions, others have more offensive aims. That includes the ground-based anti-satellite weapon demonstrated very publicly in 2007, which destroyed a Chinese weather satellite and created a massive space debris field that continues to endanger other objects in low-earth orbit.

The Financial Times’ 2021 reporting on a purported Chinese nuclear-capable hypersonic missile test — in which a platform launched from China circled the globe before diving to attack a target — fixed Washington’s attention on these emerging space-adjacent technologies and revived Cold War memories of similar Soviet systems as well as the nuclear arms race. While Chinese officials have denied the military applications of the test, hypersonic gliders like the DF-17 are hardly the only new technology in development. As the most recent report from the U.S. Office of the Director of National Intelligence notes, Beijing is deeply involved in the development of space and counterspace capabilities, with such capabilities “intended to target U.S. and allied satellites” and “integral to potential military campaigns by the [People’s Liberation Army].”

Nor is China the only one with eyes fixed on the heavens. News reports claim that the United States is poised to unveil a previously secret space weapon. Key targets of this unveiling: policymakers in Moscow and Beijing. Gen. John Hyten, vice chairman of the Joint Chiefs of Staff, has pushed for greater transparency around American military capabilities in space, arguing that “deterrence does not happen in the classified world.” But as with nuclear arms, deterrence and reassurance go hand in hand. And just as analysts have noted the need to avoid a nuclear arms race with China, the United States should seek to avoid sparking an arms race in space. A space arms race — particularly further testing of destructive anti-satellite weapons — puts the peaceful use of space at risk for the whole of humanity.

Space Issues Are Strategic Issues

Given both the U.S. and Chinese footprints in outer space, space issues are also strategic issues. And recent reports that the Chinese military is moving to a launch-on-warning footing for its nuclear forces makes a resumption of bilateral space security exchanges with China all the more urgent. As the 2021 Department of Defense report on Chinese capabilities notes, part of China’s early warning system to detect ballistic missile launches is space-based, as is the U.S. system. At the same time, the Department of Defense reports that Chinese experts focus on the need to “cripple or destroy the enemy’s information system … by making it blind, deaf or paralyzed.” Both the United States and China expect the other to target space-based assets, such as early-warning satellites, with just this goal in mind. This is a deadly combination. It would be all too easy for either side to interpret a satellite accident — either a collision with debris or a simple system failure — as an attempt to take out its early-warning network and thus the first strike in a potentially nuclear war.

At the time of the June 2021 Biden-Putin summit, Chinese Foreign Ministry spokesman Zhao Lijian noted China’s willingness “to have bilateral dialogue with relevant sides with mutual respect and on an equal footing” on issues of strategic stability. The United States should take them up on their offer in a renewed Space Security Exchange.

The initial U.S.-China Space Security Exchanges, held in May and December of 2016, were led by the U.S. Department of State and the Chinese Ministry of Foreign Affairs, with additional participants from the Chinese Ministry of Defense and the China National Space Agency. Frank Rose, then assistant secretary of state for arms control, verification, and compliance, chaired the talks for the U.S. side, saying they were “a very good dialogue … a real discussion rather than just an exchange of talking points.” However, those dialogue processes lapsed after 2016 and have not been renewed.

Reviving the U.S.-China Space Security Exchange would bring bilateral discussions on space security in line with how Washington engages other countries on space issues — at present, the United States has over a dozen dialogues on space security with countries like Japan, India, and Russia. Moreover, a regular, repeated dialogue on space security issues would bring together U.S. and Chinese officials working on space security, establish common understandings of one another’s national policy, and allow them to build working relationships that could help defuse a crisis before it escalates.

Civil Space: It’s Getting Crowded Up Here

But it’s not just the military use of space that Washington and Beijing need to discuss. Civilian space issues, too, are part of the geostrategic landscape. And with low Earth orbit getting increasingly crowded, both sides have issues that need to be addressed.

In 2021, China’s Tiangong space station twice had to maneuver to avoid colliding with StarLink satellites put into orbit by Elon Musk’s SpaceX corporation. In response, China submitted a formal complaint through the United Nations, pointing to the responsibilities of all countries party to Outer Space Treaty. Ratified in 1967, the treaty bans nuclear weapons in space, establishes that space and celestial bodies will be freely explored for peaceful purposes, and precludes claims of sovereignty over non-Earth territories — though it does not go so far as to ban military activities in space. The treaty also states that countries are responsible for the actions of their nations’ commercial actors — and thus the United States is responsible for the actions of SpaceX.

This isn’t the first time SpaceX has been criticized for its behavior in outer space. And the problem is only going to grow more serious: The 2,000 StarLink satellites currently deployed are only a fraction of the planned total of 30,000 as part of SpaceX’s second-generation low Earth orbit broadband constellation. Of course, America’s SpaceX is not the only one interested in building massive satellite constellations. The newly-created state-owned (and independent of existing telecoms) China Satellite Network Group has been tasked with launching China’s own broadband satellite constellation, with plans for roughly 13,000 satellites. With so many satellites heading into low Earth orbit in the coming years, experts fear additional near-misses — or even collisions — between orbiting satellites.

Why the concern over satellite collisions? In a word, debris. Whether produced by an anti-satellite weapons test or an accidental collision, any collision in low Earth orbit creates additional orbiting space debris, which in turn increases the probability of additional collisions — and more debris. In the worst-case scenario, this could lead to a catastrophic cascade of collisions (“Kessler Syndrome”) of the type featured in Alfonso Cuarón’s 2013 Academy Award-winning film Gravity. Such a cascade event would leave low Earth orbit an inhospitable place for human spaceflight. With the United States and China both launching thousands of satellites into orbit in the coming years, bilateral dialogue between the two will be critical to reining in the growth of space debris. A formal dialogue process such as the Civil Space Dialogue would provide officials on both sides an arena to identify critical problems, connect the appropriate authorities to one another, and address issues of common concern.

Making Space to Keep Outer Space an Open Space

Resuming the U.S.-China Civil Space Dialogue is also an easier to bar to clear than other, broader forms of civil cooperation between the United States and China on space issues. One barrier to that cooperation is the Wolf amendment, which limits engagement with China on space issues. Named for former Rep. Frank Wolf, the language has been included in the annual appropriations bill since 2011 and puts a number of obstacles in front of the National Aeronautics and Space Administration(as well as the White House Office of Science and Technology Policy and the National Space Council) for any efforts to coordinate or collaborate with China or any Chinese company. While not a ban on interactions with China on space issues, the amendment has certainly chilled past efforts at engaging China in these areas. The U.S.-China Civil Space Dialogue, hosted by the U.S. Department of State, provided an easier path to get American and Chinese space experts in the same room (though officials from the National Aeronautics and Space Administration were still required to submit advanced certification to Congress that the meeting would not violate the Wolf restrictions in order to participate in the dialogue).

Resuming a pair of dialogues might not seem like enough given the stakes and the scope of issues at hand. Space policy experts have proposed a range of potential policies for the United States to pursue, including a voluntary moratorium on anti-satellite weapons tests, legally binding agreements on space security as part of a broader space arms control agenda, and even a global ban on anti-satellite testing.

These proposals all have their merits. But the United States is a long way from engaging China in an arms control framework for space. At present, U.S.-Chinese relations are still in rough shape, with limited engagement on most issues. While officials from the Biden administration have stated their desire to engage China in discussions of nuclear arms control, the United States and China are not currently engaged in any such talks. Nor have the United States and China ever concluded a bilateral nuclear arms control agreement, though the United States has far more experience negotiating over nuclear weapons than on space arms control.

The U.S.-Chinese relationship also now lacks the overarching framework for discussion once provided by the Strategic and Economic Dialogue, which, though oft maligned in Washington, D.C., produced many successful outcomes for the United States. If the United States and China cannot manage to sustain a basic level of dialogue on space issues, grander proposals — no matter their policy rigor — will never take off.

These two dialogue processes can also focus and motivate internal policy discussions in Washington and Beijing. As space experts have pointed out, one obstacle to the United States promoting a common set of space norms in its own behavior is that the United States itself does not have a shared understanding across agencies of what those norms should be. One of the conclusions from our investigation of the U.S.-China Strategic and Economic Dialogue was the role that the annual dialogue process served in forcing both sides — American and Chinese alike — to engage in interagency negotiations back home over issues of common concern.

A call for engagement and dialogue with China might seem quaint given the public funeral for the era of engagement. Yet the Biden administration has continued to seek a dialogue process with Beijing, as indicated by the repeated engagements between high-level U.S. officials and their Chinese counterparts and by President Joe Biden’s own direct dialogues with Chinese leader Xi Jinping. Per Secretary of State Anthony Blinken, the Biden administration’s approach to China is “competitive when it should be, collaborative when it can be, and adversarial when it must be” — a line oft repeated by administration officials. Space issues, both civil and security, are and will continue to be a mixture of collaboration and competition. But both the United States and China should engage with one another to ensure that that competition does not lead to space becoming an adversarial arena. Given the outstanding space issues in the Sino-American relationship, it’s time to re-launch both the Civil Space Dialogue and the Space Security Exchange.

### 4

#### SSP is key to space settlement. Best source of power for basing and deep space exploration.

Oberhaus 21 [DANIEL OBERHAUS, “Space Solar Power: An Extraterrestrial Energy Resource For The U.S.,” Innovation Frontier Project, August 18, 2021. <https://innovationfrontier.org/space-solar-power-an-extraterrestrial-energy-resource-for-the-u-s/>] CT

DEEP SPACE EXPLORATION

In 2017, the Trump administration directed NASA to land humans on the Moon by 2024.70 Known as the Artemis Program, the space agency aims to establish a permanent human presence on the lunar surface (i.e., a moon base) and use this outpost as a proving ground for the technologies that will eventually carry humans to Mars.71 One of the main goals of Artemis is to advance the technologies required for in-situ resource utilization, which will allow astronauts to make productive use of lunar resources.72 For example, a heat treatment process known as sintering can fuse lunar dust to create a concrete-like material for rocket landing pads, and frozen water can be broken down into its constituent elements — hydrogen and oxygen — which are the main ingredients of rocket fuel.73 The problem is that all these activities, including simply sustaining a human habitat, require far more energy than has ever been artificially generated in space. Moreover, the agency has shortlisted the Moon’s south pole as a likely site for its first landing, which is a particularly inhospitable piece of lunar real estate.74 To meet the energy needs of its planned lunar missions, NASA is developing small nuclear reactors capable of providing up to 10 kilowatts of power.75 While these should be sufficient to meet the needs of a small lunar crew, they also come with important limitations. They must be sited sufficiently far from the lunar base to limit astronaut’s exposure to nuclear radiation. Furthermore, these reactors are effectively immobile once they are operational. Because of the infrastructure required to transport the energy from the reactor to the load source, they cannot easily be moved to meet evolving exploration needs. Conventional solar power on the lunar surface may also be an insufficient solution for future moonbases, especially around the lunar south pole. There are craters on the Moon’s south pole that are permanently shadowed and others that receive near constant sunlight.76 The challenge is that it may not be possible to simply put solar collectors in the permanently sunny craters and route this power to where resource extraction is happening in the shadows. These craters may be separated by kilometers of rugged terrain, which would require substantial investments in lunar surface infrastructure to route energy from the source to the end user. While there may be areas closer to the extractive operations that receive sunlight, this light will be intermittent. And like nuclear power on the surface, any large-scale solar installations are likely to be immobile.77 Space solar power is a strong alternative candidate for providing power for lunar surface operations. It is fundamentally safe for humans, it can be rerouted to different locations to meet changing mission requirements, and it can be scaled as necessary. While the size of both the solar collector and ground-based receiver is a limiting factor for lunar operations, the tenuous lunar atmosphere means that smaller systems that use laser light can be a viable option on the Moon.

#### Space Settlement is coming now and prevents inevitable extinction. Settlement requires private industry and rule of law.

Gesl 18 [Paul M. Gesl (Maj, USAF JD), “PREPARING FOR THE NEXT SPACE RACE: Legislation and Policy Recommendations for Space Colonies,” A Research Report Submitted to the Faculty In Partial Fulfillment of the Graduation Requirements for the Degree of MASTER OF OPERATIONAL ARTS AND SCIENCES (April 2018). <https://apps.dtic.mil/sti/pdfs/AD1053024.pdf>] CT

Why the United States Needs to Think About Space Colonization Now

The United States’ space policies under the previous two Presidential administrations have not matched the ambition of the commercial sector. The author has criticized the National Space Policies of both President Obama and George W. Bush as being too “Earth-Centric.”6 Based on the current state of technologies, it is easy to dismiss space colonization as, at best, a problem to worry about tomorrow and, at worst, mere science fiction. This is irresponsible. Reaching space is difficult. Colonizing it will be even more difficult; however, we cannot overlook it as a likely possibility. NASA viewed space colonization as an endeavor within humanity’s reach in the 1970s.7 Now it is beginning to take shape as a reality. In 2015 at the Pioneering Space National Summit, policy makers, industry leaders and advocates agreed that “The long term goal of the human spaceflight and exploration program of the United States is to expand permanent human presence beyond low-Earth orbit in a way that will enable human settlement and a thriving space economy. This will be best achieved through public-private partnerships and international collaboration (emphasis in original).”8 Additionally, there have been several attempts in Congress to pursue space settlement.9 Private industry appears to be taking the lead in this race. Elon Musk, the CEO of SpaceX intends to establish a colony of a million settlers on the surface of Mars.10 SpaceX is targeting the first manned missions to make this a reality to launch in 2024.11 Mr. Musk envisions the full colonization to take 40-100 years.12 Even if this timeline misses its ambitious deadline by a decade, humanity will be a multi-planetary species in many readers’ lifetimes. It is important to note that Mr. Musk recently stated that SpaceX is “building the first Mars, or interplanetary ship, and I think we’ll be able to do short trips, flights by first half of next year.”13 Even though he joked that the company might miss their timeline, his comments highlight that colonization is an issue that is fast approaching.14 Another factor to consider is that a legal framework needs to be developed before a Martian colony is at its full capacity. Mr. Musk envisions using SpaceX’s BFR to send approximately 100 people per flight to Mars.15 Additionally, SpaceX appears to be planning for humans living on the lunar surface in their Moon Base Alpha.16 SpaceX is not alone in their ambitions. United Launch Alliance (ULA) published their plans to expand the population of humans living and working in space. Their Cis-lunar 1,000 framework is a 30-year plan to develop the cis-lunar economy and grow the population of humans living and working in space from six to 1,000.17 Space colonization is more important to our species than the economic benefits of a space economy and the conquests of exploration. The current world population is 7.4 billion people.18 According to the World Wildlife Foundation and the Global Footprint Network, “the equivalent of 1.7 planets would be needed to produce enough natural resources to match our consumption rates and a growing population.”19 The problem will likely grow worse as the population of the planet continues to grow. According to the United Nations, the Earth’s population will grow to over 11 billion people by 2100.20 Based partially on this, “Prof [Stephen] Hawking said it was only a matter of time before the Earth as we know it is destroyed by an asteroid strike, soaring temperatures or over-population.

”21 Hawking further stated that, “When we have reached similar crisis in or (sic.) history there has usually been somewhere else to colonise (sic.). Columbus did it in 1492 when he discovered the new world. But now there is no new world. No Eutopia (sic.) around the corner. We are running out of space and the only places to go are other worlds.”22 The late Professor Hawking is not alone in his view, the National Space Society observed the benefits of expanding into space. “Outer space holds virtually limitless amounts of energy and raw materials, which can be harvested for use both on Earth and in space. Quality of life can be improved directly by utilization of these resources and also indirectly moving hazardous and polluting industries and/or their waste products off planet Earth.”23 These are just several of the many compelling reasons to colonize space advocated by groups such as the National Space Society and the Space Frontier Foundation.24 ULA appears to be taking steps to meet their ambitions for the future. ULA announced the first step towards making their Cis-lunar 1,000 vision a reality. In October 2017, they announced a partnership with Bigelow Aerospace to launch a habitat to low lunar orbit.25 The launch is expected to be completed before the end 2022.26 Some feel that colonization is going to happen, no matter what governments do.27 If colonization is going to happen, then it is in the United States’ best interest to develop a legal framework that supports the efforts and protects our citizens who will travel to and live in these habitats. This is important for several reasons. First, private corporations appear to have an interest in colonizing space, so it is in humanity’s future whether the government is involved nor not. However, governments can take actions that will accelerate things.28 Second, it is in the best interest of the United States’ economy to support commercial companies that are expanding into space. Third, if the United States does not create a favorable legal framework for space colonization, someone else will. Finally, as humanity expands away from the surface of the Earth, it is important to create a free society based on the principles of the Rule of Law rather than some other form of government, or an anarchistic company town.

#### An extinction event is inevitable, unpredictable, and the risk is growing. Space settlement is the only solution and it requires a thriving private space industry including orbital installations, mining, and tourism.

Hertzler and Rench 16 [Kevin Hertzler and Rebecca McCauley Rench (PhD), “GLOBAL EXTINCTION or a Space-Industrial Complex,” Potomac Institute for Policy Studies (2016). <https://www.potomacinstitute.org/steps/images/PDF/Articles/HertzlerSTEPS_2016Issue3.pdf>] CT

Yet, the bigger existential threat of annihilation of all humanity, by nuclear holocaust or natural forces, is currently considered too remote to be taken seriously. The geological record has preserved the rise and decline of many species throughout earth’s history, whether their extinctions were the result of asteroid impacts, volcanic activity, solar flares, or gamma ray bursts from distant star systems. To think humanity above the historical trends of the universe is conceited and illogical. Perhaps it is time to reconsider the annihilation threat and to entertain the need for an off-Earth sustainable colony.

Humanity might not get a second chance at survival. The idea of an extinction event has long been fuel for science fiction writers, and is exemplified in the novel by Neal Stephenson entitled Seveneves. 3 In Seveneves, humanity will be wiped out on Earth within two years unless nations collaborate to put a small group of astronauts and scientists on the International Space Station in hopes they survive and repopulate the planet. Science fiction has been known to become science fact, both in ways that are beneficial to society, and in ways that have negative consequences. A study of threats and a dystopian future is also inculcated into academia, with Niklas Bostrom, the founder of the “Future of Humanity Institute,” as a recognized leader. While the risk in any given year might be quite small, there is almost certainly an eventual global extinction event. With a growing population and the speed of destructive technological advancements, the annual risk of humanity’s downfall may be increasing. When the inevitable is presented as a certain future, or happens before we can react, what will be humanity’s last collective thought? Given our current technological prowess, perhaps the time to take action is now. During a Wall Street Journal All Things Digital conference,4 Elon Musk said:

Either we spread Earth to other planets, or we risk going extinct. An extinction event is inevitable and we’re increasingly doing ourselves in.

World renown physicist Steven Hawking agrees and recently told a gathering at the Big Think:5

I believe that the long-term future of the human race must be in space. It will be difficult enough to avoid disaster on planet Earth in the next hundred years, let alone the next thousand, or million. The human race shouldn’t have all its eggs in one basket, or on one planet. Let’s hope we can avoid dropping the basket until we have spread the load.

The timing and the nature of this event remains truly unknown. Predictions suggest an existential event may come from space or be the product of our own hand, but we will likely remain ignorant of the cause until its near arrival. What we do know is that if humanity is still inhabiting only one planet, our unique life stories will be tragically and permanently erased. Thus, we confront the realization of the likelihood of a global extinction event that we have absolutely no control over, that we currently have no defense for, and no plans to escape from. We are deluded into believing that since an extinction event is rare, it can not occur in our lifetime. Consider the attitude expressed in the Jet Propulsion Laboratory’s Near Earth Object program’s website6 which states:

On an average of every several hundred thousand years or so, asteroids larger than a kilometer could cause global disasters … No one should be overly concerned about an Earth impact of an asteroid or comet. The threat to any one person from auto accidents, disease, other natural disasters and a variety of other problems is much higher than the threat from [Near Earth Objects] NEOs. Over long periods of time, however, the chances of the Earth being impacted are not negligible so that some form of NEO insurance is warranted. At the moment, our best insurance rests with the NEO scientists and their efforts to first find these objects and then track their motions into the future. We need to first find them, then keep an eye on them.

However, what will our response be if we find an NEO larger than a kilometer that is on a collision course with Earth? A database is not an insurance policy and leaves open the issue of an appropriate response. Currently, our only real hope lies with mitigation strategies predicated on intercepting7 or redirecting8 NEO objects. The former suggests using a robotic spacecraft that is weighted or carries a nuclear explosive and the latter will redirect the NEO object with a robotic spacecraft. However, as NASA states in their “Asteroid and Comet Watch” website9 a response requires decades of warning time if the NEO object is larger that a few hundred meters.

We needed Sputnik to motivate our resolve for the domination of space. The mental contrast of one day dreaming about space travel through science fiction, and then seeing it live on television in the living room, stimulated our imaginations. President Kennedy’s speech inspired a nation and the decade-long pursuit that saw a surge in academic scholarship and technological advances. There are many technologies and spinoffs10 woven into the fabric of the world culture that owe their birth to that speech and subsequent technology development.

Can we expect the development of a humanity insurance policy before a crisis begins? It might require funding of NASA at levels similar to the 1960s, when we successfully landed men on the moon. It might require the development of a space-industrial complex that could help drive future economic growth. It might require that we spread out to other planets and achieve Earth independence to stave off global human extinction, even on our watch. It does require that we take the threat, and its inevitability, seriously and devote resources to preventing our extinction.

The ancient seafarers were motivated to take risks for the sake of curiosity and the desire for exploration and resources.11 The drive to leave the planet and set up colonies is similar: There is the allure, the curiosity, the adventure, and the insurance. It could, and should, be an international effort justified based on the purpose of planning for the preservation of humanity.

Certain plans are underway. Mars One is a nonprofit organization that promotes its plans for a Mars settlement within fifteen years.12 Elon Musk’s company SpaceX is reportedly developing plans to send large numbers of people to Mars.13 And NASA recently released a comprehensive strategy14 that leverages nearterm space activities with a comprehensive capability development culminating in an independent human presence on Mars. The NASA plan, at a minimum, would provide a future with a sustainable presence for humanity in deep space and provide an answer to many global extinction scenarios. Some of these plans are more logistically feasible than others, but all demonstrate the ambition of a select sect of humanity interested in pursuing off-Earth colonization. This strategy is well reasoned and has the potential to save humanity as well as provide a much needed economic boost by creating a space-industrial complex with the nascent private-public partnerships15 for mining asteroids, manufacturing propellant on the moon, creating fuel depots, and launching humans into space. The spinoff technologies would fuel real job growth as evidenced by the Apollo program of the 1960s. Rather than a short lived event to win a space race, this modern space age will be designed as a sustained effort in human space colonization. The current roadblocks preventing this strategy from moving forward are budgets, political priorities, and the changeable public interests; the exact same denouement of the moon landings over 40 years ago. An article posted on the Washington Post website by Joel Achenbach made the following observation:16

At the moment NASA can’t even get an astronaut to the International Space Station without buying a seat on a Russian rocket. A new NASA space capsule that was conceived in 2005 likely won’t be ready until 2023, according to NASA’s latest estimate, and it’s built for 21-day missions, not for trips to Mars.

The same article quotes Doug Cooke, a former NASA associate administrator as saying:

There needs to be more of a plan for actually getting there [Mars]. You can’t have a flatline budget indefinitely and think you’re going to put all of this together by 2030.

We must support the mission of human space exploration and colonization with both our interests as well as our national budget priorities if we want any hope of surviving the inevitable existential global extinction event.

#### Space settlement outweighs every impact. Even slight delays result in an unfathomable loss of life.

Bostrom 03 [Nick Bostrom, “Astronomical Waste: The Opportunity Cost of Delayed Technological Development,” Utilitas Vol. 15, No. 3 (2003): pp. 308-314. https://nickbostrom.com/astronomical/waste.html#\_edn8,] CT

II. THE OPPORTUNITY COST OF DELAYED COLONIZATION

From a utilitarian perspective, this huge loss of potential human lives constitutes a correspondingly huge loss of potential value. I am assuming here that the human lives that could have been created would have been worthwhile ones. Since it is commonly supposed that even current human lives are typically worthwhile, this is a weak assumption. Any civilization advanced enough to colonize the local supercluster would likely also have the ability to establish at least the minimally favorable conditions required for future lives to be worth living. The effect on total value, then, seems greater for actions that accelerate technological development than for practically any other possible action. Advancing technology (or its enabling factors, such as economic productivity) even by such a tiny amount that it leads to colonization of the local supercluster just one second earlier than would otherwise have happened amounts to bringing about more than 10^29 human lives (or 10^14 human lives if we use the most conservative lower bound) that would not otherwise have existed. Few other philanthropic causes could hope to match that level of utilitarian payoff. Utilitarians are not the only ones who should strongly oppose astronomical waste. There are many views about what has value that would concur with the assessment that the current rate of wastage constitutes an enormous loss of potential value. For example, we can take a thicker conception of human welfare than commonly supposed by utilitarians (whether of a hedonistic, experientialist, or desire-satisfactionist bent), such as a conception that locates value also in human flourishing, meaningful relationships, noble character, individual expression, aesthetic appreciation, and so forth. So long as the evaluation function is aggregative (does not count one person’s welfare for less just because there are many other persons in existence who also enjoy happy lives) and is not relativized to a particular point in time (no time-discounting), the conclusion will hold. These conditions can be relaxed further. Even if the welfare function is not perfectly aggregative (perhaps because one component of the good is diversity, the marginal rate of production of which might decline with increasing population size), it can still yield a similar bottom line provided only that at least some significant component of the good is sufficiently aggregative. Similarly, some degree of time-discounting future goods could be accommodated without changing the conclusion.[7]

III. THE CHIEF GOAL FOR UTILITARIANS SHOULD BE TO REDUCE EXISTENTIAL RISK

In light of the above discussion, it may seem as if a utilitarian ought to focus her efforts on accelerating technological development. The payoff from even a very slight success in this endeavor is so enormous that it dwarfs that of almost any other activity. We appear to have a utilitarian argument for the greatest possible urgency of technological development. However, the true lesson is a different one. If what we are concerned with is (something like) maximizing the expected number of worthwhile lives that we will create, then in addition to the opportunity cost of delayed colonization, we have to take into account the risk of failure to colonize at all. We might fall victim to an existential risk, one where an adverse outcome would either annihilate Earth-originating intelligent life or permanently and drastically curtail its potential.[8] Because the lifespan of galaxies is measured in billions of years, whereas the time-scale of any delays that we could realistically affect would rather be measured in years or decades, the consideration of risk trumps the consideration of opportunity cost. For example, a single percentage point of reduction of existential risks would be worth (from a utilitarian expected utility point-of-view) a delay of over 10 million years. Therefore, if our actions have even the slightest effect on the probability of eventual colonization, this will outweigh their effect on when colonization takes place. For standard utilitarians, priority number one, two, three and four should consequently be to reduce existential risk. The utilitarian imperative “Maximize expected aggregate utility!” can be simplified to the maxim “Minimize existential risk!”.

### 5

#### CP: The appropriation of outer space by private entities except for American private entities via space-based solar power is unjust.

#### SSP is key to U.S. soft and hard power.

Oberhaus 21 [DANIEL OBERHAUS, “Space Solar Power: An Extraterrestrial Energy Resource For The U.S.,” Innovation Frontier Project, August 18, 2021. <https://innovationfrontier.org/space-solar-power-an-extraterrestrial-energy-resource-for-the-u-s/>] CT

GEOPOLITICS OF SSP

The geopolitics of space solar power are best understood along two dimensions: diplomacy and national security. SSP is valuable as a diplomatic tool both during its construction and operation. The assembly of such a massive piece of space infrastructure will almost certainly involve international participation due to the substantial costs of construction. But even if SSP projects are undertaken on a national or regional basis, they will still involve cooperation from the international community to establish frameworks for their safe operation. In each instance, there are important historical precedents to consider. The International Space Station began its life as a national project of the United States called Space Station Freedom.94 But as costs ballooned and policymakers began to sour on the project, NASA opened the station to international partners. The lessons learned from the internationalization of the space station, such as bringing partners into the conversation early, the clear delegation of responsibilities, and equitable cost-sharing agreements are directly relevant to the construction of a space solar power platform. Similarly, there is also a precedent for establishing operational norms for space. The 1967 UN Outer Space Treaty remains the guiding document for all spacefaring nations and also establishes a basic framework for the operation of SSP assets (e.g., their beamed energy cannot be used as a weapon). Fortunately, the community of researchers working on SSP are already well acclimated to international cooperation and consensus building from decades of workshops and conferences dedicated to the subject. SSP can also play a vital role in national security.95 Just in the past year there have been multiple high-profile failures of the U.S. electricity grid from extreme weather events, such as the unprecedented wildfire season in California and the cold snap in Texas. The vulnerability of our energy supplies to cyberattacks was also exposed during the recent breach of the Colonial Pipeline. Cybersecurity experts expect that state-sponsored attacks of critical infrastructure, particularly energy infrastructure, will become more frequent in the future and have raised concerns that the U.S. grid is unprepared to adequately manage this threat. SSP can bolster the resiliency of the U.S. electric grid by rapidly delivering clean energy to affected regions of the U.S. in the immediate aftermath of a natural or man-made disaster. SSP can further play a role in national security by supplying cheap and readily available clean energy to remote U.S. army facilities and U.S. forward operating bases.96 It would prove to be especially valuable in the latter case given the high cost of supplying these bases with electricity. Typically, they rely on fossil fuel-powered generators, but delivering these fuels to the base can be dangerous and incredibly expensive. During the early days of the Iraq war in the mid-2000s, for example, the cost of generator fuel for these bases ranged from $15 to well over $100 per gallon.97 A 2009 study from Deloitte underscored the risk that fuel transportation poses to American soldiers, concluding that “During the modern age of warfare, the use of fossil fuels to power these vehicles has increased exponentially and this dependence has itself created casualty risk.”98 If SSP is used to reduce the U.S. military’s reliance on fossil fuels to power their forward operating bases, it could save both money and lives. A key limiting factor in the use of SSP for remote military installations is the size of the ground receiver required for SSP. According to researchers at the U.S. Naval Research Laboratory, however, it should be possible to build modest receivers that are able to generate power on the order of 10 kilowatts to 10 megawatts, which is sufficient to meet the needs of most forward operating bases. In the baseline model proposed by the researchers, such a receiver would occupy 0.8 square kilometers or less. This would also require a substantially smaller space-based collector and transmission system compared to the massive platforms required to deliver baseload energy to the grid.99 Finally, SSP can also be a powerful diplomatic tool that can be used to help developing nations decarbonize their electric grids through power purchasing agreements. Climate change is ultimately a global problem and extraterrestrial energy assets are particularly well-suited to address the challenges associated with decarbonizing the world’s electricity. The economic, political, and security benefits of SSP are well-understood by both allies and adversaries of the United States. In particular, Japan and China have made the development of SSP a central priority of their space exploration programs. Japan has been actively researching and developing experimental SSP hardware since the early 2000s.100 In early 2019, China announced its intention to build a megawatt-scale SSP platform by 2030 and create a gigawatt-scale SSP station by 2050.101 India and the European Union are also pursuing their own SSP projects.102, 103 In late 2020, the UK conducted its first major assessment of space solar power and identified it as an important option to achieve its national carbon net-zero goals by mid-century.104 This makes the United States the only major space faring nation whose national space agency does not have a serious plan to develop a SSP platform.

**Hegemony prevents extinction**

**Barnett 11** (Thomas P.M., Former Senior Strategic Researcher and Professor in the Warfare Analysis & Research Department, Center for Naval Warfare Studies, U.S. Naval War College American military geostrategist and Chief Analyst at Wikistrat., worked as the Assistant for Strategic Futures in the Office of Force Transformation in the Department of Defense, “The New Rules: Leadership Fatigue Puts U.S., and Globalization, at Crossroads,” March 7 <http://www.worldpoliticsreview.com/articles/8099/the-new-rules-leadership-fatigue-puts-u-s-and-globalization-at-crossroads>)

Events in Libya are a further reminder for Americans that we **stand at a crossroads in our continuing evolution as the world's sole full-service superpower**. Unfortunately, we are increasingly seeking change without cost, and shirking from risk because we are tired of the responsibility. We don't know who we are anymore, and our president is a big part of that problem. Instead of leading us, he explains to us. Barack Obama would have us believe that he is practicing strategic patience. But many experts and ordinary citizens alike have concluded that he is actually beset by strategic incoherence -- in effect, a man overmatched by the job. It is worth first examining the larger picture: We live in a time of arguably **the greatest structural change in the global order yet endured**, with this historical moment's most amazing feature being its relative and absolute **lack of mass violence**. That is something to consider when Americans contemplate military intervention in Libya, because if we do take the step to prevent larger-scale killing by engaging in some killing of our own, we will not be adding to some fantastically imagined global death count stemming from the ongoing "megalomania" and "evil" of American "empire." We'll be engaging in the same sort of system-administering activity that has marked our stunningly successful stewardship of global order since World War II. Let me be more blunt: As the **guardian of globalization**, the U.S. military has been the **greatest force for peace the world has ever known**. Had America been removed from the global dynamics that governed the 20th century, the **mass murder never would have ended**. Indeed, it's entirely conceivable **there would now be no identifiable human civilization left, once nuclear weapons entered the killing equation.**  But the world did not keep sliding down that **path of perpetual war**. Instead, America stepped up and changed everything by **ushering in our now-perpetual great-power peace**. We introduced the **international liberal trade order known as globalization** and played loyal Leviathan over its spread. What resulted was the collapse of empires, **an explosion of democracy**, the **persistent spread of human rights**, the liberation of women, **the doubling of life expectancy**, a roughly **10-fold increase in adjusted global GDP** and a **profound and persistent reduction in** battle deaths from **state-based conflicts.** That is what American "hubris" actually delivered. Please remember that the next time some TV pundit sells you the image of "unbridled" American military power as the cause of global disorder instead of its cure. With self-deprecation bordering on self-loathing, we now imagine a post-American world that is anything but. Just watch who scatters and who steps up as the Facebook revolutions erupt across the Arab world. While we might imagine ourselves the status quo power, we remain the world's most vigorously revisionist force. As for the sheer "evil" that is our military-industrial complex, again, let's examine what the world looked like before that establishment reared its ugly head. The last great period of global structural change was the first half of the 20th century, a period that saw a death toll of about 100 million across two world wars. That comes to an average of 2 million deaths a year in a world of approximately 2 billion souls. Today, with far more comprehensive worldwide reporting, researchers report an average of less than 100,000 battle deaths annually in a world fast approaching 7 billion people. Though admittedly crude, these calculations suggest a 90 percent absolute drop and a 99 percent relative drop in deaths due to war. We are clearly headed for a world order characterized by multipolarity, something the American-birthed system was designed to both encourage and accommodate. But given how things turned out the last time we collectively faced such a fluid structure, we would do well to keep U.S. power, in all of its forms, deeply embedded in the geometry to come. To continue the historical survey, after salvaging Western Europe from its half-century of civil war, the U.S. emerged as the progenitor of a new, far more just form of globalization -- one based on actual free trade rather than colonialism. America then successfully replicated globalization further in East Asia over the second half of the 20th century, setting the stage for the Pacific Century now unfolding.

# CASE

### UV

#### 1AR theory is not automatically drop the debater – they have to prove why that specific violation is enough. Anything else incentivizes frivolous theory and crowds out substantive education

### Miscalc

#### Public actors thump – China will do anything

#### Won’t go nuclear – seen as a normal conventional attack because of integration with ground forces

Firth 7/1/19 [News Editor at MIT Technology Review, was Chief News Editor at New Scientist. How to fight a war in space (and get away with it). July 1, 2019. MIT Technology Review]

Space is so intrinsic to how advanced militaries fight on the ground that an attack on a satellite need no longer signal the opening shot in a nuclear apocalypse. As a result, “deterrence in space is less certain than it was during the Cold War,” says Todd Harrison, who heads the Aerospace Security Project at CSIS, a think tank in Washington, DC. Non-state actors, as well as more minor powers like North Korea and Iran, are also gaining access to weapons that can bloody the noses of much larger nations in space.

#### Other satellites thump.

Pultarova 21 “SpaceX Starlink satellites responsible for over half of close encounters in orbit, scientist says” Tereza Pultarova [Master's in Science from the International Space University, France, to her Bachelor's in Journalism and Master's in Cultural Anthropology from Prague's Charles University. She worked as a reporter at the Engineering and Technology magazine, freelanced for a range of publications including Live Science, Space.com, Professional Engineering, Via Satellite and Space News and served as a maternity cover science editor at the European Space Agency.], August 18, 2021 <https://www.space.com/spacex-starlink-satellite-collision-alerts-on-the-rise> SM

SpaceX Starlink satellites responsible for over half of close encounters in orbit, scientist says

Starlink satellites might soon be involved in 90% of close encounters between two spacecraft in low Earth orbit.

Operators of satellite constellations are constantly forced to move their satellites because of encounters with other spacecraft and pieces of space junk. And, thanks to SpaceX's Starlink satellites, the number of such dangerous approaches will continue to grow, according to estimates based on available data.

SpaceX's Starlink satellites alone are involved in about 1,600 close encounters between two spacecraft every week, that's about 50 % of all such incidents, according to Hugh Lewis, the head of the Astronautics Research Group at the University of Southampton, U.K. These encounters include situations when two spacecraft pass within a distance of 0.6 miles (1 kilometer) from each other.

Lewis, Europe's leading expert on space debris, makes regular estimates of the situation in orbit based on data from the Socrates (Satellite Orbital Conjunction Reports Assessing Threatening Encounters in Space ) database. This tool, managed by Celestrack, provides information about satellite orbits and models their trajectories into the future to assess collision risk.

Lewis publishes regular updates on Twitter and has seen a worrying trend in the data that reflects the fast deployment of the Starlink constellation.

"I have looked at the data going back to May 2019 when Starlink was first launched to understand the burden of these megaconstellations," Lewis told Space.com. "Since then, the number of encounters picked up by the Socrates database has more than doubled and now we are in a situation where Starlink accounts for half of all encounters."

The current 1,600 close passes include those between two Starlink satellites. Excluding these encounters, Starlink satellites approach other operators’ spacecraft 500 times every week.

In comparison, Starlink's competitor OneWeb, currently flying over 250 satellites, is involved in 80 close passes with other operators' satellites every week, according to Lewis' data.

And the situation is bound to get worse. Only 1,700 satellites of an expected constellation of tens of thousands have been placed into orbit so far. Once SpaceX launches all 12,000 satellites of its first generation constellation, Starlink satellites of all close approaches, Lewis’ calculations suggest.will be involved in 90%

Betancourt, Kiantar () "Legal Challenges Facing Solar Power Satellites," Online Journal of Space Communication: Vol. 9 : Iss. 16 , Article 19. Available at: https://ohioopen.library.ohio.edu/spacejournal/vol9/iss16/19

Solar power satellites automatically raise questions concerning the currently applicable international law, and which laws and processes may need to be in place to accommodate the special requirements of SunSats. These questions include coordination and registration of space objects, property rights in space, rights of private parties, liability for damage, and environmental protection. The general framework to answer these questions already exists, but further development will be needed. The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) has led the development of this legal framework. Presently there are three treaties relating to outer space significant to SBSP. The first and most important is the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space (Outer Space Treaty).[40] Second is the Convention on International Liability for Damage Caused by Space Objects (Liability Convention).[41] Third is the Convention on Registration of Objects Launched into Outer Space (Registration Convention).[42] Outer Space Treaty: The Outer Space Treaty has been accepted and ratified by over 100 countries including all current space faring nations. Ratified in 1967, the Outer Space Treaty created the fundamental base of outer space law under the idea that outer space is the common heritage of mankind. [43] Thus, the exploration and use of outer space shall be free for exploration and use by all states. Article II states outer space, including the moon and other celestial bodies, is not subject to national appropriation by any means. Even for countries that currently lack the resources to reach outer space, the right of exploration and use remains available to them as they become capable of space exploration. Under Article VII, though a state cannot claim ownership to outer space or any celestial bodies within, a state on whose registry launches an object into outer space retains jurisdiction and control over that object. The ownership of such objects in outer space is also not affected by their presence in outer space or by their return to earth. Thus, countries or companies that launch satellites on their state’s registry retain ownership of those satellites. If no such ownership interest existed, there would be no incentive to send a satellite into space that could be appropriated by another country or private party. The Outer Space Treaty addresses actions taken by states. It does, however, contemplate the actions of private companies in two sections. First, in article VI, parties to the treaty agree to bear international responsibility for their national activities in outer space, whether those activities are carried out by governmental agencies or by non-governmental entities. Second, article IX requires states and their nationals are required to seek international consultation in circumstance that could cause harm to other states. Though space exploration in 1968 was dominated by states, the Outer Space Treaty still contemplated private companies joining the states in space travel. For the purposes of SBSP, the Outer Space Treaty contains several other key provisions. Article V of the Outer Space Treaty specifically prohibits the placement of any objects in space carrying nuclear weapons or weapons of mass destruction. Further, testing of any military weapons is strictly forbidden. An example might be an attempt to transform a solar power satellite into a death ray using microwaves or laser beams.[44] Such an action would be in strict violation of the Outer Space Treaty.

#### SSP solves warming. In the short term provides cheap, renewable, and flexible baseload power for on and off-world applications. It’s also key to transition heavy industry to space.

Oberhaus 8/18 [DANIEL OBERHAUS, “Space Solar Power: An Extraterrestrial Energy Resource For The U.S.,” Innovation Frontier Project, August 18, 2021. <https://innovationfrontier.org/space-solar-power-an-extraterrestrial-energy-resource-for-the-u-s/>] CT

EXECUTIVE SUMMARY

What is often left unsaid in discussions about extraterrestrial industrialization and deep space settlement is how to supply the energy needed for large scale infrastructure projects. Nuclear energy has long been the power source of choice for deep space missions.2 This is largely because nuclear power systems can operate for decades without intervention and in locations where there is limited or non-existent sunlight. But nuclear energy is limited in its ability to scale and also creates serious health hazards for near-Earth operation.3 In this paper, we make the case for space-based solar power (SSP) megaprojects as relatively low-cost, scalable, renewable, and always-on power source for on-and-off world applications. Although SSP is a space-based energy asset, it has the potential to rapidly accelerate decarbonization on Earth while also fulfilling space exploration priorities. SSP is a decades-old idea that has only recently become economically viable due to the rapidly falling costs of space access and technological advancements such as higher efficiency electronics, low-cost mass-production of modular space systems like satellites, robotic in-space construction, and wireless power transmission. NASA, the Department of Energy, and several other research agencies have conducted in-depth studies and limited experiments on SSP, but the development of this energy resource was hindered by unfavorable economics. Things have changed and it is time to reconsider SSP as a valuable tool in the nation’s decarbonization strategy. This paper shows how the development of SSP can serve several national imperatives at once. In space, it can provide a renewable and cost-effective source of energy for moon bases and deep space missions. SSP can also provide a valuable source of energy — both electric and thermal — for industrial processes in cislunar space. This will facilitate the transition of heavy industry from Earth to space, which will mitigate carbon emissions

in the medium-to-long term on Earth. Critically, SSP will have a massive impact on terrestrial greenhouse gas (GHG) emissions in the near term through wireless energy transfer from space to Earth. This is SSP’s original “killer app,” and multiple studies have shown that SSP can meet a substantial portion of Earth’s energy needs. Unlike terrestrial solar power, SSP is always on. It can provide solar power rain or shine, day or night. It is also flexible and can be quickly redirected to ground stations in geographically distant locations to meet rapidly changing energy needs. The dream for SSP is to have a source of clean baseload energy that’s available regardless of weather, location, or time of day. The baseload is the minimum electrical energy demand on a grid, which has historically been provided by power stations that are able to generate large and relatively constant amounts of energy. But as more renewables penetrate the grid and create fluctuations in electric supply, the base load power stations of the future must be flexible enough to rapidly ramp up and down to meet the evolving supply and demand dynamics of the grid. Much like the advent of GPS, a robust SSP capacity would have profound geopolitical implications. China is investing heavily in SSP and plans to have the first operating SSP plant in orbit by the end of the decade.4 The Department of Defense (DOD) is also pursuing SSP research for military applications. Notably, the Air Force Research Laboratory recently created a $100 million program to advance key SSP technologies.5 This paper concludes that the U.S. must allocate substantially more human and financial capital to SSP as part of its national security, domestic energy, and space exploration strategies.

#### Warming causes extinction.

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Oh, it could get **very bad**. In 2015, a study in the Journal of Mathematical Biology pointed out that if the world’s **oceans** kept warming, by 2100 they might become hot enough to “**stop oxygen production** by **phyto-plankton** by disrupting the process of photosynthesis.” Given that **two-thirds** of the **Earth’s oxygen** comes from phytoplankton, that would “likely result in the **mass mortality of animals and humans**.”A year later, above the Arctic Circle, in Siberia, a heat wave thawed a reindeer carcass that had been trapped in the permafrost. The exposed body released anthrax into nearby water and soil, infecting two thousand reindeer grazing nearby, and they in turn infected some humans; a twelve-year-old boy died. As it turns out, **permafrost** is a “very good preserver of **microbes** and **viruses**, because it is cold, there is no oxygen, and it is dark” — scientists have managed to revive an eight-million-year-old bacterium they found beneath the surface of a glacier. Researchers believe there are fragments of the **Spanish flu virus**, **smallpox**, and **bubonic plague** buried in Siberia and Alaska. Or consider this: as ice sheets melt, they take weight off land, and that can **trigger earthquakes** — seismic activity is already increasing in Greenland and Alaska. Meanwhile, the added weight of the new seawater starts to bend the Earth’s crust. “That will give you a **massive increase in volcanic activity**. It’ll activate faults to create earthquakes, submarine landslides, tsunamis, the whole lot,” explained the director of University College London’s Hazard Centre. Such a landslide happened in Scandinavia about eight thousand years ago, as the last Ice Age retreated and a Kentucky-size section of Norway’s continental shelf gave way, “plummeting down to the abyssal plain and creating a series of **titanic waves** that roared forth with a vengeance,” **wiping all signs of life** from coastal Norway to Greenland and “drowning the Wales-sized landmass that once connected Britain to the Netherlands, Denmark, and Germany.” When the waves hit the Shetlands, they were sixty-five feet high. There’s even this: if we keep raising carbon dioxide levels, we may not be able to think straight anymore. At a thousand parts per million (which is within the realm of possibility for 2100), human cognitive ability falls 21 percent. “The largest effects were seen for Crisis Response, Information Usage, and Strategy,” a Harvard study reported, which is too bad, as those skills are what we seem to need most. I could, in other words, do my best to scare you silly. I’m not opposed on principle — changing something as fundamental as the composition of the atmosphere, and hence the heat balance of the planet, is certain to trigger all manner of horror, and we shouldn’t shy away from it. The dramatic uncertainty that lies ahead may be the most frightening development of all; the physical world is going from backdrop to foreground. (It’s like the contrast between politics in the old days, when you could forget about Washington for weeks at a time, and politics in the Trump era, when the president is always jumping out from behind a tree to yell at you.) But let’s try to occupy ourselves with the most likely scenarios, because they are more than disturbing enough. Long before we get to tidal waves or smallpox, long before we choke to death or stop thinking clearly, we will need to concentrate on the most mundane and basic facts: everyone needs to eat every day, and an awful lot of us live near the ocean. FOOD SUPPLY first. We’ve had an amazing run since the end of World War II, with crop yields growing fast enough to keep ahead of a fast-rising population. It’s come at great human cost — displaced peasant farmers fill many of the planet’s vast slums — but in terms of sheer volume, the Green Revolution’s fertilizers, pesticides, and machinery managed to push output sharply upward. That climb, however, now seems to be running into the brute facts of heat and drought. There are studies to demonstrate the dire effects of warming on coffee, cacao, chickpeas, and champagne, but it is cereals that we really need to worry about, given that they supply most of the planet’s calories: corn, wheat, and rice all evolved as crops in the climate of the last ten thousand years, and though plant breeders can change them, there are limits to those changes. You can move a person from Hanoi to Edmonton, and she might decide to open a Vietnamese restaurant. But if you move a rice plant, it will die. A 2017 study in Australia, home to some of the world’s highest-tech farming, found that “**wheat productivity** has **flatlined** as a **direct result of climate change**.” After tripling between 1900 and 1990, wheat yields had stagnated since, as temperatures increased a degree and rainfall declined by nearly a third. “The chance of that just being variable climate without the underlying factor [of climate change] is less than one in a hundred billion,” the researchers said, and it meant that despite all the expensive new technology farmers kept introducing, “they have succeeded only in standing still, not in moving forward.” Assuming the same trends continued, yields would actually start to decline inside of two decades, they reported. In June 2018, researchers found that a two-degree Celsius rise in temperature — which, recall, is what the Paris accords are now aiming for — could cut U.S. corn yields by 18 percent. A four-degree increase — which is where our current trajectory will take us — would cut the crop almost in half. The United States is the world’s largest producer of corn, which in turn is the planet’s most widely grown crop. **Corn is vulnerable** because even a week of high temperatures at the key moment can **keep it from fertilizing**. (“You only get one chance to pollinate a quadrillion kernels of corn,” the head of a commodity consulting firm explained.) But even the hardiest crops are susceptible. Sorghum, for instance, which is a staple for half a billion humans, is particularly hardy in dry conditions because it has big, fibrous roots that reach far down into the earth. Even it has limits, though, and they are being reached. Thirty years of data from the American Midwest show that heat waves affect the “vapor pressure deficit,” the difference between the water vapor in the sorghum leaf’s interior and that in the surrounding air. Hotter weather means the sorghum releases more moisture into the atmosphere. Warm the planet’s temperature by two degrees Celsius — which is, again, now the world’s goal — and sorghum yields drop 17 percent. Warm it five degrees Celsius (nine degrees Fahrenheit), and yields drop almost 60 percent. It’s hard to imagine a topic duller than sorghum yields. It’s the precise opposite of clickbait. But **people have to eat**; in the human game, the single most important question is probably “What’s for dinner?” And when the answer is “Not much,” things **deteriorate fast**. In 2010 a severe heat wave hit Russia, and it wrecked the grain harvest, which led the Kremlin to ban exports. The global **price of wheat spiked**, and that helped **trigger the Arab Spring** — Egypt at the time was the largest wheat importer on the planet. That experience set academics and insurers to work gaming out what the next **food shock** might look like. In 2017 one team imagined a vigorous El Niño, with the attendant floods and droughts — for a season, in their scenario, corn and soy yields declined by 10 percent, and wheat and rice by 7 percent. The result was chaos: “quadrupled commodity prices, civil unrest, significant negative humanitarian consequences . . . **Food riots** break out in urban areas across the Middle East, North Africa, and Latin America. The euro weakens and the main European stock markets lose ten percent.” At about the same time, a team of British researchers released a study demonstrating that even if you can grow plenty of food, the transportation system that distributes it runs through just fourteen major choke-points, and those are vulnerable to — you guessed it — massive disruption from climate change. For instance, U.S. rivers and canals carry a third of the world’s corn and soy, and they’ve been frequently shut down or crimped by flooding and drought in recent years. Brazil accounts for 17 percent of the world’s grain exports, but heavy rainfall in 2017 stranded three thousand trucks. “It’s the glide path to a perfect storm,” said one of the report’s authors. Five weeks after that, another report raised an even deeper question. What if you can figure out how to grow plenty of food, and you can figure out how to guarantee its distribution, but the food itself has lost much of its value? The paper, in the journal Environmental Research, said that rising carbon dioxide levels, by speeding plant growth, seem to have reduced the amount of protein in basic staple crops, a finding so startling that, for many years, agronomists had overlooked hints that it was happening. But it seems to be true: when researchers grow grain at the carbon dioxide levels we expect for later this century, they find that minerals such as calcium and iron drop by 8 percent, and protein by about the same amount. In the developing world, where people rely on plants for their protein, that means huge reductions in nutrition: India alone could lose 5 percent of the protein in its total diet, putting 53 million people at new risk for protein deficiency. The loss of zinc, essential for maternal and infant health, could endanger 138 million people around the world. In 2018, rice researchers found “significantly less protein” when they grew eighteen varieties of rice in high–carbon dioxide test plots. “The idea that food became less nutritious was a surprise,” said one researcher. “It’s not intuitive. But I think we should continue to expect surprises. We are completely altering the biophysical conditions that underpin our food system.” And not just ours. People don’t depend on goldenrod, for instance, but bees do. When scientists looked at samples of goldenrod in the Smithsonian that dated back to 1842, they found that the protein content of its pollen had “declined by a third since the industrial revolution — and the change closely tracks with the rise in carbon dioxide.” Bees help crops, obviously, so that’s scary news. But in August 2018, a massive new study found something just as frightening: crop pests were thriving in the new heat. “It gets better and better for them,” said one University of Colorado researcher. Even if we hit the UN target of limiting temperature rise to two degrees Celsius, pests should cut wheat yields by 46 percent, corn by 31 percent, and rice by 19 percent. “Warmer temperatures accelerate the metabolism of insect pests like aphids and corn borers at a predictable rate,” the researchers found. “That makes them hungrier[,] and warmer temperatures also speed up their reproduction.” Even fossilized plants from fifty million years ago make the point: “**Plant damage** from insects **correlated** with rising and falling **temperatures**, reaching a maximum during the warmest periods.”