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#### CP Text: Major spacefaring Nations ought to modernize the Outer Space Treaty.

#### CP solves aff and larger celestial management issues—prefer it.

Rajeswari Pillai Rajagopalan 2021, 2-23-2021, "The Outer Space Treaty," Council on Foreign Relations, <https://www.cfr.org/report/outer-space-treaty> (Dr. Rajeswari (Raji) Pillai Rajagopalan is the Director of the Centre for Security, Strategy & Technology (CSST) at the Observer Research Foundation, New Delhi. ) //ingp

All major spacefaring nations should prioritize revitalizing the Conference on Disarmament (CD). The CD is the multilateral body in Geneva responsible for international arms control negotiations, including for outer space. But the CD has not participated in any significant negotiations for more than two decades largely due to member states’ disagreement on their annual program of work. If this stalemate continues to block new multilateral agreements, countries will be forced to rely on deterrence to protect their assets in outer space. This approach would be inherently destabilizing and would have a cascading effect: if one country relies on deterrence, others will be forced to follow, making further negotiations difficult. Deterrence has not yet become the default policy for any state in outer space. The world can still avoid this path. Before this happens, multilateral negotiations need to resume in the CD. Certain countries have a tendency to suggest other venues, but, to a large number of countries, the CD is the only multilateral institution that can negotiate a space security–related agreement. Many countries attach importance to the CD’s consensus rule for decision-making, which allows smaller, weaker members to veto decisions. On the flip side, this rule also holds agreements susceptible to the whims of any of the member states. Developing consensus among the major powers has remained the biggest stumbling block to creating an effective outer space regime, which means that the CD’s functioning will continue to suffer unless countries, particularly great powers, can sufficiently resolve their differences. Unless states find ways to revitalize the CD’s functioning and start agreeing on a program of work at the minimum, addressing the growing problems of governance in outer space will be difficult. Other venues such as the UN First Committee and the UN Disarmament Commission are too large and unwieldy to negotiate, while venues such as the UN Committee on the Peaceful Uses of Outer Space do not have the mandate to discuss military space issues. All OST signatories should review and modernize the treaty. Although the OST has served as a useful instrument in ensuring safe and secure access to outer space, the development of counter-space capabilities including electronic and cyberwarfare measures is a major threat that needs to be dealt with. Counter-space capabilities are weapons that can destroy space-based objects or disrupt and interfere with space-based services through either kinetic physical attacks or electronic and cyber means. There are currently no effective regulations against them, as the OST only prohibits weapons of mass destruction (WMD) in outer space. Some states are now beginning to dangerously interpret the OST to mean that “non-WMD armaments in space do not violate international law.” Although customary international law could still be used to make the weaponization of outer space illegal, some states will likely exploit the OST loopholes. Therefore, signatories need to review and modernize the OST in two ways. First, Article IV of the OST should be expanded to include conventional weapons and other non-WMD technologies, including land-based anti-satellite weapons and other counter-space systems. Second, the OST needs to refine ambiguous wording to provide greater clarity. Important terms in the OST such as “peaceful uses of outer space” have come to have such expansive interpretations that they are not useful in restricting irresponsible actions in outer space. For instance, some have interpreted “peaceful” to suggest the “nonmilitary” use of space, while others suggest it means “nonaggressive” behavior. Unless such basic concepts are clarified, the effectiveness of the OST, any other treaty, or TCBMs will be in doubt. Formulating new rules of the road in outer space should be more inclusive. Although an inclusive approach to rulemaking is challenging, it critically leads to more buy-in from states, thus ensuring better compliance. Of course, developing an agreement involving all actors could lead to an instrument that is less than ideal because building consensus requires compromises, but ensuring more participation and endorsement is worth the effort. Processes and approaches are as important as the final outcome document. An inclusive process gives states a sense of ownership over drafting a treaty or a TCBM. The voice of emerging powers and developing countries is important in developing rule-based systems for global governance. An inclusive process that brings different stakeholders together should be pursued to ensure wider acceptability, which could lead to increased legitimacy and compliance. It will not help if this is done as an afterthought. States should develop transparency and confidence-building measures. The effort to create a Code of Conduct for Outer Space Activities in the European Union (EU) is illustrative in this respect. The substance of the EU code itself was not a problem. The code, for instance, recommended avoiding actions that create long-lasting space debris and called on states to undertake collision avoidance measures and participate in prelaunch and high-risk reentry notifications. Many countries outside the EU, such as China and India, opposed the code because they were not part of the development process. This prevented it from gaining broad support. To its credit, the EU eventually recognized the problem and reached out to other countries, but the damage was already done. This experience should be considered carefully, especially if efforts at the CD prove fruitless and geopolitical conditions do not improve. This kind of initiative of like-minded countries offers a path forward on space governance, but it needs to be done differently than the EU code. It would be useful to include a larger group of concerned countries at the start of the deliberative process. States should develop TCBMs. Reviewing and modernizing the OST will take time. Developing TCBMs could bridge the gap as an intermediate step to legal instruments, which should remain the ultimate goal. TCBMs should be seen as useful, pragmatic steps in building trust among countries. They can strengthen dialogue among multiple stakeholders and encourage openness, information sharing, and transparency. TCBMs have the flexibility to start with the least common denominator, measures that all parties agree to. These could include norms of responsible behavior, an outer space code of conduct, or GGE activity. Despite the failure of the most recent UNGGE on the Prevention of an Arms Race in Outer Space, such efforts still need to be pursued. TCBMs can be narrowly focused and start with specific measures, such as “no testing/deployment of space weapons in outer space,” before proceeding to broader issues, such as “noninterference with peaceful activities of other states.” Adopting specific TCBMs such as prelaunch notifications can also strengthen efforts to establish norms of responsible behavior and regulate activities and capabilities that are inherently destabilizing. A recent proposal from the United Kingdom (UK) on space security can be a helpful reference. The proposal, “Reducing Space Threats Through Norms, Rules and Principles of Responsible Behaviors,” aims to look at space security challenges with a bottom-up approach. One of the operative clauses in the proposal asks countries to “characterize actions and activities that could be considered responsible, irresponsible or threatening” and share their ideas on how they can be managed. That the UK proposal focuses on a behavior-based approach and does not favor a specific format for its outcome leaves reasonable flexibility for states to discuss and arrive at an advantageous outcome. States should pursue innovative multilateralism. Given the challenges surrounding the CD, states should consider setting up a body akin to the Intergovernmental Panel on Climate Change to address some of the pressing challenges in outer space. Similar to the GGE, the group could be established through a UN General Assembly resolution, but for a period of two or three years. Such a group of international experts could be mandated to review universal challenges confronting every state, including space debris, the outer space arms race, and counter-space capabilities, and produce an outcome document that can be submitted to the UN secretary-general. The group could be an inclusive platform with policy and technical experts from developing and developed countries, thus providing a voice to emerging powers. States could also consider creating an institution modeled after the International Civil Aviation Organization, given the importance of space traffic management in handling outer space affairs. Having a group of technical experts ideating possible resolutions could alleviate some of the political issues that have prevented consensus among major powers. States could also pursue smaller, technical agreements addressing a particular threat rather than attempt all-encompassing treaties, which are difficult to build support for. The United States has taken the lead in lunar exploration. The United States’ Artemis Accords are an innovative attempt at forging international cooperation, but the bilateral approach has limits. The United States has taken the lead in lunar exploration through a series of bilateral agreements, reinforcing many of the norms and principles enshrined in the OST. Although countries including Australia, Canada, Japan, the United Arab Emirates, and the United Kingdom have signed on, space powers such as China, India, and Russia have not. Geopolitical rivalry with the United States will likely prevent China from accepting these arrangements, and India and others have avoided signing on because it is not a multilateral agreement under the UN umbrella. A better approach to promoting OST norms in lunar exploration would be developed under the aegis of a multilateral entity.

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#### Space-Based Solar Power (SBSP) is a megaconstellation, and it’s going to happen within 10 years in the squo. Aff banning private megaconstellations kills the necessary tech

David 11-03, [David, Leonard. 11/03/21 Space Solar Power’s Time May Finally Be Coming.”https://www.space.com/space-solar-power-research-advances/] Recut DurSac

The sun never sets in space. **The idea of** harvesting solar energyvia power-beaming satelliteshas therefore long intrigued researchers looking for ways to feed an energy-ravenous [Earth](https://www.space.com/54-earth-history-composition-and-atmosphere.html). That reflection has fomented for decades but is now garnering new looks all over the world: Technologists in the U.S. and China, experts in Japan and researchers within the European Space Agency and the United Kingdom Space Agency are all working to make space-based solar power a reality. Related: [Solar power stations in space could be the answer to our energy needs](https://www.space.com/solar-power-stations-in-space-could-be-the-answer-to-our-energy-needs.html) History machine Peter Glaser, the father of the solar power satellite concept. (Image credit: Arthur D. Little Inc.) The idea of wireless power transmission dates back to [Nikola Tesla](https://www.livescience.com/45950-nikola-tesla-biography.html) near the end of the 19th century. Fast-forwarding to 1968, the notion of a solar power satellite was detailed and patented by U.S. space pioneer Peter Glaser. He blueprinted a novel way to collect energy from sunlight using solar cells and beam down an energetic muscle of microwaves to receiving antennas ("rectennas") on Earth. Those microwaves could then be converted to electrical energy and supplied to the power grid. Then, in the mid-1970s, microwave power transmission experiments in the tens of kilowatts were successfully conducted at the Goldstone Deep Space Communications Complex in California, a facility of NASA's [Jet Propulsion Laboratory](https://www.space.com/16952-nasa-jet-propulsion-laboratory.html). And this "power trip" doesn't stop there.The Space Solar Power Incremental and Demonstrations Research (SSPIDR) project is designed to beam power from space to Earth. SSPIDR consists of several small-scale flight experiments that will mature technology needed to build a prototype solar power distribution system. (Image credit: Air Force Research Laboratory (AFRL)) Impressive **advances Over the past decade,** researchers have made impressive advances **that** increase **the** likelihood **that space solar power (**SSP**)** will be realized during the next decade, said John Mankins, president of Artemis Innovation Management Solutions of Santa Maria, California. His view: the longstanding vision for SSP as a sustainable energy alternative should be revisited in light of such recent advances.Bolstering that outlook is a set of key perspectives, Mankins told Space.com. "Climate change is really going to be a disaster. Nations are committed to go [carbon net-zero](https://www.livescience.com/climate-report-net-zero.html) … and they have no idea how to do it."**The** rapidly unfolding value of "NewSpace**" is also** reshaping the landscape of 21st century space activities**, he added. "Two of the biggest hurdles to the realization of SSP have always been the cost of launch and the cost of hardware**," said Mankins. "Add flight rate, and all of a sudden you're looking at numbers always talked about for solar power satellites."Related: [What is climate change?](https://www.livescience.com/climate-change.html) Megaconstellations **Another** recent change isthedawn of the megaconstellations, Mankins added. **That's** exemplified by SpaceX's [Starlink](https://www.space.com/spacex-starlink-satellites.html) broadband network**, a** mass-production effort that now cranks out 30 tons of satellites a month**. SpaceX is on course to potentially manufacture 40,000 satellites within five years, and launch all of them. "The path to low-cost hardware has been shown," Mankins said. "It's modular and mass-produced. The hurdles of less-expensive launch and lowering hardware costs have been overcome.**"Mankins said that the economics of SSP concepts in the near term, within the next decade, have never been more viable. He flagged advances in space launch capabilities; progress in robotics for space assembly, maintenance and servicing systems; and the growth in various component technologies, such as high-efficiency solid state power amplifiers. **As a result, SSP is ready to see the light of day,** Mankins said.Astroelectricity An early entrant in focusing on understanding the energy policy needed and establishment of SSP is James Michael Snead, president of the Spacefaring Institute. He's adopted the use of the term "astroelectricity" to describe the transmitted electrical power produced by SSP systems.In looking at what he terms the "[coming age of astroelectricity](https://www.youtube.com/watch?v=5E-0NYnAaUA)," he sees a world needing a replacement for oil and natural gas, the two primary sources of energy currently maintaining an industrial standard of living. Snead envisions a world in the year 2100 where about 20% of electrical power comes from terrestrial nuclear and renewables, with 80% supplied by astroelectricity."Just as the military, economic and diplomatic control of Middle East oil has substantially influenced world events for the past 80 years, the control of space solar power platforms will come to dominate outer space activities this century," Snead told Space.com. Wanted: high-priority leadershipIf SSP becomes a reality later this century, Snead said, the U.S. military will be required to protect and defend these new sources of national energy security just as it guards oil infrastructure in the Persian Gulf today."While some people are developing SSP concepts that would be launched from the Earth and autonomously assembled in geostationary Earth orbit, I do not see this as a successful proposition," said Snead. He believes that building the thousands of SSP platforms needed requires a substantial [space industrialization effort](https://www.space.com/nasa-low-earth-orbit-iss-commercialization.html) involving more than a million people in space by the end of the century. The starting point, Snead said, will be establishing the enabling "astrologistics" infrastructure operating throughout the Earth-moon system. He stressed that those astrologistics require high-priority U.S. Air Force — not [Space Force](https://www.space.com/42089-space-force.html) — leadership to draw upon nearly a century of human flight/operational logistics experience and expertise.That is necessary to manage industry's efforts to design and build the required new human spaceflight systems, with a clearly needed emphasis on safety and effectiveness, Snead said. As these new military astrologistics capabilities begin, Snead contends, commercialization of these capabilities will extend these safety and operational benefits to support the coming space industrial revolution needed to undertake SSP. "This is exactly what happened to enable U.S. airline manufacturers to dominate the airline and air cargo industry for decades. It is a successful model to now replicate in space — a model that neither NASA nor the U.S. Space Force can effectively execute," Snead said. The U.S. Naval Research Laboratory’s Paul Jaffe holds a module designed for space solar power investigations in front of a customized vacuum chamber used to test the device. (Image credit: NRL/Jamie Hartman) 'Performing like a champ' While new artwork, economic plots and conceptual SPS thinking and visions flow, there's an in-space technology experiment already underway. On its latest mission, which launched in May 2020, the Space Force's robotic [X-37B space plane](https://www.space.com/25275-x37b-space-plane.html) is toting the Photovoltaic Radio-frequency Antenna Module Flight Experiment (PRAM-FX), a Naval Research Laboratory (NRL) investigation into transforming solar power into radio-frequency microwave energy. The focus of that X-37B investigation is not establishing an actual power-beaming link, but more on appraising the performance of sunlight-to-microwave conversion. "It is performing like a champ," said Paul Jaffe, an NRL electronics engineer working on power beaming and solar power satellites. "We are getting data regularly, and that data is exceeding our expectations," he told Space.com. [PRAM-FX](https://www.space.com/x-37b-space-plane-solar-power-beaming) is principally made out of commercial parts, not "space-grade" hardware. "The fact that it is continuing to operate and give us positive results is quite encouraging," Jaffe said. Commercial parts are mass-produced, while many space-grade parts are one-offs. Solar power satellites, like those envisioned in high Earth orbit, would have thousands of elements made out of similar components being tested onboard the X-37B, Jaffe said. [The US Space Force's secretive X-37B space plane: 10 surprising facts](https://www.space.com/x-37b-military-space-plane-surprising-facts) Space-based solar power could help the UK achieve net-zero emissions by 2050, according to a leading British systems, engineering and technology company. (Image credit: Frazer-Nash Consultancy) Making the economics work There's much more work ahead, of course. "The big strike against space solar power has always been making the economics work. People who have looked at the idea seriously do understand that, from a physics standpoint, there is no reason you couldn't do it," Jaffe said. "With mass production of space hardware, and with the cost reduction of space access, it is more plausible that it could work," he added. "I would caution against excessive optimism … but also point out that things are changing. There are a lot of encouraging developments." SPS will assuredly be compared to a "levelized cost of energy" metric, Jaffe concluded. "There's just not enough data to come up with a levelized cost of energy basis for space solar power. It's premature. What you are seeing now is laying the foundation for that sort of evaluation." Clear, affordable path To that end, Mankins of Artemis Innovation Management Solutions has rolled out SPS-ALPHA ("Solar Power Satellite by means of Arbitrarily Large Phased Array"), a design he showcased at the 72nd International Astronautical Congress, which was held from Oct. 25 to Oct. 29 in Dubai, United Arab Emirates. Detailing a business model and step-by-step SSP roadmap, he feels the concept promises a clear, affordable path to deploying a critically needed new energy option. "**I believe you could have operational solar power satellites to scale within a decade,"** Mankins said. That possibility, combined with the fact that multiple nations are eying SSP as a promising power generation system of the future, begs a question: Is there a solar power satellite race afoot? It is close to that, Mankins said. "I think it has to be cooperation among friends and allies. But I think it's very likely to end up being competition with China. The longer we wait with regard to the urgency of policies on [climate change](https://www.space.com/climate-change-dimming-earth), the more likely it is we're going to miss the boat." Mankins is a 26-year veteran of assessing SSP and the technologies required. "The moment has come," he said. "I think the right answer is really clear: We need to just go do it."

#### Key to solve climate change.

Katete 12-17, [Katete, Esthere. (December 17 2021) “Space-Based Solar Power: The Future Source of Energy?”https://www.greenmatch.co.uk/blog/2020/02/space-based-solar-power] Sachin

Space-based solar power (SBSP) involves collecting the sun’s energy in space, and then wirelessly transmitting it to Earth. There are several [advantages to solar energy](https://www.greenmatch.co.uk/blog/2014/08/5-advantages-and-5-disadvantages-of-solar-energy). Although expensive, it **is** **a** great source of [clean energy](https://www.greenmatch.co.uk/blog/clean-energy) that has the capacity to provide more energythan the world consumes **or is predicted to consume in the future**. A space-based solar power technological process includes using [solar panels](https://www.greenmatch.co.uk/solar-energy/solar-panels) to collect solar energy in space with reflectors or inflatable mirrors that direct solar radiation onto solar panels, and then beaming it on Earth through a microwave or laser. The energy is then received on Earth via a microwave antenna (a rectenna). **According to the** [**National Space Society**](https://space.nss.org/space-solar-power/)**,** space-based solar power **has the** potential to dwarf all the other sources of energy combined**. They argue that space-based solar power can provide large quantities of energy** with very little negative environmental impact**. It can also** solve our current energy and greenhouse gas emissions problems**.** The infographic below highlights information about space-based solar power, current related trends, and what different countries are doing in terms of research and funding. Current Global Energy Consumption and Trends **The** world’s energy consumption is only growing. According to a report by the University of Oxford’s Our World in Data, on the global primary energy consumption, the current world consumption is over 160,000 TWh annually. Solar energy contributes only 585 TWh. Although there is an increase in renewable energy solutions, investments, and usage, oil, coal, and gas still generate more than 80% of the global energy that is consumed - with solar energy generating less than 1%. Between 2004 and 2015, investments in renewable energy increased by 600% from £36.2 billion (US$46.7 billion) to £220.6 billion (US$284.8 billion). Current predictions indicate that the world population will reach [9.7 billion by 2050](https://www.un.org/development/desa/en/news/population/world-population-prospects-2019.html). With the increase in population, the world energy consumption is also predicted to grow by 50% by 2050. In addition, climate change impacts are accelerating. Although we generate a big percentage of the world energy from fossil fuels, fossil fuels contribute significantly to the increase of climate change. **Comparatively,** solar energy is the [safest source of energy](https://ourworldindata.org/uploads/2020/02/Safest-source-of-energy.png) today - though it still only contributes a small percentage of the global energy production. The death rates from solar production are 1,230 times lower than coal, and it has one of the lowest CO2 emissions, at 5g CO2 eq per kWh. Why Space-Based Solar Power? Space-based solar power has several benefits; unlike solar panels on our roofs that can only generate electricity during the day, space-based solar power can generate continuous electricity, 24 hours a day, 99% of the year. This is because, unlike Earth, the space environment does not have night and day, and the satellites are in the Earth's shadow for only a maximum of 72 minutes per night. **Space-based solar panels can generate** 2,000 gigawatts of power constantly. This is **40 times more energy than a solar panel would generate on Earth annually**. This is also several folds higher than the [efficiency of solar panels](https://www.greenmatch.co.uk/blog/2014/11/how-efficient-are-solar-panels) today. **What’s more, is that space-based** solar power would generate [0% greenhouse gas emissions](https://space.nss.org/space-solar-power/) unlike other alternatives **energy like nuclear, coal, oil, gas, and ethanol**. The current source of energy that generates the lowest CO2 is nuclear power, which generates CO2 of 5g CO2 eq per kWh. **Space-based solar power** generates almost 0% hazardous waste to our environment **compared to nuclear power**. Why Are We Not There Yet? While space-based solar power is an innovative concept, we are not able to fully launch a system into space yet. Launching a space-based solar system is very expensive. In fact, the cost is estimated to be about 100 times too high to compete with current utility costs. One of the causes of the high costs is the high cost of launching the panels to space, which is mostly due to the high mass per watt generated by the current solar panels. In other words, the solar panels are currently too heavy per watt generated to make it feasible. Currently, the cost of launching in space is estimated to be £7,716 per kilogram - approximately £154 per watt. In comparison to the cost that homeowners pay today, which is approximately £2 per watt peak, the cost in space is extremely high to be competitive. In UK homes, the [installation cost of solar panels](https://www.greenmatch.co.uk/blog/2014/08/what-is-the-installation-cost-for-solar-panels) can be as low as £1.5 per watt. Other reasons for high costs include the overall high transport costs to space. This is because transporting all other materials that are needed to space would require many space shuttle launches, and these space shuttles are currently not reusable. So, not only is the launch of solar panels themselves expensive, but the additional materials needing to be transported is also expensive. A lot of research and engineering is still ongoing to find the most feasible way to launch space-based solar panels and launch systems, at a lower cost. The environment out in space also has several hazards that could cause damage to the solar panels. These include space debris and extreme solar radiation, which could degrade the solar panels up to 8 times faster than panels installed on Earth. Finally, there is a potential of wasting large amounts of energy when transporting or during transmission from space to Earth. Therefore, scientists and engineers must continue their R&D efforts to ensure little to no energy is lost during the process. Current SBSP Projects and Progress The key players in SBSP include China, the US, and Japan, who have shown progress in terms of technology advancements, partnerships, and launch plans. China is already progressing to launch into space. The China Aerospace Science and Technology Corporation plans to launch small to medium solar satellites in the stratosphere that can harness energy in space between 2021 and 2025. China also plans to generate one megawatt of energy from space-based solar panels by 2030, and to be operating a commercially viable solar space station by 2050. In the US, there are ongoing partnerships and investments. For example, a $100 million partnership between Northrop Grumman and U.S. Air Force Research Laboratory has been established to provide advanced technology for SBSP. Also in the US, a $17.5 million collaboration between Northrop Grumman Corporation and Caltech was set up to develop the space solar power project called ‘The Space Solar Power Initiative’. The initiative’s goal was to develop scientific and technological innovations that would enable a space-based solar power system generate electricity at a cost comparable to current sources of electricity. There has been ongoing research and technological advancements. In the US, the development of the SPS-ALPHA Mark-II concept is underway. This, if successful, would enable construction of huge platforms in space that can remotely deliver tens of thousands of megawatts of electricity to Earth, using wireless power transmissions. This will also enable delivery of affordable power to Earth and on space missions. In addition, progress is being made to build reusable launch systems. Success in this will lower the cost of transport to space and overall cost of space-based solar power. An example is SpaceX, that is currently working on reusable launch vehicles that can be used for transport to space. In Japan, researchers successfully transmitted electric power wirelessly using microwaves. Researchers transformed 1.8 kW of electric power into microwaves and accurately transmitted it into a receiver that was 55 metres away. This was a technological advancement towards bringing SBSP closer to reality. Japan also made space-based solar systems part of its future space exploration vision. Future Outlook for SBSP Fossil fuels are finite and can eventually run out. According to predictions, oil and natural gas could run out in 50 years and coal production in 115 years. With ongoing research and investments, there is a high possibility that space-based solar power is the viable [future of solar power](https://www.greenmatch.co.uk/blog/2015/01/the-future-for-solar-power-in-the-uk). If the cost of space-based solar power can be lowered, it is likely to be a major source of sustainable energy that cannot diminish. Major players like China, who already have timelines of implementing the technology in space, may be able to provide some key learnings for future improvements in the technology.

#### Warming causes extinction

Xu 17, [Yangyang Xu 17, Assistant Professor of Atmospheric Sciences at Texas A&M University; and Veerabhadran Ramanathan, Distinguished Professor of Atmospheric and Climate Sciences at the Scripps Institution of Oceanography, University of California, San Diego, 9/26/17, “Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes,” Proceedings of the National Academy of Sciences of the United States of America, Vol. 114, No. 39, p. 10315-10323]

We are proposing the following extension to the DAI risk categorization: warming greater than 1.5 °C as “dangerous”; warming greater than 3 °C as “catastrophic?”; and warming in excess of 5 °C as “unknown??,” with the understanding that changes of this magnitude, not experienced in the last 20+ million years, pose **existential threats** to a majority of the population. The question mark denotes the subjective nature of our deduction and the fact that catastrophe can strike at even lower warming levels. The justifications for the proposed extension to risk categorization are given below. From the IPCC burning embers diagram and from the language of the Paris Agreement, we infer that the DAI begins at warming greater than 1.5 °C. Our criteria for extending the risk category beyond DAI include the potential risks of climate change to the physical climate system, the ecosystem, human health, and **species extinction**. Let us first consider the category of catastrophic (3 to 5 °C warming). The first major concern is the issue of **tipping points**. Several studies (48, 49) have concluded that 3 to 5 °C global warming is likely to be the threshold for tipping points such as the collapse of the western Antarctic ice sheet, shutdown of deep water circulation in the North Atlantic, dieback of Amazon rainforests as well as boreal forests, and collapse of the West African monsoon, among others. While natural scientists refer to these as **abrupt and irreversible climate changes**, economists refer to them as catastrophic events (49). Warming of such magnitudes also has **catastrophic human health effects**. Many recent studies (50, 51) have focused on the direct influence of extreme events such as heat waves on public health by evaluating exposure to heat stress and hyperthermia. It has been estimated that the likelihood of extreme events (defined as 3-sigma events), including heat waves, has increased 10-fold in the recent decades (52). Human beings are extremely sensitive to heat stress. For example, the 2013 European heat wave led to about 70,000 premature mortalities (53). The major finding of a recent study (51) is that, currently, about 13.6% of land area with a population of 30.6% is exposed to deadly heat. The authors of that study defined deadly heat as exceeding a threshold of temperature as well as humidity. The thresholds were determined from numerous heat wave events and data for mortalities attributed to heat waves. According to this study, a 2 °C warming would double the land area subject to deadly heat and expose 48% of the population. A 4 °C warming by 2100 would subject 47% of the land area and almost 74% of the world population to deadly heat, which could pose **existential risks to humans** and mammals alike unless massive adaptation measures are implemented, such as providing air conditioning to the entire population or a massive relocation of most of the population to safer climates. Climate risks can vary markedly depending on the socioeconomic status and culture of the population, and so we must take up the question of “dangerous to whom?” (54). Our discussion in this study is focused more on people and not on the ecosystem, and even with this limited scope, there are multitudes of categories of people. We will focus on the poorest 3 billion people living mostly in tropical rural areas, who are still relying on 18th-century technologies for meeting basic needs such as cooking and heating. Their contribution to CO2 pollution is roughly 5% compared with the 50% contribution by the wealthiest 1 billion (55). This bottom 3 billion population comprises mostly subsistent farmers, whose livelihood will be severely impacted, if not destroyed, with a one- to five-year megadrought, heat waves, or heavy floods; for those among the bottom 3 billion of the world’s population who are living in coastal areas, a 1- to 2-m rise in sea level (likely with a warming in excess of 3 °C) poses **existential threat** if they do not relocate or migrate. It has been estimated that several hundred million people would be subject to famine with warming in excess of 4 °C (54). However, there has essentially been no discussion on warming beyond 5 °C. Climate change-induced species extinction is one major concern with warming of such large magnitudes (>5 °C). The current rate of loss of species is ∼1,000-fold the historical rate, due largely to habitat destruction. At this rate, about 25% of species are in danger of extinction in the coming decades (56). Global warming of 6 °C or more (accompanied by increase in ocean acidity due to increased CO2) can act as a major force multiplier and **expose** as much as **90% of species to** the dangers of **extinction** (57). The bodily harms combined with climate change-forced species destruction, biodiversity loss, and threats to water and food security, as summarized recently (58), motivated us to categorize warming beyond 5 °C as unknown??, implying the possibility of **existential threats**. Fig. 2 displays these three risk categorizations (vertical dashed lines).

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#### Current business sentiment promises a slow and steady recovery.

Dr. Mark Zandi 11/15, PhD from UPenn, economist, and director of economic research at Moody’s Analytics, 11/15/21, “Moody's Analytics Survey of Business Confidence,” <https://www.economy.com/economicview/indicator/usa_dsbc/5C438EAA-8AA1-484E-8931-62208FCACE22>, cc

Abstracting from the weekly ups and downs of responses to the global business survey, business sentiment remains stuck consistent with a slowly recovering global economy. Most encouraging, more than one-third of respondents to the survey say present business conditions are improving and more than half say their sales are strengthening. Hiring and investment intentions aren’t as strong, but they are much improved since the dark days of the pandemic. Demand for office space remains depressed, inventory accumulation is weak, and though financial conditions are good, they aren’t as good as they were prior to the pandemic.

#### **Consistent space regulations are key to business confidence**

Christensen ND [Ian Christensen is a Project Manager at Secure World Foundation, and has eight years of experience as a consultant and analyst focused on international and domestic commercial space, satellite, and aviation markets. "Building Confidence and Reducing Risk in Space Resources Policy," Room, The Space Journal, https://room.eu.com/article/building-confidence-and-reducing-risk-in-space-resources-policy]/ISEE

Like most areas of economic activity, space resource utilisation business plans are based upon the ability to access a resource, produce a product, service, or goods based from the resource, and produce revenue from that product based on established market activities. An economic system requires a level of regulation and oversight to ensure it functions. Regulation and governmental oversight is part of an overall market framework that provides stability and confidence in validity for commercial entities and those that invest in them. Just as the commercial companies are in the initial stages of developing and validating hardware, governments have begun to establish regulatory and policy frameworks.

#### Business confidence is tied to economic growth

Sarah Chaney Cambon 21, Reporter on The Wall Street Journal's Economics Team, BA in Business Journalism from the University of North Carolina-Chapel Hill, “Capital-Spending Surge Further Lifts Economic Recovery”, Wall Street Journal, 6/27/2021, https://www.wsj.com/articles/capital-spending-surge-further-lifts-economic-recovery-11624798800

Business investment is emerging as a powerful source of U.S. economic growth that will likely help sustain the recovery.

Companies are ramping up orders for computers, machinery and software as they grow more confident in the outlook.

Nonresidential fixed investment, a proxy for business spending, rose at a seasonally adjusted annual rate of 11.7% in the first quarter, led by growth in software and tech-equipment spending, according to the Commerce Department. Business investment also logged double-digit gains in the third and fourth quarters last year after falling during pandemic-related shutdowns. It is now higher than its pre-pandemic peak.

Orders for nondefense capital goods excluding aircraft, another measure for business investment, are near the highest levels for records tracing back to the 1990s, separate Commerce Department figures show.

“Business investment has really been an important engine powering the U.S. economic recovery,” said Robert Rosener, senior U.S. economist at Morgan Stanley. “In our outlook for the economy, it’s certainly one of the bright spots.”

Consumer spending, which accounts for about two-thirds of economic output, is driving the early stages of the recovery. Americans, flush with savings and government stimulus checks, are spending more on goods and services, which they shunned for much of the pandemic.

Robust capital investment will be key to ensuring that the recovery maintains strength after the spending boost from fiscal stimulus and business reopenings eventually fades, according to some economists.

Rising business investment helps fuel economic output. It also lifts worker productivity, or output per hour. That metric grew at a sluggish pace throughout the last economic expansion but is now showing signs of resurgence.

The recovery in business investment is shaping up to be much stronger than in the years following the 2007-09 recession. “The events especially in late ’08, early ’09 put a lot of businesses really close to the edge,” said Phil Suttle, founder of Suttle Economics. “I think a lot of them said, ‘We’ve just got to be really cautious for a long while.’”

Businesses appear to be less risk-averse now, he said.

After the financial crisis, businesses grew by adding workers, rather than investing in capital. Hiring was more attractive than capital spending because labor was abundant and relatively cheap. Now the supply of workers is tight. Companies are raising pay to lure employees. As a result, many firms have more incentive to grow by investing in capital.

Economists at Morgan Stanley predict that U.S. capital spending will rise to 116% of prerecession levels after three years. By comparison, investment took 10 years to reach those levels once the 2007-09 recession hit.

Company executives are increasingly confident in the economy’s trajectory. The Business Roundtable’s economic-outlook index—a composite of large companies’ plans for hiring and spending, as well as sales projections—increased by nine points in the second quarter to 116, just below 2018’s record high, according to a survey conducted between May 25 and June 9. In the second quarter, the share of companies planning to boost capital investment increased to 59% from 57% in the first.

“We’re seeing really strong reopening demand, and a lot of times capital investment follows that,” said Joe Song, senior U.S. economist at BofA Securities.

Mr. Song added that less uncertainty regarding trade tensions between the U.S. and China should further underpin business confidence and investment. “At the very least, businesses will understand the strategy that the Biden administration is trying to follow and will be able to plan around that,” he said.

#### Decline cascades---nuclear war

Dr. Mathew Maavak 21, PhD in Risk Foresight from the Universiti Teknologi Malaysia, External Researcher (PLATBIDAFO) at the Kazimieras Simonavicius University, Expert and Regular Commentator on Risk-Related Geostrategic Issues at the Russian International Affairs Council, “Horizon 2030: Will Emerging Risks Unravel Our Global Systems?”, Salus Journal – The Australian Journal for Law Enforcement, Security and Intelligence Professionals, Volume 9, Number 1, p. 2-8

Various scholars and institutions regard global social instability as the greatest threat facing this decade. The catalyst has been postulated to be a Second Great Depression which, in turn, will have profound implications for global security and national integrity. This paper, written from a broad systems perspective, illustrates how emerging risks are getting more complex and intertwined; blurring boundaries between the economic, environmental, geopolitical, societal and technological taxonomy used by the World Economic Forum for its annual global risk forecasts. Tight couplings in our global systems have also enabled risks accrued in one area to snowball into a full-blown crisis elsewhere. The COVID-19 pandemic and its socioeconomic fallouts exemplify this systemic chain-reaction. Onceinexorable forces of globalization are rupturing as the current global system can no longer be sustained due to poor governance and runaway wealth fractionation. The coronavirus pandemic is also enabling Big Tech to expropriate the levers of governments and mass communications worldwide. This paper concludes by highlighting how this development poses a dilemma for security professionals.

Key Words: Global Systems, Emergence, VUCA, COVID-9, Social Instability, Big Tech, Great Reset

INTRODUCTION

The new decade is witnessing rising volatility across global systems. Pick any random “system” today and chart out its trajectory: Are our education systems becoming more robust and affordable? What about food security? Are our healthcare systems improving? Are our pension systems sound? Wherever one looks, there are dark clouds gathering on a global horizon marked by volatility, uncertainty, complexity and ambiguity (VUCA).

But what exactly is a global system? Our planet itself is an autonomous and selfsustaining mega-system, marked by periodic cycles and elemental vagaries. Human activities within however are not system isolates as our banking, utility, farming, healthcare and retail sectors etc. are increasingly entwined. Risks accrued in one system may cascade into an unforeseen crisis within and/or without (Choo, Smith & McCusker, 2007). Scholars call this phenomenon “emergence”; one where the behaviour of intersecting systems is determined by complex and largely invisible interactions at the substratum (Goldstein, 1999; Holland, 1998).

The ongoing COVID-19 pandemic is a case in point. While experts remain divided over the source and morphology of the virus, the contagion has ramified into a global health crisis and supply chain nightmare. It is also tilting the geopolitical balance. China is the largest exporter of intermediate products, and had generated nearly 20% of global imports in 2015 alone (Cousin, 2020). The pharmaceutical sector is particularly vulnerable. Nearly “85% of medicines in the U.S. strategic national stockpile” sources components from China (Owens, 2020).

An initial run on respiratory masks has now been eclipsed by rowdy queues at supermarkets and the bankruptcy of small businesses. The entire global population – save for major pockets such as Sweden, Belarus, Taiwan and Japan – have been subjected to cyclical lockdowns and quarantines. Never before in history have humans faced such a systemic, borderless calamity.

COVID-19 represents a classic emergent crisis that necessitates real-time response and adaptivity in a real-time world, particularly since the global Just-in-Time (JIT) production and delivery system serves as both an enabler and vector for transboundary risks. From a systems thinking perspective, emerging risk management should therefore address a whole spectrum of activity across the economic, environmental, geopolitical, societal and technological (EEGST) taxonomy. Every emerging threat can be slotted into this taxonomy – a reason why it is used by the World Economic Forum (WEF) for its annual global risk exercises (Maavak, 2019a). As traditional forces of globalization unravel, security professionals should take cognizance of emerging threats through a systems thinking approach.

METHODOLOGY

An EEGST sectional breakdown was adopted to illustrate a sampling of extreme risks facing the world for the 2020-2030 decade. The transcendental quality of emerging risks, as outlined on Figure 1, below, was primarily informed by the following pillars of systems thinking (Rickards, 2020):

• Diminishing diversity (or increasing homogeneity) of actors in the global system (Boli & Thomas, 1997; Meyer, 2000; Young et al, 2006);

• Interconnections in the global system (Homer-Dixon et al, 2015; Lee & Preston, 2012);

• Interactions of actors, events and components in the global system (Buldyrev et al, 2010; Bashan et al, 2013; Homer-Dixon et al, 2015); and

• Adaptive qualities in particular systems (Bodin & Norberg, 2005; Scheffer et al, 2012) Since scholastic material on this topic remains somewhat inchoate, this paper buttresses many of its contentions through secondary (i.e. news/institutional) sources.

ECONOMY

According to Professor Stanislaw Drozdz (2018) of the Polish Academy of Sciences, “a global financial crash of a previously unprecedented scale is highly probable” by the mid- 2020s. This will lead to a trickle-down meltdown, impacting all areas of human activity.

The economist John Mauldin (2018) similarly warns that the “2020s might be the worst decade in US history” and may lead to a Second Great Depression. Other forecasts are equally alarming. According to the International Institute of Finance, global debt may have surpassed $255 trillion by 2020 (IIF, 2019). Yet another study revealed that global debts and liabilities amounted to a staggering $2.5 quadrillion (Ausman, 2018). The reader should note that these figures were tabulated before the COVID-19 outbreak.

The IMF singles out widening income inequality as the trigger for the next Great Depression (Georgieva, 2020). The wealthiest 1% now own more than twice as much wealth as 6.9 billion people (Coffey et al, 2020) and this chasm is widening with each passing month. COVID-19 had, in fact, boosted global billionaire wealth to an unprecedented $10.2 trillion by July 2020 (UBS-PWC, 2020). Global GDP, worth $88 trillion in 2019, may have contracted by 5.2% in 2020 (World Bank, 2020).

As the Greek historian Plutarch warned in the 1st century AD: “An imbalance between rich and poor is the oldest and most fatal ailment of all republics” (Mauldin, 2014). The stability of a society, as Aristotle argued even earlier, depends on a robust middle element or middle class. At the rate the global middle class is facing catastrophic debt and unemployment levels, widespread social disaffection may morph into outright anarchy (Maavak, 2012; DCDC, 2007).

Economic stressors, in transcendent VUCA fashion, may also induce radical geopolitical realignments. Bullions now carry more weight than NATO’s security guarantees in Eastern Europe. After Poland repatriated 100 tons of gold from the Bank of England in 2019, Slovakia, Serbia and Hungary quickly followed suit.

According to former Slovak Premier Robert Fico, this erosion in regional trust was based on historical precedents – in particular the 1938 Munich Agreement which ceded Czechoslovakia’s Sudetenland to Nazi Germany. As Fico reiterated (Dudik & Tomek, 2019):

“You can hardly trust even the closest allies after the Munich Agreement… I guarantee that if something happens, we won’t see a single gram of this (offshore-held) gold. Let’s do it (repatriation) as quickly as possible.” (Parenthesis added by author).

President Aleksandar Vucic of Serbia (a non-NATO nation) justified his central bank’s gold-repatriation program by hinting at economic headwinds ahead: “We see in which direction the crisis in the world is moving” (Dudik & Tomek, 2019). Indeed, with two global Titanics – the United States and China – set on a collision course with a quadrillions-denominated iceberg in the middle, and a viral outbreak on its tip, the seismic ripples will be felt far, wide and for a considerable period.

A reality check is nonetheless needed here: Can additional bullions realistically circumvallate the economies of 80 million plus peoples in these Eastern European nations, worth a collective $1.8 trillion by purchasing power parity? Gold however is a potent psychological symbol as it represents national sovereignty and economic reassurance in a potentially hyperinflationary world. The portents are clear: The current global economic system will be weakened by rising nationalism and autarkic demands. Much uncertainty remains ahead. Mauldin (2018) proposes the introduction of Old Testament-style debt jubilees to facilitate gradual national recoveries. The World Economic Forum, on the other hand, has long proposed a “Great Reset” by 2030; a socialist utopia where “you’ll own nothing and you’ll be happy” (WEF, 2016).

In the final analysis, COVID-19 is not the root cause of the current global economic turmoil; it is merely an accelerant to a burning house of cards that was left smouldering since the 2008 Great Recession (Maavak, 2020a). We also see how the four main pillars of systems thinking (diversity, interconnectivity, interactivity and “adaptivity”) form the mise en scene in a VUCA decade.

ENVIRONMENTAL

What happens to the environment when our economies implode? Think of a debt-laden workforce at sensitive nuclear and chemical plants, along with a concomitant surge in industrial accidents? Economic stressors, workforce demoralization and rampant profiteering – rather than manmade climate change – arguably pose the biggest threats to the environment. In a WEF report, Buehler et al (2017) made the following pre-COVID-19 observation:

The ILO estimates that the annual cost to the global economy from accidents and work-related diseases alone is a staggering $3 trillion. Moreover, a recent report suggests the world’s 3.2 billion workers are increasingly unwell, with the vast majority facing significant economic insecurity: 77% work in part-time, temporary, “vulnerable” or unpaid jobs.

Shouldn’t this phenomenon be better categorized as a societal or economic risk rather than an environmental one? In line with the systems thinking approach, however, global risks can no longer be boxed into a taxonomical silo. Frazzled workforces may precipitate another Bhopal (1984), Chernobyl (1986), Deepwater Horizon (2010) or Flint water crisis (2014). These disasters were notably not the result of manmade climate change. Neither was the Fukushima nuclear disaster (2011) nor the Indian Ocean tsunami (2004). Indeed, the combustion of a long-overlooked cargo of 2,750 tonnes of ammonium nitrate had nearly levelled the city of Beirut, Lebanon, on Aug 4 2020. The explosion left 204 dead; 7,500 injured; US$15 billion in property damages; and an estimated 300,000 people homeless (Urbina, 2020). The environmental costs have yet to be adequately tabulated.

Environmental disasters are more attributable to Black Swan events, systems breakdowns and corporate greed rather than to mundane human activity.

Our JIT world aggravates the cascading potential of risks (Korowicz, 2012). Production and delivery delays, caused by the COVID-19 outbreak, will eventually require industrial overcompensation. This will further stress senior executives, workers, machines and a variety of computerized systems. The trickle-down effects will likely include substandard products, contaminated food and a general lowering in health and safety standards (Maavak, 2019a). Unpaid or demoralized sanitation workers may also resort to indiscriminate waste dumping. Many cities across the United States (and elsewhere in the world) are no longer recycling wastes due to prohibitive costs in the global corona-economy (Liacko, 2021).

Even in good times, strict protocols on waste disposals were routinely ignored. While Sweden championed the global climate change narrative, its clothing flagship H&M was busy covering up toxic effluences disgorged by vendors along the Citarum River in Java, Indonesia. As a result, countless children among 14 million Indonesians straddling the “world’s most polluted river” began to suffer from dermatitis, intestinal problems, developmental disorders, renal failure, chronic bronchitis and cancer (DW, 2020). It is also in cauldrons like the Citarum River where pathogens may mutate with emergent ramifications.

On an equally alarming note, depressed economic conditions have traditionally provided a waste disposal boon for organized crime elements. Throughout 1980s, the Calabriabased ‘Ndrangheta mafia – in collusion with governments in Europe and North America – began to dump radioactive wastes along the coast of Somalia. Reeling from pollution and revenue loss, Somali fisherman eventually resorted to mass piracy (Knaup, 2008).

The coast of Somalia is now a maritime hotspot, and exemplifies an entwined form of economic-environmental-geopolitical-societal emergence. In a VUCA world, indiscriminate waste dumping can unexpectedly morph into a Black Hawk Down incident. The laws of unintended consequences are governed by actors, interconnections, interactions and adaptations in a system under study – as outlined in the methodology section.

Environmentally-devastating industrial sabotages – whether by disgruntled workers, industrial competitors, ideological maniacs or terrorist groups – cannot be discounted in a VUCA world. Immiserated societies, in stark defiance of climate change diktats, may resort to dirty coal plants and wood stoves for survival. Interlinked ecosystems, particularly water resources, may be hijacked by nationalist sentiments. The environmental fallouts of critical infrastructure (CI) breakdowns loom like a Sword of Damocles over this decade.

GEOPOLITICAL

The primary catalyst behind WWII was the Great Depression. Since history often repeats itself, expect familiar bogeymen to reappear in societies roiling with impoverishment and ideological clefts. Anti-Semitism – a societal risk on its own – may reach alarming proportions in the West (Reuters, 2019), possibly forcing Israel to undertake reprisal operations inside allied nations. If that happens, how will affected nations react? Will security resources be reallocated to protect certain minorities (or the Top 1%) while larger segments of society are exposed to restive forces? Balloon effects like these present a classic VUCA problematic.

Contemporary geopolitical risks include a possible Iran-Israel war; US-China military confrontation over Taiwan or the South China Sea; North Korean proliferation of nuclear and missile technologies; an India-Pakistan nuclear war; an Iranian closure of the Straits of Hormuz; fundamentalist-driven implosion in the Islamic world; or a nuclear confrontation between NATO and Russia. Fears that the Jan 3 2020 assassination of Iranian Maj. Gen. Qasem Soleimani might lead to WWIII were grossly overblown. From a systems perspective, the killing of Soleimani did not fundamentally change the actor-interconnection-interaction adaptivity equation in the Middle East. Soleimani was simply a cog who got replaced.

### 1NC --- OFF

#### Innovation high now but aff trades off

Raghavan 21[Seetha Raghavan, Seetha Raghavan is a professor in UCF’s Department of Mechanical and Aerospace Engineering. 8-4-2021, "The Impact of Innovation in the New Era of Space Exploration," University of Central Florida News | UCF Today, https://www.ucf.edu/news/the-impact-of-innovation-in-the-new-era-of-space-exploration/]/ISEE

Every once in a while, a confluence of discoveries, events and initiatives results in a breakthrough so significant that it propels the entire world to a higher level, redefining what is possible in so many different fields. This breakthrough is taking centerstage now, as the new era of space exploration — catalyzed by increasing launch access — dawns upon us. The surge of innovation that comes with this will create new opportunities and inspire the next generation of doers. When this happens, boundaries between scientific and social impact are blurred. Innovation leading to scientific discovery can benefit society in the same way that social innovation can diversify and support scientific innovators, who can contribute to global progress. To ride this wave of progress, we must all participate and innovate in the new era of space exploration. The intersection of space exploration, innovation and impact isn’t a new phenomenon. In the past, technology developments and spin-offs from space research have consistently found their way into communities worldwide sometimes with lifesaving benefits. The International Space Station supports experiments that have led to discoveries and inventions in communication, water purification, and remote guidance for health procedures and robotic surgeries. Satellite-enabled Earth observation capabilities that monitor natural disasters, climate and crops often support early warnings for threats and mitigation strategies. Space exploration has always been relevant to everyone no matter the discipline or interest. Commercialization of space has been key in many ways to the current boost in “firsts” over the last few years. It has spurred innovation in launch vehicles and related technologies that led to firsts in vertical-takeoff-vertical landing rocket technology, reusability of rocket boosters and privately developed crewed missions to orbit. Concurrently, NASA has continued to captivate our imagination with the first flight of a helicopter in another world, a mission to return an asteroid sample to Earth and sending a probe to make the closest ever approach to the sun. While we celebrate the scientific progress, there is a vastly important question that we all need to focus on: How can we drive the surge in innovation offered by increased access to space, to benefit humankind? Access to low-Earth orbit, and eventually human exploration of space, is a portal to achieve many impactful outcomes. The numbers and completion rate of microgravity experiments conducted by scientists will be greatly increased as a range of offerings in suborbital flights provide more opportunities to advance critical research in health, agriculture, energy, and more. Lunar, planetary, and even asteroid exploration may lead to discoveries of new materials — busting the limitations now imposed on capabilities for energy, transportation, and infrastructure or creating new sensors and devices that enhance safety on Earth. Space tourism —one can hope — has the power to potentially create an awareness of our oneness that may lead to social change.

#### Private sector megaconstellations key to further innovation.

Adam Mann 22, 1-7-22, "Starlink: SpaceX's satellite internet project," Space, https://www.space.com/spacex-starlink-satellites.html

SpaceX's satellite internet proposal was announced in January 2015. Though it wasn't given a name at the time, CEO Elon Musk said that the company had filed documents with international regulators to place about 4,000 satellites in low Earth orbit. "We're really talking about something which is, in the long term, like rebuilding the internet in space," Musk said during a speech in Seattle when revealing the project. (Musk also owns electric car company Tesla, but Tesla does not produce satellites.) Musk's initial estimate of the number of satellites soon grew, as he hoped to capture a part of the estimated $1 trillion worldwide internet connectivity market to help achieve his Mars colonization vision. The U.S. Federal Communications Commission (FCC) has granted SpaceX permission to fly 12,000 Starlink satellites, and the company has filed paperwork with an international regulator to loft up to 30,000 additional spacecraft. To put that into perspective, as of Jan.5 2022, 12,480 satellites have been launched in all of history with only 4,900 still active, according to the European Space Agency. SpaceX launched its first two Starlink test craft, named TinTinA and TinTinB, in February 2018. The mission went smoothly. Based on initial data, the company asked regulators for its fleet to be allowed to operate at lower altitudes than originally planned, and the FCC agreed. The first 60 Starlink satellites launched on May 23, 2019, aboard a SpaceX Falcon 9 rocket. The satellites successfully reached their operational altitude of 340 miles (550 kilometers) — low enough to get pulled down to Earth by atmospheric drag in a few years so that they don't become space junk once they die. HOW STARLINK SATELLITES WORK Click here for more Space.com videos... CLOSE The current version of each Starlink satellite weighs 573 lbs. (260 kilograms) and is, according to Sky & Telescope magazine, roughly the size of a table. Rather than sending internet signals through electric cables, which must be physically laid down to reach far-flung places, satellite internet works by beaming information through the vacuum of space, where it travels 47% faster than in fiber-optic cable, Business Insider reported. Current satellite internet works using large spacecraft that orbit 22,236 miles (35,786 km) above a particular spot on Earth. But at that distance, there are generally significant time delays in sending and receiving data. By being closer to our planet and networking together, Starlink’s satellites are meant to carry large amounts of information rapidly to any point on Earth, even over the oceans and in extremely hard-to-reach places where fiber-optic cables would be expensive to lay down. Musk has said that the Starlink network would be able to provide "minor" internet coverage after 400 spacecraft were up and running, and "moderate" coverage after about 800 satellites became operational. As of early January 2022, SpaceX had launched more than 1,900 Starlink satellites overall. The constellation is now providing broadband service in select areas around the world, as part of a beta-test program with download speeds of between 100 Mb/s and 200 Mb/s and latency as low as 20 milliseconds, according to a Starlink guide. Users on the ground access the broadband signals using a kit sold by SpaceX. The kit contains a small satellite dish with mounting tripod, a wifi router, cables and a power supply, according to the company's website.

#### Yes link – leos driving development

Song and Bloom 20 “Big Tech is leading the new space race. Here's why that's a problem” Steve Song is a Fellow with the Mozilla Foundation where he works to promote policy and regulation that will increase equitable and affordable access to communication in rural and underserved regions of the world. Peter Bloom is a community digital defense activist and the founder and General Coordinator of Rhizomatica, an international non-profit that helps communities build their own communications infrastructure. He is a former Shuttleworth Foundation fellow and was named an Innovator under 35 by MIT Technology Review and appeared on Foreign Policy's 100 Leading Global Thinkers list in 2015. November 14, 2020 <https://www.salon.com/2020/11/14/big-tech-is-leading-the-new-space-race-heres-why-thats-a-problem/> SM

Big Tech is leading the new space race. Here's why that's a problem

New satellite tech could bring billions more online. But will Big Tech bring their extractive ethos into space?

The coronavirus pandemic has made having a stable and reliable internet connection a matter of extreme urgency, as people all over the world struggle to work, access education, and participate in society while staying safe. Yet universal affordable access is far from being achieved; indeed, half of the world still lacks access to the Internet, despite sustained efforts from governments and corporations.

One popular proposal for ubiquitous connectivity comes from Low Earth Orbit (LEO) satellite constellations. LEO boosters claims that such satellites will have the ability to deliver high-speed broadband anywhere on the planet. These satellites provide internet access from space, and require placing thousands of satellites into orbit at a much closer proximity to Earth than traditional satellites.

The prospect of a globe-encircling mesh of broadband communication satellites has attracted the interest and investment of billionaires ranging from Bill Gates in the 1990s to Elon Musk and Jeff Bezos today. Currently there are at least four major LEO initiatives from the US and Europe, including Starlink (SpaceX), Project Kuiper (Amazon), OneWeb, and Telesat. China has announced at least three LEO constellations, and Russia one. The size and scope of these projects are massive. To put current LEO satellite ambitions in context: the current total number of satellites of any kind orbiting Earth is just over 2,500. Starlink, who already have nearly 900 satellites in orbit, recently petitioned the US communications regulator for permission to launch a total of 12,000 satellites. Not to be outdone, OneWeb recently applied for permission to launch 48,000 satellites.

So what's not to love?

While the goal of these companies to ensure broadband anywhere and everywhere is laudable, the technology and the approach to connectivity are not free from concerns. Recent history, especially the development of the Internet itself, has shown us that simply having the capability to build something doesn't necessarily make it a good idea. The Silicon Valley ethos of "move fast and break things," perhaps valid in developing small applications, becomes irresponsible when the consequences of failure may be catastrophic and irreversible. Criticism of LEO constellations to date have focused on practical concerns around a variety of issues, including: the economic viability of the constellations, the occlusion of the night sky from astronomers, wireless interference between different constellations, and the potential chain reaction of collisions from a single error in satellite trajectory, leaving near-space an inaccessible junkyard of debris.

Beyond that, LEO constellations have deeper and longer-term implications that have yet to find their way into mainstream public debate. For one, LEO constellations are part of a larger process in which space exploration is being redefined and reframed in military and commercial terms. Closer to Earth, LEO constellations raise important concerns around the potential for the further entrenchment of a global internet oligopoly that increases inequality and disempowers citizens.

The scramble for space

Over the past seven decades, as our ability to explore beyond our planet has evolved, national security interests in space have aligned with commercial ones to an extent that they are nearly indistinguishable today. In the United States, private space launch companies like SpaceX and United Launch Alliance are major recipients of government contracts and now provide the bulk of US launch capacity for both scientific and military missions. While close ties between the defense and aerospace industries is nothing new, we are in a decidedly new phase of this relationship due to technological advancement, new policy priorities and the rise of private actors.

As commercial launch capacity has increased and space exploration technologies have advanced, the decades-old agreements around how we treat space and recognize our solar system as a commons for the benefit of all humanity are beginning to unravel. One clear example of this is the White House's recent "Executive Order on Encouraging International Support for the Recovery and Use of Space Resources," which emphasizes that "the United States does not view outer space as a 'global commons'" and refers to the Moon Agreement as "a failed attempt at constraining free enterprise."

It is necessary to better understand the deep ties of LEO companies to the hegemonic designs of national governments on near space. Recently, in exchange for $28 million USD, Starlink provided the services of its satellites for live-fire demos with the US Air Force to test its Advanced Battle Management System and lay the groundwork for a military Internet of Things. Speaking after the latest live-fire demo, William Roper, Air Force acquisition chief, opined that "the military needs to be ready to play a strategic role because we need communications in many areas of the world that there are no commercial providers . . . we can be the stability case for companies like SpaceX and others who want to sell communications worldwide."

SpaceX's connections to the military-industrial complex were made clear in comments by SpaceX president Gwynne Shotwell in 2018, who stated that her company would be willing to launch a space weapon to protect the US, in contravention of established space norms. Only weeks ago, SpaceX signed a contract with the Pentagon to jointly develop a rocket that can deliver up to 80 tons of cargo and weaponry anywhere in the world in just one hour.

The Internet, too, from its very inception until today, has proven to be a useful tool for pursuing military and security objectives. Of these, surveillance remains at the heart of Silicon Valley's highly profitable business model of manipulating our attention and preferences for the sake of profit. This profit model facilitates the designs of space-obsessed billionaires like Jeff Bezos who make it no secret that their ultimate goal and passion is the human colonization of other planets in our solar system. In general terms, with material and economic support from taxpayers through defense spending, the profits from the colonization of our data-bodies are being invested in the militarization, privatization and colonization of space.

Telecommunications: driving inequality or empowering citizens?

The telecommunications sector has always been a battleground for regulation. While the early days of the Internet seemingly teemed with competition and diversity, power and control has ultimately become concentrated with the growth of giant internet companies that now dominate our online life. The consequences of unregulated, technology-fueled expansion of globalization and inequality can now be seen in almost every aspect of life.

Digital technology plays a critical role in amplifying inequality, highlighting the need to reframe how we approach network technology development. Some governments and citizen groups understand the connection between economic mobility and tech skills development.

One great example of this comes from Broadband for the Rural North (B4RN), a cooperative in Northern England, that delivers 1 gigabit-per-second fiber-optic capacity to homes in a region deemed economically unviable by the incumbent telecommunications giant. B4RN's ability to build and sustain an affordable internet service at speeds many times that of commercial offerings is based upon the investment they make in both community engagement and the development of local capacity. Contrast this with the prospect of a broadband service from a LEO constellation, in which the role of the citizen is that of a consumer only. It is also worth noting that B4RN's profits are reinvested locally, while revenues from LEO constellations are beamed straight out of the country.

The failure to invest in alternatives that build local capacity replicates itself at the national level as well. LEO constellations have the potential to further abstract Internet service to a supra-national level in a manner that disempowers not just individuals but nation-states themselves in terms of domestic expertise and infrastructure. Investment and deployment costs for LEO constellations are so "astronomical," and in many cases so tied to national/military investment and subsidies, that only a small handful of corporations/countries will be capable of owning and managing their own constellation. This is likely to open up a new front in the ongoing wrangling by geo-political power blocs over the future of the Internet.

Furthermore, it is far from clear that LEO constellations have either the capacity or the economic model to deliver on their claims of providing affordable connectivity to the unserved in most parts of the world. Consider that the half of the world's population that remains unconnected to the Internet are the most economically disadvantaged. As such, most people will not be direct consumers of LEO services but will instead need to rely on a telco building infrastructure and using LEO as backhaul—a scenario which already exists with conventional satellite services. A further concern is that LEO constellations may ultimately create a disincentive to investment in rural connectivity, based on the assumption by service providers and governments that LEO constellations will address that gap.

It is troubling that companies like Amazon and Google (the third largest shareholder in SpaceX), which already wield tremendous power and influence over society, are vying to expand their dominance by becoming global internet service providers with support from taxpayers via subsidies and military spending. With their hands in essentially every layer of the communication stack, it will prove challenging to regulate or even know about the data they harvest and how those are used to competitive advantage in other areas of their businesses.

At the time of their emergence, both space exploration and the Internet served as beacons of hope and of potential transcendence for humanity—one of shared imagination and resources, and of cooperation in human development. In both cases, that hope has been dimmed in a quest for profit and geo-political power. If we want to recover a sense of shared purpose as a species, the question as to "who gets to put their satellites into low earth orbit?" is more important than we might think. Is space for everyone, or just a few huge corporations and global superpowers? This is the question we ask when we ask who gets to park their satellites in orbit.

There is an opportunity to return to the spirit of internationalism that infused the early days of space exploration in which space was held as a shared resource to be protected and guarded from exploitation. Similarly, here on Earth, we see successful efforts to manage Internet infrastructure as a commons in contrast to Silicon Valley's model of surveillance capitalism. Recognizing that individual and collective empowerment and agency are as important as the actual infrastructure itself is the key to a more egalitarian Internet. LEO satellite networks may deliver connectivity (although many doubts remain), but they are less likely to empower people and move us toward a more equitable world. The development of a healthy Internet that actually benefits humanity involves not just the end result of affordable access, but also the process through which people gain that access.

#### Commercial space innovation stops extinction

Charles Beames 18, Chairman of the SmallSat Alliance, Executive Chairman of York Space Systems, former Principal Director of Space and Intelligence in the Office of the Undersecretary of Defense for Acquisition, Technology, and Logistics (OUSD(AT&L)), Col. (ret.) in the USAF where he served 23 years in space & intelligence leadership positions around the world, 8/8/18, “Op-ed | SmallSat Alliance is on a path toward a new space horizon,” <https://spacenews.com/op-ed-smallsat-alliance-is-on-a-path-toward-a-new-space-horizon/>

We find ourselves still at the dawn of a new space century, mindful of the victories and setbacks of our past, eager to pass the torch to the next generation of space visionaries, scientists, engineers, and enthusiasts. We look to the future not just to see how much bigger, faster, or higher we can reach, but also how the United States, and specifically the U.S. space community, can again inspire the nations of the world to align with us, as it did in the 20th century. The SmallSat Alliance is an alliance of companies developing, producing, and operating in all segments of the ‘next generation’ space economy; championing renewed U.S. leadership in the burgeoning commercial space economy, and advocating for the transformation of government-led space capabilities. We are experienced space professionals who have chosen to join with others leveraging our decades of hard-won experience, to develop smarter ways to explore space in the 21st century. A wonderful outgrowth of the legacy space program is the commercial, entrepreneurial, and job-creating commercial space business that it bequeathed. These next-generation enterprises range from multi-million-dollar startups providing rideshare opportunities or components for small satellites to multi-billion-dollar space data-analytic platforms reinventing urban car service and agricultural production. The early returns of this economic revolution are already on our doorstep: space data capabilities are exponentially growing elements of the 21st century world economy. Beginning with the dreams and funding by successful tech entrepreneurs, enormous venture investments are already delivering wondrous benefits to the world. Commercial Space – Profit and Non-Profit There are really two major categories in the commercial sector, the profit driven and the non-profit. The classic for-profit companies include not only those designing, building, launching, and operating satellites but also the tech sector that is turning that raw space data into gold through machine-learning analytics. Since for-profit companies are no longer dependent upon the revenues generated by the Cold War space race culture of a bygone era, this new generation of space companies is able to more efficiently capitalize on Moore’s Law, the nonstop exponential growth in chip density, and the associated networking technology co-evolving with it. This new generation is building profitable businesses helping to clean up our oceans of garbage and debris with satellite surveillance, reconnoitering to assist in enforcing laws that protect our oceans from illegal, unregulated, unlicensed fishing, something that is rapidly depleting the world’s most valuable and essential lifeforms. It’s leading in the innovative use of low-cost satellite constellations to produce ubiquitous remote-sensing data, enabling small business owners to be more profitable and less wasteful. For example, precise timing signals from space are already optimizing transportation of people, goods, and services, with even further gains anticipated with the introduction of artificial intelligence to assist drivers, perhaps even someday replacing them entirely. The non-profit sector is the other side of commercial space, concerned more for the general welfare of society, but every bit as integral to this new space enterprise. Much like every century before it in human history, ours is not without its unique challenges, some of which have been a consequence of the last, and all of which the space data domain can be leveraged to help solve. Examples are endless, but one challenge that this new space community is uniquely well-adapted for is to further inform worldwide resource allocation for the 21st century and beyond. These two primary resources are sustainable water and the materials needed for adequate housing for an ever-increasing human population. As cities and urbanization continue to expand, governmental planning challenges such as transportation design optimization for goods and services are only the beginning. Additionally, through using inexpensive remote sensing technologies, some members are designing space data analytics to mitigate human suffering from plagues, contain outbreaks, and combating illegal poaching. Some are connecting with other non-profits to curtail human trafficking for the sex trade or forced labor for migrant debt repayment. Still others are helping non-governmental organizations in their work to expose the use of children as soldiers. Addressing these challenges has little to do with resuscitating dreams conceived by long deceased science-fiction writers and much more to do with turning “swords back into plowshares” to solve real threats to humanity. Other non-profit initiatives include pursuing an even more foundational understanding of who we are and how to be the best custodians of our environment. Much as exploring and monitoring the world’s oceans has advanced civilization through a better understanding of human life and the planet, so too does exploring and monitoring from space. Low Earth orbit (LEO) provides a unique vantage point to look back on the planet and understand what is happening, anticipate what might happen and prepare for the future. In addition to better understanding Earth, responsible and rapid exploitation of the low Earth orbit domain will enhance the understanding of the solar system and the rest of the universe. Small satellites already offer low-cost platforms to study and explore what lies beyond the Earth. Other members are pioneering the use of zero-carbon, hydrogen-based reusable propulsion systems to ensure we don’t worsen our atmosphere using kerosene-fueled rockets for the coming tsunami of satellite launches. Finally, a mission ensuring the general welfare and planet survival for the next thousand years is finally confronting the existential threat that asteroids and comets pose to humanity. These extra-terrestrial, deep-space threats are passing dangerously close to our planet, and today we have no solar map of them and no defense.

## Case

### Collisions

**No risk of accidents – tech solves AND space isn’t crowded.**

**Fernholz ’19** [Tim, "SpaceX’s new satellites will dodge collisions autonomously (and they’d better)," May 24, https://qz.com/1627570/how-autonomous-are-spacexs-starlink-satellites]

“Within a year and a half, maybe two years, if things go well, SpaceX will probably have more satellites in orbit than all other satellites combined,” Elon Musk said last week. This is an exaggeration. There are almost 2,000 operational satellites in space right now. But Thursday night’s launch of 60 satellites for a new internet network called Starlink is the first step towards that goal. Today, Musk’s space company said it expects to launch six more times in 2019, with the goal of operating 720 satellites by the end of the 2020, and eventually more than 4,000. The Federal Communications Commission—the lead regulator for American satellites—approved these satellite, among 13,000 new satellites okayed in the last year. That huge number has many in the space community nervous about the potential for collisions with other satellites or with space debris. Neither the United States nor the world has a reliable system for managing traffic in space, and policymakers are struggling to keep up with the private sector’s growing ability to hurl computers into the cosmos at faster and faster rates. Musk said the satellites his company launches will avoid potential collisions on their own. And Mark Juncosa, the SpaceX executive in charge of developing the Starlink satellites, downplayed concerns when answering press inquiries on the matter last week. “It might be worth mentioning for people that are not in the space industry … space is really big,” he said. It was experts focused on pinning down what’s going on in orbit who questioned whether the autonomous systems would have sufficient data to safely maneuver. Musk’s electric cars at Tesla often face similar questions. However advanced their AI, what’s more important is how well the car can see. The ultimate source for space situational awareness is the US Air Force’s Combined Space Operations Center, or CSpOC, which tracks orbital objects 10 centimeters in diameter or larger with a worldwide radar network. Most satellite companies, especially those with large fleets, automate the communications and “station keeping” maneuvers. But when they receive a warning from CSpOC that there is a risk of collision with another spacecraft or with space debris, their team consults with the Air Force to make a decision about how to move. Planet, which operates more than 150 spacecraft, automates its communications with CSpOC and has software that calculates the probability of potential conjunctions when they receive a warning. But, when the probability of conjunction reaches about 1 in 10,000, their flight operations team steps in to plan a maneuver to keep their satellites out of trouble. SpaceX says there will be no human in the loop when it comes to its satellites. When notified of a potential conjunction with another object in space, their software will decide whether and how to maneuver, and communicate that information back to CSpOC. It’s not clear what their threshold will be for taking action, or how much warning they will give to the US Air Force. CSpOC did not respond to questions about this communications system. Satellite experts are happy to see efforts at automation, because conjunction reports are only going to increase as more satellites fly. But they worry about an automated system responding to imperfect data, and emphasize the need for the widest possible transparency. Though orbital mechanics are extremely predictable, space sensing is imperfect and the margin of error around where exactly a satellite can be is quite large. Many spacecraft operators join the Space Data Association, a trade association for exchanging space traffic data, and others partner with new space surveillance companies like LeoLabs to obtain more data about what’s happening in orbit. “Because we look at many hundreds of satellites every single day, we find that there are issues with the data,” Dr. T.S. Kelso, a former Air Force officer who works for the Space Data Association, told Quartz. His operation generates about 2,000 conjunction reports every four days. “We can go from something that looks very serious one day to all of the sudden there is nothing in the data. … if you are maneuvering because it is a 1 in 10,000 chance, if you had done nothing, you still had a pretty good chance nothing was going to happen.” SpaceX isn’t responsible for the lack of a real space traffic management system, but as a first mover among companies preparing ambitious satellite networks that far outstrip anything that came before, it is likely to set the tone for how operators and regulators interact. The company chose to fly the satellites at a low enough altitude that if they fail, they will safely burn up in the atmosphere within a year, rather than remaining space junk. “The space junk thing, we don’t want to trivialize it or not take it seriously,” Musk said. “[But] it’s not crowded up there. It’s extremely sparse. If your goal was to hit something, it wouldn’t be easy.”

#### No miscalc or escalation

James Pavur 19, DPhil Researcher at the Cybersecurity Centre for Doctoral Training at Oxford University, and Ivan Martinovic, Professor of Computer Science in the Department of Computer Science at Oxford University, “The Cyber-ASAT: On the Impact of Cyber Weapons in Outer Space”, 2019 11th International Conference on Cyber Conflict: Silent Battle, https://ccdcoe.org/uploads/2019/06/Art\_12\_The-Cyber-ASAT.pdf

A. Limited Accessibility

Space is difficult. Over 60 years have passed since the first Sputnik launch and only nine countries (ten including the EU) have orbital launch capabilities. Moreover, a launch programme alone does not guarantee the resources and precision required to operate a meaningful ASAT capability. Given this, one possible reason why space wars have not broken out is simply because only the US has ever had the ability to fight one [21, p. 402], [22, pp. 419–420].

Although launch technology may become cheaper and easier, it is unclear to what extent these advances will be distributed among presently non-spacefaring nations. Limited access to orbit necessarily reduces the scenarios which could plausibly escalate to ASAT usage. Only major conflicts between the handful of states with ‘space club’ membership could be considered possible flashpoints. Even then, the fragility of an attacker’s own space assets creates de-escalatory pressures due to the deterrent effect of retaliation. Since the earliest days of the space race, dominant powers have recognized this dynamic and demonstrated an inclination towards de-escalatory space strategies [23].

B. Attributable Norms

There also exists a long-standing normative framework favouring the peaceful use of space. The effectiveness of this regime, centred around the Outer Space Treaty (OST), is highly contentious and many have pointed out its serious legal and political shortcomings [24]–[26]. Nevertheless, this status quo framework has somehow supported over six decades of relative peace in orbit.

Over these six decades, norms have become deeply ingrained into the way states describe and perceive space weaponization. This de facto codification was dramatically demonstrated in 2005 when the US found itself on the short end of a 160-1 UN vote after opposing a non-binding resolution on space weaponization. Although states have occasionally pushed the boundaries of these norms, this has typically occurred through incremental legal re-interpretation rather than outright opposition [27]. Even the most notable incidents, such as the 2007-2008 US and Chinese ASAT demonstrations, were couched in rhetoric from both the norm violators and defenders, depicting space as a peaceful global commons [27, p. 56]. Altogether, this suggests that states perceive real costs to breaking this normative tradition and may even moderate their behaviours accordingly.

One further factor supporting this norms regime is the high degree of attributability surrounding ASAT weapons. For kinetic ASAT technology, plausible deniability and stealth are essentially impossible. The literally explosive act of launching a rocket cannot evade detection and, if used offensively, retaliation. This imposes high diplomatic costs on ASAT usage and testing, particularly during peacetime.

C. Environmental Interdependence

A third stabilizing force relates to the orbital debris consequences of ASATs. China’s 2007 ASAT demonstration was the largest debris-generating event in history, as the targeted satellite dissipated into thousands of dangerous debris particles [28, p. 4]. Since debris particles are indiscriminate and unpredictable, they often threaten the attacker’s own space assets [22, p. 420]. This is compounded by Kessler syndrome, a phenomenon whereby orbital debris ‘breeds’ as large pieces of debris collide and disintegrate. As space debris remains in orbit for hundreds of years, the cascade effect of an ASAT attack can constrain the attacker’s long-term use of space [29, pp. 295– 296]. Any state with kinetic ASAT capabilities will likely also operate satellites of its own, and they are necessarily exposed to this collateral damage threat. Space debris thus acts as a strong strategic deterrent to ASAT usage.

#### Hotlines solve

Chen Lan 15, Writer on the Chinese Space Program, Go Taikounauts, http://www.go-taikonauts.com/images/newsletters\_PDF/GoTaikonauts18.pdf

Though Sino-U.S. cooperation on human spaceflight is still uncertain, a positive move between the two countries has been made, that is the establishment of a space hotline. Western media reported in November that the hotline has been setup between Washington and Beijing to allow easy sharing of technical information about their space operations, hopefully avoiding any misunderstandings or accidents.

#### No cyber impact---every scenario is empirically denied

James Andrew **Lewis 18**, senior vice president at the Center for Strategic and International Studies, Ph.D. from the University of Chicago, January 2018, “Rethinking Cybersecurity: Strategy, Mass Effect, and States,” <https://espas.secure.europarl.europa.eu/orbis/sites/default/files/generated/document/en/180108_Lewis_ReconsideringCybersecurity_Web.pdf>, p. 7-11

The most dangerous and damaging attacks required resources and engineering knowledge that are beyond the capabilities of nonstate actors, and those who possess such capabilities consider their use in the context of some larger strategy to achieve national goals. Precision and predictability—always desirable in offensive operations in order to provide assured effect and economy of force—suggest that the risk of collateral damage is smaller than we assume, and with this, so is the risk of indiscriminate or mass effect.

State Use of Cyber Attack Is Consistent with Larger Strategic Aims

Based on a review of state actions to date, cyber operations give countries a new way to implement existing policies rather than leading them to adopt new policy or strategies. State opponents use cyber techniques in ways consistent with their national strategies and objectives. But for now, cyber may be best explained as an addition to the existing portfolio of tools available to nations.

Cyber operations are ideal for achieving the strategic effect our opponents seek in this new environment. How nations use cyber techniques will be determined by their larger needs and interests, by their strategies, experience, and institutions, and by their tolerance for risk. Cyber operations provide unparalleled access to targets, and the only constraint on attackers is the risk of retaliation—a risk they manage by avoiding actions that would provoke a damaging response. This is done by staying below an implicit threshold on what can be considered the use of force in cyberspace.

The reality of cyber attack differs greatly from our fears. Analysts place a range of hypothetical threats, often accompanied by extreme consequences, before the public without considering the probability of occurrence or the likelihood that opponents will choose a course of action that does not advance their strategic aims and creates grave risk of damaging escalation. Our opponents' goals are not to carry out a cyber 9/11. While there have been many opponent probes of critical infrastructure facilities in numerous countries, the number of malicious cyber actions that caused physical damage can be counted on one hand. While opponents have probed critical infrastructure networks, there is no indication that they are for the purposes of the kind of crippling strategic attacks against critical infrastructure that dominated planning in the Second World War or the Cold War.

Similarly, the popular idea that opponents use cyber techniques to inflict cumulative economic harm is not supported by evidence. Economic warfare has always been part of conflict, but there are no examples of a country seeking to imperceptibly harm the economy of an opponent. The United States engaged in economic warfare during the Cold War, and still uses sanctions as a tool of foreign power, but few if any other nations do the same. The intent of cyber espionage is to gain market or technological advantage. Coercive actions against government agencies or companies are intended to intimidate. Terrorists do not seek to inflict economic damage. The difficulty of wreaking real harm on large, interconnected economies is usually ignored.

Economic warfare in cyberspace is ascribed to China, but China's cyber doctrine has three elements: control of cyberspace to preserve party rule and political stability, espionage (both commercial and military), and preparation for disruptive acts to damage an opponent's weapons, military information systems, and command and control. "Strategic" uses, such as striking civilian infrastructure in the opponent's homeland, appear to be a lower priority and are an adjunct to nuclear strikes as part of China's strategic deterrence. Chinese officials seem more concerned about accelerating China's growth rather than some long-term effort to undermine the American economy.6 The 2015 agreement with the United States served Chinese interests by centralizing tasking authority in Beijing and ending People's Liberation Army (PLA) "freelancing" against commercial targets.

The Russians specialize in coercion, financial crime, and creating harmful cognitive effect—the ability to manipulate emotions and decisionmaking. Under their 2010 military doctrine on disruptive information operations (part of what they call "New Generation Warfare"). Russians want confusion, not physical damage. Iran and North Korea use cyber actions against American banks or entertainment companies like Sony or the Sands Casino, but their goal is political coercion, not destruction.

None of these countries talk about death by 1000 cuts or attacking critical infrastructure to produce a cyber Pearl Harbor or any of the other scenarios that dominate the media. The few disruptive attacks on critical infrastructure have focused almost exclusively on the energy sector. Major financial institutions face a high degree of risk but in most cases, the attackers' intent is to extract money. There have been cases of service disruption and data erasure, but these have been limited in scope. Denial-of-service attacks against banks impede services and may be costly to the targeted bank, but do not have a major effect on the national economy. In all of these actions, there is a line that countries have been unwilling to cross.

When our opponents decided to challenge American "hegemony," they developed strategies to circumvent the risks of retaliation or escalation by ensuring that their actions stayed below the use-of-force threshold—an imprecise threshold, roughly defined by international law, but usually considered to involve actions that produce destruction or casualties. Almost all cyber attacks fall below this threshold, including, crime, espionage, and politically coercive acts. This explains why the decades-long quest to rebuild Cold War deterrence in cyberspace has been fruitless.

It also explains why we have not seen the dreaded cyber Pearl Harbor or other predicted catastrophes. Opponents are keenly aware that launching catastrophe brings with it immense risk of receiving catastrophe in return. States are the only actors who can carry out catastrophic cyber attacks and they are very unlikely to do so in a strategic environment that seeks to gain advantage without engaging in armed conflict. Decisions on targets and attack make sense only when embedded in their larger strategic calculations regarding how best to fight with the United States.

There have been thousands of incidents of cybercrime and cyber espionage, but only a handful of true attacks, where the intent was not to extract information or money, but to disrupt and, in a few cases, destroy. From these incidents, we can extract a more accurate picture of risk. The salient incidents are the cyber operations against Iran's nuclear weapons facility (Stuxnet), Iran's actions against Aramco and leading American banks, North Korean interference with Sony and with South Korean banks and television stations, and Russian actions against Estonia, Ukrainian power facilities, Canal 5 (television network in France), and the 2016 U S. presidential elections. Cyber attacks are not random. All of these incidents have been part of larger geopolitical conflicts involving Iran, Korea, and the Ukraine, or Russia's contest with the United States and NATO.

There are commonalities in each attack. All were undertaken by state actors or proxy forces to achieve the attacking state's policy objectives. Only two caused tangible damage; the rest created coercive effect, intended to create confusion and psychological pressure through fear, uncertainty, and embarrassment. In no instance were there deaths or casualties. In two decades of cyber attacks, there has never been a single casualty. This alone should give pause to the doomsayers. Nor has there been widespread collateral damage.

#### No warrant for why – the other 50 percent of satilites doesn’t solve

### Space Militarization

1. Uniqueness issue on Militarization: This is going to happen either way. The Bernat evidence they read at best suggest that private entitities have partnered with public entities, not that they are the ones approprorating.
2. Regulation solves 100% of the aff.
3. Revise the space treaty!!! Sufficient to solve
4. States will still be bad actors. They will find ways to militarize the space. Public entities leading the way. Banning private entities prevents necessary checks.

#### Offensive capabilities are weak, there are lots of defenses---their ev is hype

Dr. Joan Johnson-Freese 16, Ph.D. in Political Science and International Relations from Kent State University, Chair of the Department of National Security Studies at the Naval War College, and Theresa Hitchens, Senior Research Scholar at the Center for International and Security Studies and Former Director of the United Nations Institute for Disarmament Research (UNIDIR), “Stop The Fearmongering Over War In Space: The Sky’s Not Falling, Part 1”, Breaking Defense, 12/27/2016, https://breakingdefense.com/2016/12/stop-the-fearmongering-over-war-in-space-the-skys-not-falling-part-1/

Star Wars it ain’t, but the Pentagon is increasingly anxious over threats to its satellites, as we’ve reported frequently in recent years. But in this op-ed, scholars Joan Johnson-Freese and Theresa Hitchens argue that war in space is dangerously overhyped. — the editors

In the last two years, we’ve seen rising hysteria over a future war in space. Fanning the flames are not only dire assessments from the US military, but also breathless coverage from a cooperative and credulous press. This reporting doesn’t only muddy public debate over whether we really need expensive systems. It could also become a self-fulfilling prophecy. The irony is that nothing makes the currently slim possibility of war in space more likely than fearmongering over the threat of war in space.

Two television programs in the past two years show how egregious this fearmongering can get. In April 2015, the CBS show 60 Minutes ran a segment called “The Battle Above.” In an interview with General John Hyten, the then-chief of U.S. Air Force Space Command, it came across loud and clear that the United States was being forced to prepare for a battle in space — specifically against China — that it really didn’t want.

Gen. John Hyten: It’s a competition that I wish wasn’t occurring, but it is. And if we’re threatened in space, we have the right of self-defense, and we’ll make sure we can execute that right.

David Martin: And use force if necessary.

Gen. John Hyten: That’s why we have a military. You know, I’m not NASA.

It was explained by Hyten and other guests that China is building a considerable amount of hardware and accumulating significant know-how regarding space, all threatening to space assets Americans depend on every day. If viewers weren’t frightened after watching the segment, it wasn’t for lack of trying on the part of CBS.

Using terms like “offensive counterspace” as a 1984 NewSpeak euphemism for “weapons,” it was made clear that the United States had no choice but to spend billions of dollars on offensive counterspace technology to not just thwart the Chinese threat, but control and dominate space. While it didn’t actually distort facts — just omit facts about current U.S. space capabilities — the segment was basically a cost-free commercial for the military-industrial complex.

In retrospect though, “The Battle Above” was pretty good compared to CNN’s recent special, War in Space: The Next Battlefield. The latter might as well have been called Sharknado in Space – because the only far-out weapons technology our potential adversaries don’t have, according to the broadcast, seems to be “sharks with frickin’ laser beams attached to their heads!”

First, CNN needs to hire some fact checkers. Saying “unlike its adversaries, the U.S. has not yet weaponized space” is deeply misleading, like saying “unlike his political opponents, President-Elect Donald Trump has not sprouted wings and flown away”: A few (admittedly alarming) weapons tests aside, no country in the world has yet weaponized space. Contrary to CNN, stock market transactions are not timed nor synchronized through GPS, but a closed system. Cruise missiles can find their targets even without GPS, because they have both GPS and precision inertial measurement units onboard, and IMUs don’t rely on satellite data. Oh, and the British rock group Pink Floyd holds the only claim to the Dark Side of the Moon: There is a “far side” of the Moon — the side always turned away from the Earth — but not a “dark side” — which would be a side always turned away from the Sun.

More nefariously, the segment sensationalized nuggets of truth within a barrage of half-truths, backed by a heavy bass, dramatic soundtrack (and gravelly-voiced reporter Jim Sciutto) and accompanied by sexy and scary visuals.

Make no mistake there are dangers in space, and the United States has the most to lose if space assets are lost. The question is how best to protect them. Here are a few facts CNN omitted.

The Reality

The U.S. has all of the technologies described on the CNN segment and deemed potentially offensive: maneuverable satellites, nano-satellites, lasers, jamming capabilities, robotic arms, ballistic missiles that can be used as anti-satellite weapons, etc. In fact, the United States is more technologically advanced than other countries in both military and commercial space.

That technological superiority scares other countries; just as the U.S. military space community is scared of other countries obtaining those technologies in the future. The U.S. military space budget is more than 10 times greater than that of all the countries in the world combined. That also causes other countries concern.

More unsettling still, the United States has long been leery of treaty-based efforts to constrain a potential arms race in outer space, as supported by nearly every other country in the world for decades. Indeed, under the administration of George W. Bush, the U.S. talking points centered on the mantra “there is no arms race in outer space,” so there is no need for diplomat instruments to constrain one. Now, a decade later, the U.S. military – backed by the Intelligence Community which operates the nation’s spy satellites – seems to be shouting to the rooftops that the United States is in danger of losing the space arms race already begun by its potential adversaries. The underlying assumption — a convenient one for advocates of more military spending — is that now there is nothing that diplomacy can do.

However, it must be remembered that most space-related technologies – with the exception of ballistic missiles and dedicated jammers – have both military and civil/commercial uses; both benign — indeed, helpful — and nefarious uses. For example, giving satellites the ability to maneuver on orbit can allow useful inspections of ailing satellites and possibly even repairs.

Further, the United States is not unable to protect its satellites, as repeated during the CNN broadcast by various interviewees and the host. Many U.S. government-owned satellites, including precious spy satellites, have capabilities to maneuver. Many are hardened against electro-magnetic pulse, sport “shutters” to protect optical “eyes” from solar flares and lasers, and use radio frequency hopping to resist jamming.

Offensive weapons, deployed on the ground to attack satellites, or in space, are not a silver bullet. To the contrary, U.S. deployment of such weapons may actually be detrimental to U.S. and international security in space (as we argued in a recent Atlantic Council publication, Towards a New National Security Space Strategy). Further, there are benefits to efforts started by the Obama Administration to find diplomatic tools to restrain and constrain dangerous military activities in space.

These diplomatic efforts, however, would be undercut by a full-out U.S. pursuit of “space dominance.” This includes dialogue with China, the lack of which Gen. William Shelton, retired commander of Air Force Space Command, lamented in the CNN report.

Given CNN’s “cast,” the spin was not surprising. Starting with Ghost Fleet author Peter Singer set the sensationalist tone, which never altered. The apocalyptic opening, inspired by Ghost Fleet, posited a scenario where all U.S. satellites are taken off-line in nearly one fell swoop. Unless we are talking about an alien invasion, that scenario is nigh on impossible. No potential adversary has such capabilities, nor will they ever likely do so. There is just too much redundancy in the system.

**Weaponizing space now is critical to prevent arms races – reduces conventional arms racing and prevents future space arms race – creates peace through deterrence.**

**Dolman ‘6**

Everett C. Dolman, Associate Professor of Comparative Military Studies @ the US Air Force School of Advanced Air and Space Studies. “US Military Transformation and Weapons in Space”. SAIS Review 26.1 (2006). Project Muse.

There is another, perhaps far more compelling reason that weaponizing space would in time be less threatening to the international system than the failure to do so. The weaponization of space would decrease the likelihood of an arms race by shifting spending away from conventional weapons systems. One of the more cacophonous refrains against weapons procurement of any kind is that the money needed to purchase them is better spent elsewhere. It is a simple cliché but a powerful one. Space weapons in particular will be very, very expensive. Are there not a thousand better ways to spend the money? But funding for weapons does not come directly from education, housing or transportation budgets. It comes from military budgets. Thus the question should be directed not at particular weapons, but at all weapons. The immediate budget impact of significant funding increases for space weapons would be to decrease funding for combat aircraft, the surface battle fleet, and ground forces. This may well set the proponents of space weaponization at odds with both proponents and opponents of increased defense spending. Space advocates must sell their ideas to fellow pro-weapons groups by making the case that the advantages they provide outweigh the capabilities forgone. This is a mighty task. The tens or even hundreds of billions of dollars needed to develop, test and deploy a minimal space weapons system with the capacity to engage a few targets around the world could displace a half-dozen or more aircraft carrier battle groups, entire aircraft procurement programs such as the F-22, and several heavy armored divisions. This is a tough sell for supporters of a strong military. It is an even more difficult dilemma for those who oppose weapons in general, and space weapons in particular. Ramifications for the most critical current function of the Army, Navy, and Marines—pacification, occupation, and control of foreign territory—are profound. With the downsizing of traditional weapons to accommodate heightened space expenditures, the U.S. ability to do all three would wane significantly. At a time when many are calling for increased capability to pacify and police foreign lands, in light of the no-end-in-sight occupations of Iraq and Afghanistan, space weapons proponents must advocate reduction of these capabilities in favor of a system that will have no direct potential to do so. Hence, the argument that the unilateral deployment of space weapons will precipitate a disastrous arms race is further eroded. To be sure, space weapons are offensive by their very nature. They deter violence by the omnipresent threat of precise, measured, and unstoppable retaliation. But they offer no advantage in the mission of territorial occupation. As such, they are far less threatening to the international environment than any combination of conventional weapons employed in their stead. What would be more threatening to a state in opposition to American hegemony: a dozen lasers in space with pinpoint accuracy, or (for about the same price) 15 infantry divisions massed on the border? A state employing offensive deterrence through space weapons can punish a transgressor state, but it is in a poor position to challenge that state's sovereignty. A transgressor state is less likely to succumb to the security dilemma if it perceives that its national survival is not at risk. Moreover, the tremendous expense of space weapons would inhibit their indiscriminate use. Over time, the world of sovereign states would recognize that the United States could not and would not use space weapons to threaten another country's internal self-determination. The United States still would challenge any attempts to intervene militarily in the politics of others, and it would have severely restricted its own capacity to do the latter. Judicious and non-arbitrary use of a weaponized space eventually could be seen as a net positive, an effective global police force that punishes criminal acts but does not threaten to engage in aggressive behavior. Seizing the initiative and securing low-Earth orbit now, while the United States is unchallenged in space, would do much to stabilize the international system and prevent an arms race in space. The enhanced ability to deny any attempt by another nation to place military assets in space and to readily engage and destroy terrestrial anti-satellite capacity would make the possibility of large-scale space war or military space races less likely, not more. Why would a state expend the effort to compete in space with a superpower that has the extraordinary advantage of holding securely the highest ground at the top of the gravity well? So long as the controlling state demonstrates a capacity and a will to use force to defend its position, in effect expending a small amount of violence as needed to prevent a greater conflagration in the future, the likelihood of a future war in space is remote.