# OFF

## NC

T- appropriation

#### Appropriation is establishing property rights in something formerly un-owned

Dominiak 17

Łukasz Dominiak (Associate Professor at Nicolaus Copernicus University in Poland; he holds a PhD and habilitation in political philosophy and is a Fellow of the Mises Institute). “Libertarianism and Original Appropriation.” Historia i Polityka, 29/2017: 22. Pp. 43-56. JDN. <https://apcz.umk.pl/HiP/article/view/HiP.2017.026/13714>

Ownership1, or property, on the other hand is a normative concept. To own a thing is to have a right to possess it, i.e. to be in such a juridical position that one’s claim to deal with the thing at will is a justified claim whereas claims of other persons are unjustified or less justified than the owner’s. As Barnett puts it, “rights are those claims a person has to legal enforcement that are justified, on balance, by the full constellation of relevant reasons, whether or not they are actually recognized and enforced by a legal system” (2004). To recognise someone’s ownership is therefore to assert that his possession of a thing is just, rightful, lawful, licit or reasonable etc., is to conclude that he ought to possess the thing if such is his will, even if he actually does not possess it. As Kinsella writes, “ownership is the right to control, use, or possess, while possession is actual control” (2009). Thus, ownership is a threefold normative or juridical relation between the owner, the thing owned and the rest of mankind such as the owner may control the thing to the exclusion of others because he has the best title to do it. Hence, the distinction between possession and ownership is a distinction between factual and normative relation.

Having drawn the above distinction between possession and ownership, we are ready to define original appropriation. Thus, original appropriation is acquiring ownership of unowned things. To originally appropriate is to establish property rights, i.e. justified claims to physical things that at the moment of acquisition are unowned. What is important to underline again, is that original appropriation is not about taking factual possession of things that are unpossessed or unowned – this process is called occupation and can be conceived as one of the possible investitive facts that can result in original appropriation but should not be confounded with the latter. Neither is it about acquiring ownership of things already owned. It is about instituting new property rights to unowned things. As Nozick puts it, the topic of “original acquisition of holdings, the appropriation of unheld things includes the issues of how unheld things may come to be held” (2014), i.e. come to be owned. Hence, original appropriation is about creating normative relations between persons and things.

#### That is distinct from use- it requires “exclusive use”

Gorove, 69 -- Famous legal jurist on space law, formerly a professor emeritus at the University of Mississippi

[Stephen, Interpreting Article II of the Outer Space Treaty, 37 Fordham L. Rev. 349. 1969. <https://ir.lawnet.fordham.edu/flr/vol37/iss3/2>, accessed 6-25-21]

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

#### Appropriation would allow private entities to claim comprehensive property rights- that includes the right to transfer

Reinstein 99

Ezra J. Reinstein (JD, Associate at Kirkland & Ellis), Owning Outer Space, 20 Nw. J. Int'l L. & Bus. 59 (1999). JDN. https://scholarlycommons.law.northwestern.edu/njilb/vol20/iss1/7

IV. PROPOSAL: APPROPRIATIVE OWNERSHIP OF REAL PROPERTY The ideal legal regime should create maximum incentives for efficient development of space, in recognition of the fact that the potential wealth in space will not drop into our laps. But as much as commercial development of space would benefit all mankind, it is just as important that the development be controlled. We must learn from mistakes of the past. Any legal regime should guard against inefficient exploitation, waste, and environmental despoliation. Furthermore, space should not become the next Wild West. Destruction and sabotage must be discouraged. My proposal, which will be developed throughout this essay, is to maximize incentives by giving developers comprehensive property rights. Humanity's welfare demands that we alter the current law to allow real estate ownership -- not just usufructary rights -- to those who would best develop land in space.7 The potential wealth of outer space, in the form of minerals, energy, living space, etc., doesn't do us any good unless we are able to harness it. And, as Jeffrey Kargel, a planetary scientist at the U.S. Geological Survey, has written, "if you want to cross the bridge into the 21st century of space [development], then space must pay its way and give private investors a handsome early return on investment.' 75 What do we mean by "ownership?" Property is commonly recognized as being a "bundle" of disparate rights regulating relations between people with respect to things. The bundle of rights can be unpacked. It includes: the right to possess, the right to use, the right to exclude, and the right to transfer.76 These rights are not on/off affairs; they can each be limited or expanded along a continuum. I use the term "ownership" to describe a state of affairs wherein a person has all four of these rights to their maximum extent with respect to a piece of property. Current space law ostensibly respects the right to use real property in space and to collect and own its fruits. Historically, this has been known as the usufructary right.77 But the current law doesn't even provide this right freely; it seems to be limited by several clauses of the Outer Space Treaty (e.g. use "for the benefit...of all countries").78 Nor does the OST recognize the right to exclude, as is evidenced by article I's prohibition on appropriating what it recognizes as being "the province of all mankind," the guarantee in the same article of "free access to all areas of celestial bodies," and article XII's requirement that "[a]ll stations [and] installations...shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity." Likewise, as illuminated in the SpaceCorp hypothetical, the prohibition on appropriation seems to negate a long-term right of possession. Without the right to exclude or possess, of course, a legal system need not provide the right to transfer real estate. Anyone else may simply help themselves. In sum, the OST demands that "[n]o State can obtain such possessions as will entitle it to claim ownership or sovereignty over them... There can be no exclusive appropriation of [celestial bodies] and any part thereof as a result of their 'use'..." 79 Under current law, space cannot be owned.

#### Violation- the aff is not appropriation

#### 1. Pepsi challenge- control-F the word appropriation in the doc- it shows up in the plan text, that’s it- they should not get a wall of new 1AR cards on this

#### 2. Satellites don’t require a system of exclusive property rights

#### 3. Satellites don’t constitute exclusive use- entities own the satellites, but NOT the slot- that’s an important distinction- you might own the car you drive on, but NOT the highway you drive it on

#### 4. Satellites don’t allow transfer- even if they de facto own it, that doesn’t mean there is a recognize property right that allows the sale and transfer of it

#### Vote neg-

#### 1. Precision- only our evidence has intent to define and exclude in the context of the legal controversies over space law about the distinction between “appropriation”, “ownership”, and “use”

#### 2. Limits- any aff that is about temporary use becomes T- that opens the floodgates and inverts neg link ground which forces bi-directional prep

#### 3. Ground- neg loses core appropriation key ground like mining and space colonization- broad appropriation debates are key

#### 4. No def means lean aff – specificity

#### Drop the debater- T indicts their whole advocacy and the debate was already skewed. Reasonability is arbitrary and collapses to competing interpretations. No RVIs- it’s their burden to be topical.

## NC

Satellites DA

#### Private company focus on satellites key for improved internet connection

**Russon 21** – Technology of Business Reporter, BBC News

[Mary-Ann Russon, “Satellite boom attracts technology giants,” BBC News, 1-29-21, <https://www.bbc.com/news/business-55807150>]

**Sir Richard Branson's rocket company Virgin Orbit has joined a growing list of private companies that can launch satellites into orbit.** Earlier this month, [**10 payloads were lofted**](https://www.bbc.co.uk/news/science-environment-55699262) on the Virgin Orbit rocket, which was launched from under the wing of one of the entrepreneur's old 747 jumbos. Sir Richard is hoping to tap into what is a growing market for small, lower-cost satellites. Space has traditionally had a high barrier to entry. Today, just seven firms make up 75% of the industry, according to Scott Campbell, director at Deloitte Ventures. The space industry is worth $380bn (£285bn), and 60% of that is commercial. But previously, virtually all investment into space was by governments, he says. The first real shift came in 2011 when US President Barack Obama opened up space to businesses, and now more disruption is coming. "The new space race and start-up scene is almost entirely based around space applications: what can I do with data from space?" says Mr Campbell. Traditionally, building and launching a satellite to collect data or enable communications costs hundreds of millions of dollars. The satellites weighed up to six tonnes, were the size of a bus, and would be sent up into geostationary orbit - 35,786km (22,236 miles) above the Earth. But today, you could send up a so-called nanosat weighing just 25-50kg into low-Earth orbit (160-1,000km above Earth) for between $100,000 and $1m. Launch prices are also falling because technology giants are driving demand, says Mark Boggett, chief executive of British venture capital firm Seraphim Capital. "Because tech firms need to launch their own satellites in the thousands [for space internet networks], this further drives down the cost of launch and storage for everyone else," he says. "Whole new industries of businesses can benefit from using this data, essentially democratising space." And of course, if more data is being transmitted back to Earth, someone will need to process it. As a result, Deloitte's Scott Campbell has seen "an explosion of businesses around space". In 2011, there were 234 space-related firms in the UK, rising to 948 companies in 2018. As for satellites, today there are fewer than 9,000 in orbit, according to Seraphim. OneWeb, SpaceX, Planet, Spire and Amazon have put up 10% of these satellites since 2016, but there are 200 smaller firms behind them who are projected to launch 25,000 satellites over the next four years. One smaller firm is nanosat manufacturer NanoAvionics, which announced plans in October to create 400 new jobs in the UK. The firm saw revenues soar 300% in the last year. "In the old days, we launched one satellite that had lots of sensors on it. But today, we've launched hundreds of satellites that have the same one sensor, and that's a much cheaper, repeatable way to do it with more consistent data," says Robin Sampson, head of operations at NanoAvionics UK. PWC UK's space lead Dinesh Patel says the nanosat market is worth only £1.8bn today, but annual growth rates of 20% are projected. Satellites have traditionally been used for communications, TV services and tracking the weather, but new cheaper options are attracting tech giants with **big plans**. Late last year Microsoft announced it was teaming up with Elon Musk's SpaceX. Their partnership, Azure Space, [**plans to combine**](https://news.microsoft.com/transform/azure-space-partners-bring-deep-expertise-to-new-venture/#:~:text=our%20partners%20below.-,SpaceX,via%20SpaceX's%20Starlink%20satellite%20network.) Microsoft's cloud computing services with a global network of satellites. Tom Keane, corporate vice president at Microsoft Azure, tells the BBC that space makes it possible to "move computing to the edge", which means processing data much closer to users' devices than ever before. "The edge could be anywhere - on a device... you're wearing, it could be something you're carrying, it could be in your car," he says. "Space allows you to connect all of that infrastructure together, and then you can use artificial intelligence [like] predictive analytics to gain insights over things that were previously not connected together." Ground stations, which receive data from satellites, are also potential money makers for IT giants. Microsoft Azure's Tom Keane plans to revolutionise ground stations, which are currently "expensive and often monolithic devices" and hook them up to Microsoft's data centres. "Today, in many cases, data [from ground stations] may not be used, or it's certainly not used as broadly as it could be. By connecting that ground station, you take the data from space... to solve problems that you can't solve today." Another opportunity is to connect the **3.8 billion people** in rural areas who **still** do not have an internet connection. SpaceX in particular [**has been launching batches of small satellites**](https://www.bbc.co.uk/news/science-environment-55775977) into orbit since 2018 to form a huge constellation, with the aim of providing **instant broadband anywhere on Earth**. Other businesses will hope to make money by collecting data from nanosats, processing it with artificial intelligence, and using it in innovative ways to solve problems. Firms are looking to collect Earth observation data like weather, heat signatures and atmospheric gas composition to help farmers, for example, and to monitor things like flood defences, traffic and construction sites.

#### Better connection required for telehealth – access suffers without it

**Balasubramanian 20** – M.D, J.D

[ Sai Balasubramanian, “Elon Musk’s Starlink May Potentially Revolutionize Healthcare,” Forbes, 11-27-2020, <https://www.forbes.com/sites/saibala/2020/11/27/elon-musks-starlink-may-potentially-revolutionize-healthcare/?sh=37c89b241e03>]

One of Elon Musk’s relatively recent and most successful ventures is [SpaceX](https://www.spacex.com/mission/), an advanced aerospace technology company with a mission of “Making Humanity Multiplanetary.” The company has celebrated some incredible milestones thus far, from its successful transportation of astronauts into space, to its valiant strides in making rocket technology reusable, and therefore, more cost-efficient. One interesting sub-division of SpaceX is Starlink, which is Musk’s venture into increasing global connectivity. Starlink’s [mission](https://www.starlink.com/) is to use a global network of low Earth orbit satellites to eventually “deliver high speed broadband internet to locations where access has been unreliable, expensive, or completely unavailable.” While satellite internet itself is not a novel concept, most of the traditional systems use **dated technology** that have far less capabilities with regards to internet speed, connectivity, and sustainability. Starlink’s goal is to provide high-speed broadband internet, using cutting-edge satellite systems that will also **not add to** the space pollution created by traditional systems. As of now, the company states that it “is targeting service in the Northern U.S. and Canada in 2020, rapidly expanding to near global coverage of the populated world by 2021.” For many, high-speed broadband internet has incredible implications for connectivity.

One of the most important potential benefits of this technology may be its impact on healthcare and access-to-care in **underserved areas**. For decades, it has been a well-recognized fact that [rural sites in America](https://www.npr.org/sections/health-shots/2019/05/21/725118232/the-struggle-to-hire-and-keep-doctors-in-rural-areas-means-patients-go-without-c) have **poor access** to healthcare. This has not been helped by the rising trend of burnout in healthcare professions, in addition to an ever-growing physician shortage. Experts have articulated that the rise of telemedicine may be one possible solution to help with this issue. Digital platforms that can effectively and safely deliver healthcare without regard to distance or location can potentially provide a viable solution to connecting underserved populations with the care they need. The Covid-19 pandemic has been a great test of this technology. As stay-at-home and social distancing orders became the norm this year due to coronavirus, many healthcare systems, and in-turn patients, often had to rely on telehealth for their care needs. Of course, as telehealth services continue to grow, regulators, healthcare professionals, and innovators will need to keep a close eye on many issues that will inevitably emerge, including data-storage concerns, cybersecurity problems, and most importantly, how best to protect patient privacy and information. The latter is especially concerning, given the growing trends in healthcare [cybersecurity breaches](https://www.forbes.com/sites/saibala/2020/10/17/healthcare-cybersecurity-continues-to-be-a-major-concern/) in the past decade. However, if the appropriate oversight bodies can indeed resolve the issues that telemedicine entails, there is significant opportunity for this technology to make an impact. The market has been receptive of this as well, with telehealth companies gaining massive amounts of utilization and market share just this year alone. In fact, [studies indicate](https://www.globenewswire.com/news-release/2020/07/29/2069575/0/en/Telehealth-Market-to-Exhibit-25-2-CAGR-till-2027-Rising-Preference-for-E-visits-Owing-to-Their-Cost-effectiveness-will-Boost-Growth-Fortune-Business-Insights.html) that the telehealth market is poised for a 25.2% CAGR (compound annual growth rate) and a valuation of nearly $559.5 billion by 2027. Nonetheless, one of the most important limiting factors for telemedicine is connectivity. Due to the same degree of distance that causes healthcare shortages in rural areas, these locations often also lack reliable and high-speed internet connections—the kind that is needed to support stable telemedicine applications and platforms.

This is where Starlink could potentially become a game-changer. If the Starlink service can indeed provide high-speed broadband internet services to rural populations, it may **resolve** yet another piece of the puzzle in increasing access-to-care in underserved communities. Furthermore, the applications of this technology are **endless** and go **far beyond** the American paradigm of rural healthcare. Starlink’s concept, if proven to be scalable and effective, may be able to one day provide internet worldwide, providing the opportunity for underserved communities across the globe to receive much needed medical attention.

#### Telehealth communications solve pandemics

**Monaghesh and Hajizadeh 20** – Department of Health Information Technology Student Research Committee

[Elham Monaghesh and Slireza Haajizadeh, “ The role of telehealth during COVID-19 outbreak: a systematic review based on current evidence,” BMC Public Health, 08-01/2020, <https://link.springer.com/article/10.1186/s12889-020-09301-4>]

Coronaviruses, a genus of the coronaviridae family, may cause illness in animals or humans [[1](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR1), [2](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR2)]. In humans, several coronaviruses are known to cause infections of respiratory ranging from the common cold to more serious diseases. The most recently discovered coronavirus causes coronavirus disease-19 (COVID-19) [[1](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR1)]. The disease originated in Wuhan, China and has kept spreading widely to other regions of the world [[3](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR3)]. Primitive symptoms of COVID-19 contain fever, dry cough, breathing difficulty, and boredom [[4](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR4), [5](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR5)]. Elderly people and those with underlying medical problems such as hypertension, heart problems, and diabetes are more susceptible to develop the disease in its form of most intensive [[1](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR1)]. This universal event has been announced a pandemic by the World Health Organization (WHO) [[6](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR6)]. A **significant factor** in slowing down the transmission of the virus is the “social gap” or social distancing that is made possible by the reduction of person-to-person contact [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7), [8](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR8)]. To reduce transmission, travel restrictions have been appointed and enforced around the world, and most cities have been quarantined [[9](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR9)]. However, people who are not infected with the COVID-19, especially those who are at greater risk of developing the disease (e.g. Elderly people and those with underlying diseases), should receive daily care without the risk of exposure to other patients in the hospital [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7)]. Moreover, under strict infection control, unnecessary personnel such as clinical psychiatrists strongly refuse to enter COVID-19 patient’s ward [[10](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR10), [11](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR11)]. Natural disasters and epidemics pose many challenges in providing health care [[12](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR12)]. As a result, unique and innovative solutions are needed to address both the critical needs of patients with COVID-19 and other people who need healthcare service. In this respect, technological advances provide new options [[13](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR13)]. Although the ultimate solution for COVID-19 will be multifaceted, it is one of the effective ways to use existing technologies to facilitate optimal service delivery while minimizing the hazard of direct person-to-person exposure [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7), [14](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR14)]. The use of telemedicine at the time of epidemic conditions (COVID-19 pandemic) has the potential to improve research of epidemiological, control of disease and management of clinical case [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7), [14](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR14), [15](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR15)]. The use of telehealth technology is a twenty-first century approach that is both patient-centered and protects patients, physicians, as well as others [[16](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR16), [17](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR17)]. Telehealth is the delivery of health care services by health care professionals, where distance is a critical factor, through using information and communication technologies (ICT) for the exchange of valid and correct information [[18](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR18)]. Telehealth services are renderdusing real-time or store-and-forward techniques [[19](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR19)]. With the rapid evolution and downsizing of portable electronics, most families have at least one device of digital, such as smartphones [[20](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR20)] and webcams that provide communication between patient and healthcare provider [[21](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR21)]. Video conferencing and similar television systems are also used to provide health care programs for people who are hospitalized or in quarantine to reduce the risk of exposure to others and employees [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7)]. Physicians who are in quarantine can employ these services to take care of their patients remotely [[8](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR8), [22](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR22)]. In addition, covering multiple sites with a tele-physician can address some of the challenges of the workforce [[8](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR8), [23](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR23)]. There are various benefits in using technology of telehealth, especially in non-emergency / routine care and in cases where services do not require direct patient-provider interaction, such as providing psychological services [[24](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR24)]. Remote care **reduces** the use of resources in health centers, improves access to care, while **minimizing** the risk of direct transmission of the infectious agent from person to person [[25](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR25)]. In addition to being beneficial in keeping people safe, including the general public, patients and health workers, another important advantage is providing widely access to care givers [[12](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR12)].. Therefore, this technology is an attractive, **effectual and affordable option** [[14](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR14), [26](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR26), [27](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR27)].

Patients are eager to use telehealth, but hindrances still exist [[28](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR28), [29](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR29)]. The barriers of implementing these programs also largely depend on accreditation, payments systems, and insurance [[8](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR8)]. Furthermore, some physicians are concerned about technical and clinical quality, safety, privacy, and accountability [[23](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR23), [30](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR30)]. Telehealth can become a basic need for the general population, health care providers, and patients with COVID-19, especially when people are in quarantine, enabling patients in real time through contact with health care provider for advice on their health problems. Thus, the aim of this review was to identify and systematically review the role of telehealth services in preventing, diagnosing, treating, and controlling diseases during COVID-19 outbreak. We recognized eight studies that presented precious data on telehealth regarding the status of people infected with COVID-19. Telehealth has the capability to incorporate several organizations and situations of health care into one virtual network, led by the central clinic. This network can contain physical locations in different region: central and remote clinics, prevention centers, private clinics, and, private offices of physicians, centers of rehab state and all registered patients within their locations. By using virtual care for very regular, essential medical care, and deferring elective procedures or yearly checkups, we can free up medical staff and equipment required for those who become seriously ill from COVID-19.

Additionally, by not congregating in small spaces like waiting rooms, the ability of the coronavirus to transmission from one person to another were thwart. Keeping people discrete is called “social distancing”. Keeping healthcare staffs discrete from patients and other providers is “medical distancing”. In present time the Telehealth is one strategy to help us carry out this. Telehealth can mobilize all aspects of healthcare potentials to decrease transmission of disease, conduct people to the right level of health care, ensure safety for provide health services online, protect patients, clinicians, and the community from exposure to infection, and finally diminish the burden on the healthcare providers and health system. Some of the telehealth usage cases for patients were control and triage during the outbreak of COVID-19 pandemic, self and distance monitoring, treatment, patients after discharge in health centers (follow-ups) and implementation of online health services. These methods have the potential to **reduce morbidity and mortality during pandemic**. For all healthcare workers and clinicians with mild symptoms can still work remotely with patients, facilitate quick access to medical decision making, seek second opinion for severe cases of patients, exchange cross-border experiences, and offer teleradiology and online trainings for health workers. To provide continued access to necessary health services, telehealth should be a **key weapon** in the fight against the COVID-19outbreak.

#### Next pandemic causes extinction

Bhadelia, 21 -- Center for Emerging Infectious Diseases Policy & Research founding director

[Nahid, MD, MALD, "What do we need to build resilience against the next pandemic?," Center for Emerging Infectious Diseases Policy & Research, 5-18-2021, https://www.bu.edu/ceid/2021/05/18/placeholder-blog-post/, accessed 10-18-2021]

What do we need to build resilience against the next pandemic?

We have lost close to 3.4 million souls to COVID-19 globally over the last year. By some estimates, the real number may be much higher than that because the excess deaths this year are closer to between 7 and 13 million, after accounting for those who died without a diagnosis and those who died because they could not receive timely care for another medical condition. And the pandemic, despite the receding cases in high-resource countries, is nowhere near its end.

Lives lost are the tip of iceberg. We cannot quantify the pain felt by family members remaining behind. Livelihoods and businesses have been devastated. The pandemic’s impact reaches into all recesses of our personal and public lives. It has and will continue to undo decades of work globally on reducing poverty, improving education and health, and empowering women. An IMF study last year showed how, in the five years after major epidemics, income inequality continues to increase in affected countries. Similar trends are already being seen in five countries with the heaviest death tolls from COVID-19. As communities around the world deal with the wreckage of their economies, 95 million more people have been pushed into extreme poverty, with another 200 million predicted to be at risk between now and the year 2030. And this does not even cover the multidimensional impact of poverty. How long will it take for us to recover from this pandemic? How do we take stock and pandemic-proof our communities?

More urgently, COVID-19 may not be the last pandemic we face in our lifetimes. The existential threat of pandemics doesn’t decrease because we are already facing one. In fact, this pandemic worsens the risk for new threats because our effort and resources are depleted, and our surveillance and healthcare systems are overstretched. And because the risk of new infectious diseases seeping into the human population from animal reservoirs is going to continue to grow as we see grow in numbers, require more land, raise more animals, put down more roads, use up more wetlands, and close the gap between us and natural habitats where yet undiscovered viruses lurk. How can we ensure that economically devastated communities coming out of this pandemic recover without worsening the tenuous balance we have with the world around us?

Within our own lifetimes, we have seen the impact of climate change, another existential crisis, transition from something we heard about in news reports to something we experience in our personal lives in the form of changing weather patterns, health effects, increased risk of natural disasters, and rising sea levels. Over the next decades, these factors will exponentially increase the incidence of many infections and change the distribution of others.

And as we tackle these complex problems, new challenges are arising: despite becoming ever more globally connected, our perceptions of reality continue to be disparate. In the deluge of digital data, many among us are falling prey to misinformation and disinformation. The urgency of outbreaks, the shifting scientific knowledge base that comes from tackling emerging pathogens, and political interference have all contributed to the signal getting lost in the noise. The role of disinformation is only going to expand in future emergencies. How do we share timely information in crisis? How do we, in government, science, and public health, earn and build the trust of our communities so ours is the voice they listen to during the fray? How do we listen more carefully to them? How do we involve them in making us all safer?

We can no longer ignore infectious threats on the other side of the world, and we can no longer practice isolationist policies. Because COVID-19 painfully instructed us that outbreaks aren’t just something that happen on the news in distant communities, but instead, they can reach into our homes and rip away our loved ones.

There are moments in history when our actions require collective metacognition and urgency. This has to be one of those moments.

The Center for Emerging Infectious Diseases (CEID) Policy & Research was founded because the time is now for collective transdisciplinary research and response. Every step of the way in this pandemic, the questions haven’t been just scientific, they have also been legal, economic, cultural, and ethical. CEID’s mission is to tug at the threads of all the complex systems that leave us vulnerable to new epidemics and help us answer some of the questions posed above. Through research, collaborative action, community engagement, and training, we hope to find ways to secure us against future global threats. I hope you will reach out with ideas, collaborate with us, and check back often to see where our work is taking us.

We are not rudderless as we head into this future. The COVID-19 pandemic, like recent Ebola virus disease outbreaks and other recent emergencies, has shown that investment in sciences, global collaboration, public health, and health-systems readiness can decrease our vulnerability. We need not only to invest in diagnostics, vaccines, and therapeutics but also find a new way of approaching the problems. My own experience serving as an outbreak responder in multiple emergencies has underscored for me again and again that epidemics fracture us along lines of existing weakness. Because at the terminus of all international surveillance for outbreaks are many communities that do not have access to care. When families can’t access care, we can’t stop cases from becoming clusters, which then become outbreaks. When communities can’t equitably access vaccines, it makes it harder for them to recover, and we continue to suffer collectively from the global economic impact and through the appearance of new variants. When structural racism keeps parts of our communities from being protected, diagnosed, and cared for, all of us are at risk. When it comes to infectious diseases outbreaks, health inequity is a threat to all our survival.

At the launch of our center, we asked public health experts and scientists, “What do we need to do to build resilience against the next pandemic?” Over the next few months, we will continue asking this question to different disciplines, covering those working on health and economic equity, lawmakers, the business community, artists and musicians, and those in media and journalism. Because the solutions, like the questions, require all of us.

## NC

Sustainable Development DA

#### 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 sustainable development

**David 21**

David, Leonard. 11/03/21 Space Solar Power’s Time May Finally Be Coming.”https://www.space.com/space-solar-power-research-advances // LHP BT + LHP PS

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."

#### SBSP key to solve climate change – turns their warming advantage

**Katete 21**

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 // LHP BT + LHP PS

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.

## NC

Innovation DA

#### Private companies solve best for innovation – reducing costs, investment, and high risk-tolerance. Regulation and lack of property rights kills

Weinzierl and Elbling 2021

(“The Commercial Space Age Is Here,” Matt Weinzierl is the Joseph and Jacqueline Elbling Professor of Business Administration at HBS and a Research Associate at the NBER, Mehak Sarang is a Research Associate at Harvard Business School and the Lunar Exploration Projects Lead for the MIT Space Exploration Initiative, February 12, 2021, <https://hbr.org/2021/02/the-commercial-space-age-is-here>, accessed 1-15-2022)

In 2019, 95% of the estimated $366 billion in revenue earned in the space sector was from the space-for-earth economy: that is, goods or services produced in space for use on earth. The space-for-earth economy includes telecommunications and internet infrastructure, earth observation capabilities, national security satellites, and more. This economy is booming, and though research shows that it faces the challenges of overcrowding and monopolization that tend to arise whenever companies compete for a scarce natural resource, projections for its future are optimistic. **Decreasing costs for launch and space hardware in general have enticed new entrants into this market, and companies in a variety of industries have already begun leveraging satellite technology and access to space to drive innovation and efficiency in their earthbound products and services.** In contrast, the space-for-space economy — that is, goods and services produced in space for use in space, such as mining the Moon or asteroids for material with which to construct in-space habitats or supply refueling depots — has struggled to get off the ground. As far back as the 1970s, research commissioned by NASA predicted the rise of a space-based economy that would supply the demands of hundreds, thousands, even millions of humans living in space, dwarfing the space-for-earth economy (and, eventually, the entire terrestrial economy as well). The realization of such a vision would change how all of us do business, live our lives, and govern our societies — but to date, we’ve never even had more than 13 people in space at one time, leaving that dream as little more than science fiction. Today, however, there is reason to think that we may finally be reaching the first stages of a true space-for-space economy. SpaceX’s recent achievements (in cooperation with NASA), as well as upcoming efforts by Boeing, Blue Origin, and Virgin Galactic to put people in space sustainably and at scale, mark the opening of a new chapter of spaceflight led by private firms. These firms have both the intention and capability to bring private citizens to space as passengers, tourists, and — eventually — settlers, opening the door for businesses to start meeting the demand those people create over the next several decades with an array of space-for-space goods and services. Welcome to the (Commercial) Space Age In our recent research, we examined how the model of centralized, government-directed human space activity born in the 1960s has, over the last two decades, made way for a new model, in which public initiatives in space increasingly share the stage with private priorities. Centralized, **government-led space programs will inevitably focus on space-for-earth activities that are in the public interest,** such as national security, basic science, and national pride. This is only natural, as expenditures for these programs must be justified by demonstrating benefits for citizens — and the citizens these governments represent are (nearly) all on earth. **In contrast to governments, the private sector is eager to put people in space to pursue their own personal interests, not the state’s** — and then supply the demand they create. This is the vision driving SpaceX, which in its first twenty years has entirely upended the rocket launch industry, securing 60% of the global commercial launch market and building ever-larger spacecraft designed to ferry passengers not just to the International Space Station (ISS), but also to its own promised settlement on Mars. Today, the space-for-space market is limited to supplying the people who are already in space: that is, the handful of astronauts employed by NASA and other government programs. While SpaceX has grand visions of supporting large numbers of private space travelers, their current space-for-space activities have all been in response to demand from government customers (i.e., NASA). **But as decreasing launch costs enable companies like SpaceX to leverage economies of scale and put more people into space, growing private sector demand** (that is, tourists and settlers, rather than government employees) could turn these proof-of-concept initiatives into a sustainable, large-scale industry. This model — of selling to NASA with the hopes of eventually creating and expanding into a larger private market — is exemplified by SpaceX, but the company is by no means the only player taking this approach. For instance, while SpaceX is focused on space-for-space transportation, another key component of this burgeoning industry will be manufacturing. Made In Space, Inc. has been at the forefront of manufacturing “in space, for space” since 2014, when it 3D-printed a wrench onboard the ISS. Today, the company is exploring other products, such as high-quality fiber-optic cable, that terrestrial customers may be willing to pay to have manufactured in zero-gravity. But the company also recently received a $74 million contract to 3D-print large metal beams in space for use on NASA spacecraft, and future private sector spacecraft will certainly have similar manufacturing needs which Made In Space hopes to be well-positioned to fulfill. Just as SpaceX has begun by supplying NASA but hopes to eventually serve a much larger, private-sector market, Made In Space’s current work with NASA could be the first step along a path towards supporting a variety of private-sector manufacturing applications for which the costs of manufacturing on earth and transporting into space would be prohibitive. **Another major area of space-for-space investment is in building and operating space infrastructure such as habitats, laboratories, and factories.** Axiom Space, a current leader in this field, recently announced that it would be flying the “first fully private commercial mission to space” in 2022 onboard SpaceX’s Crew Dragon Capsule. Axiom was also awarded a contract for exclusive access to a module of the ISS, facilitating its plans to develop modules for commercial activity on the station (and eventually, beyond it). **This infrastructure is likely to spur investment in a wide array of complementary services to supply the demand of the people living and working within it.** For example, in February 2020, Maxar Technologies was awarded a $142 million contract from NASA to develop a robotic construction tool that would be assembled in space for use on low-Earth orbit spacecraft. Private sector spacecraft or settlements will no doubt have need for a variety of similar construction and repair tools. And of course, the private sector isn’t just about industrial products. **Creature comforts also promise to be an area of rapid growth, as companies endeavor to support the human side of life in the harsh environment of space.** In 2015, for example, Argotec and Lavazza collaborated to build an espresso machine that could function in the zero-gravity environment of the ISS, delivering a bit of everyday luxury to the crew. To be sure, people have dreamt of using the vacuum and weightlessness of space to source or make things that cannot be made on earth for half a century, and time and again the business case has failed to pan out. Skepticism is natural. Those failures, however, have been in space-for-earth applications. For example, two startups of the 2010s, Planetary Resources, Inc. and Deep Space Industries, recognized the potential of space mining early on. For both companies, however, the lack of a space-for-space economy meant that their near-term survival depended on selling mined material — precious metals or rare elements — to earthbound customers. When it became clear that demand was insufficient to justify the high costs, funding dried up, and both companies pivoted to other ventures. These were failures of space-for-earth business models — but the demand for in-space mining of raw building material, metals, and water will be enormous once humans are living in space (and are therefore far cheaper to supply). In other words, when people are living and working in space, we are likely to look back on these early asteroid mining companies less as failures and more as simply ahead of their time. Seizing the Space-for-Space Opportunity The opportunity presented by the space-for-space economy is huge — but it could easily be missed. To seize this moment, policymakers must provide regulatory and institutional frameworks that will enable the risk-taking and innovation necessary for a decentralized, private-sector-driven space economy. There are three specific policy areas we believe will be especially important: 1. **Enabling private individuals to take on greater risk than would be tolerable for government-employed astronauts.** First, **as part of a general shift to that more decentralized, market-oriented space sector, policymakers should consider allowing private space tourists and settlers to voluntarily take on more risk than states would tolerate for government-employed astronauts.** In the long run, ensuring high safety levels will be essential to convince larger numbers of people to travel or live in space, but in the early years of exploration, too great an aversion to risk will stop progress before it starts. An instructive analogy can be found in how NASA works with its contractors: In the mid-2000s, NASA shifted from using cost-plus contracts (in which NASA shouldered all the economic risk of investing in space) to fixed-price contracts (in which risk was distributed between NASA and their contractors). **Because of private companies’ greater tolerance for risk, this shift catalyzed a burst of activity in the sector** — sometimes referred to as “New Space.” A similar shift in how we approach voluntary risk-taking by private-sector astronauts may be necessary in order to launch the space-for-space economy. 2. Judiciously implementing government regulation and support. Second, as with most markets, developing a stable space economy will depend on judicious government regulation and support. NASA and the U.S. Commerce and State Departments’ recent recommitment to “create a regulatory environment in [low-Earth orbit] that enables American commercial activities to thrive” is a good sign that the government is on a path of continued collaboration with industry, but there’s still a long way to go. Governments should start by clarifying how property rights over limited resources such as water on Mars, ice on the Moon, or orbital slots (i.e., “parking spots” in space) will be governed. Recent steps — including NASA’s offer to purchase lunar soil and rocks, last April’s Executive Order on the governance of space resources, and the 2015 Commercial Space Launch Competitiveness Act — indicate that the U.S. government is interested in establishing some form of regulatory framework to support the economic development of space. In 2017, Luxembourg became the first European country to establish a legal framework securing private rights over resources mined in space, and similar steps have been taken at the domestic level in Japan and the United Arab Emirates. Moreover, nine countries (though Russia and China are notably missing) have signed the Artemis Accords, which lay out a vision for the sustainable, international development of the Moon, Mars, and asteroids. These are important first steps, but they have yet to be clearly translated into comprehensive treaties that govern the fair use and allocation of scarce space resources among all major spacefaring nations. In addition, governments should continue to fill the financial gaps in the still-maturing space-for-space economic ecosystem by funding basic scientific research in support of sending humans to space, and by providing contracts to space startups. Similarly, while excessive regulation will stifle the industry, some government incentives, such as policies to reduce space debris, can help reduce the costs of operating in space for everyone in ways that would be difficult to coordinate independently. 3. Moving beyond geopolitical rivalries. Finally, the development of the space-for-space economy must not be undermined by earthly geopolitical rivalries, such as that between the United States and China. These conflicts will unavoidably extend into space at least to some extent, and military demand has long been an important source of funding for aerospace companies. But if not kept in check, such rivalries will not only distract attention and resources from borderless commercial pursuits but also create barriers and risks that hamper private investment. On earth, private economic activity has long tied together people whose states are at odds. The growing space-for-space economy offers exceptional potential to be such a force for unity — but **it’s the job of the world’s governments not to get in the way**. A collaborative, international approach to establishing — and enforcing — the rule of law in space will be essential to encouraging a healthy space-for-space economy. Visions of a space-for-space economy have been around since the dawn of the Space Age in the 1960s. Thus far, those hopes have gone largely unmet — but this moment is different. **For the first time in history, the private sector’s capital, risk tolerance, and profit motive are being channeled into putting people in space. If we seize this opportunity, we will look back on 2020 as the year when we started the truly transformational project of building an economy and a society in space, for space.**

#### Innovation solves every existential threat

Dylan **Matthews 18**. Co-founder of Vox, citing Nick Beckstead @ Rutgers University. 10-26-2018. "How to help people millions of years from now." Vox. <https://www.vox.com/future-perfect/2018/10/26/18023366/far-future-effective-altruism-existential-risk-doing-good>

If you care about improving human lives, you should overwhelmingly care about those quadrillions of lives rather than the comparatively small number of people alive today. The 7.6 billion people now living, after all, amount to less than 0.003 percent of the population that will live in the future. It’s reasonable to suggest that those quadrillions of future people have, accordingly, hundreds of thousands of times more moral weight than those of us living here today do. That’s the basic argument behind Nick Beckstead’s 2013 Rutgers philosophy dissertation, “On the overwhelming importance of shaping the far future.” It’s a glorious mindfuck of a thesis, not least because Beckstead shows very convincingly that this is a conclusion any plausible moral view would reach. It’s not just something that weird utilitarians have to deal with. And Beckstead, to his considerable credit, walks the walk on this. He works at the Open Philanthropy Project on grants relating to the far future and runs a charitable fund for donors who want to prioritize the far future. And arguments from him and others have turned “long-termism” into a very vibrant, important strand of the effective altruism community. But what does prioritizing the far future even mean? The most literal thing it could mean is preventing human extinction, to ensure that the species persists as long as possible. For the long-term-focused effective altruists I know, that typically means identifying concrete threats to humanity’s continued existence — like unfriendly artificial intelligence, or a pandemic, or global warming/out of control geoengineering — and engaging in activities to prevent that specific eventuality. But in a set of slides he made in 2013, Beckstead makes a compelling case that while that’s certainly part of what caring about the far future entails, approaches that address specific threats to humanity (which he calls “targeted” approaches to the far future) have to complement “broad” approaches, where instead of trying to predict what’s going to kill us all, you just generally try to keep civilization running as best it can, so that it is, as a whole, well-equipped to deal with potential extinction events in the future, not just in 2030 or 2040 but in 3500 or 95000 or even 37 million. In other words, caring about the far future doesn’t mean just paying attention to low-probability risks of total annihilation; it also means acting on pressing needs now. For example: We’re going to be better prepared to prevent extinction from AI or a supervirus or global warming if society as a whole makes a lot of scientific progress. And a significant bottleneck there is that the vast majority of humanity doesn’t get high-enough-quality education to engage in scientific research, if they want to, which reduces the odds that we have enough trained scientists to come up with the breakthroughs we need as a civilization to survive and thrive. So maybe one of the best things we can do for the far future is to improve school systems — here and now — to harness the group economist Raj Chetty calls “lost Einsteins” (potential innovators who are thwarted by poverty and inequality in rich countries) and, more importantly, the hundreds of millions of kids in developing countries dealing with even worse education systems than those in depressed communities in the rich world. What if living ethically for the far future means living ethically now? Beckstead mentions some other broad, or very broad, ideas (these are all his descriptions): Help make computers faster so that people everywhere can work more efficiently Change intellectual property law so that technological innovation can happen more quickly Advocate for open borders so that people from poorly governed countries can move to better-governed countries and be more productive Meta-research: improve incentives and norms in academic work to better advance human knowledge Improve education Advocate for political party X to make future people have values more like political party X ”If you look at these areas (economic growth and technological progress, access to information, individual capability, social coordination, motives) a lot of everyday good works contribute,” Beckstead writes. “An implication of this is that a lot of everyday good works are good from a broad perspective, even though hardly anyone thinks explicitly in terms of far future standards.” Look at those examples again: It’s just a list of what normal altruistically motivated people, not effective altruism folks, generally do. Charities in the US love talking about the lost opportunities for innovation that poverty creates. Lots of smart people who want to make a difference become scientists, or try to work as teachers or on improving education policy, and lord knows there are plenty of people who become political party operatives out of a conviction that the moral consequences of the party’s platform are good. All of which is to say: Maybe effective altruists aren’t that special, or at least maybe we don’t have access to that many specific and weird conclusions about how best to help the world. If the far future is what matters, and generally trying to make the world work better is among the best ways to help the far future, then effective altruism just becomes plain ol’ do-goodery.\*

# ON

## Debris

#### Turn - Risks are overestimated AND private companies ensure that satellite constellations don’t collide – Starlink, Space-X, OneWeb

**Wattles 19**

This card – more recent – describes the ways in which Oneweb and Starlink are learning

Describes private company satellite constellations

Describes the ways in which private companies are create constellations that won’t lead to mass collisions

Describes that create unsafe satellite collisions isn’t profitable for companies – they will do everything in their power to avoid it

[ Jackie Wattles – Reporter, “Space junk poses terrifying threats. Here’s what that means for SpaceX’s megaconstellation,”: CNN Business, 05-30-2019, <https://www.cnn.com/2019/05/30/tech/spacex-starlink-space-junk-debris/index.html>]

SpaceX fired [60 small satellites](http://www.cnn.com/2019/05/15/tech/spacex-starlink-internet-satellites-first-launch/index.html) into orbit last week, the first installment of an internet-beaming [megaconstellation](http://www.cnn.com/2019/05/23/business/spacex-starliner-revenue-business-case/index.html) that the company hopes will grow to include thousands of satellitesin just a few years. Elon Musk’s space company is just one of several with its eyes on beaming broadband to Earth from space. Companies including Amazon [(AMZN)](https://money.cnn.com/quote/quote.html?symb=AMZN&source=story_quote_link) and [OneWeb](http://www.cnn.com/2019/03/13/tech/oneweb-space-debris-junk-low-earth-orbit/index.html) also have similar plans. Looking ahead, [a lot could go wrong for them](http://www.cnn.com/2019/05/23/business/spacex-starliner-revenue-business-case/index.html) — financially or technologically. The most nightmarish calamity, however unlikely, wouldn’t just impact their businesses. It could set back all of human civilization. Imagine this scenario: A single satellite loses power and smashes, uncontrolled, into anothersatellite. They explode, sending plumes of junk charging through space at [23 times](https://www.nasa.gov/mission_pages/station/news/orbital_debris.html) the speed of sound. A piece of that debris slams into another satellite, and it sets off a chain reaction that obliterates everything orbiting in nearby altitudes. In low-Earth orbit, that could include multibillion-dollar networks like Starlink, the [International Space Station](https://www.nasa.gov/mission_pages/station/news/orbital_debris.html), spy satellites and [Earth-imaging](https://www.cnn.com/2015/03/12/tech/mci-planet-labs-doves/index.html) technology. Nothing would remain except an impenetrable graveyard of rubbish that could ground rocket launches for years, maybe even [centuries](https://www.nasa.gov/news/debris_faq.html). In the rarest of situations, [all satellite technology](http://www.bbc.com/future/story/20130609-the-day-without-satellites) could be done for. GPS services wouldcut out; weather tracking technology would be lost, potentially grounding commercial flights worldwide; satellite television and phone service would be gone; the loss in bandwidth couldclog ground-based systems and jam up internet and phone services. From there, [economies](https://phys.org/news/2017-05-space-junk-satellites-economies.html) could be crippled. Such a scenario remains **highly, *highly* unlikely**. Space is huge and satellites are still far from “crowded” up there. But the price of space travel is plummeting, meaning loads of new satellites are going up each year, while the risk of collisions climbs exponentially higher, explains Jonathan McDowell, an astronomer at the Harvard-Smithsonian Center for Astrophysics. “If you put up 10 times the [current total] number of satellites, the risk isn’t just ten times as big — it’s 100 times bigger,” McDowell told CNN Business, describing the risk of a collision. While a single crash might not lead to a doomsday scenario, any incident can create problems. Musk, for his part, says SpaceX takes the problem very seriously: “We are taking great pains to make sure there’s not an orbital debris issue,” he told reporters during a recent conference call. Each active Starlink satellite will be able to automatically dodge traceable pieces of debris headed their way, Musk said. The satellites will also save enough fuel at the end of their lives so that they can intentionally plunge back toward Earth to get out of the way of new devices, SpaceX says. Even if a satellite unexpectedly dies, it’ll be in such a low altitude that gravity will naturally pull it out of orbit in one-to-five years, according to the company. The Federal Communications Commission, which approves satellites for launch, approved of SpaceX’s designs and [said](https://docs.fcc.gov/public/attachments/DA-19-342A1.pdf) its Starlink satellites have “**zero, or near zero” risk of collision** while operational. The first 60 Starlink satellites have now been in orbit about a week, and everything seems to be going smoothly. **No** malfunctioning satellites or failed propulsion systems have been reported.

SpaceX’s debris mitigation plan **matches or exceeds** expert guidelines on best practices. SpaceX competitor OneWeb also has [plans](https://www.cnn.com/2019/03/13/tech/oneweb-space-debris-junk-low-earth-orbit/index.html) to ensure its satellites don’t become spaceborne garbage.With spaceflight growing cheaper and more common, however, businesses with all types of [goals](https://www.nbcnews.com/mach/science/startup-wants-put-huge-ads-space-not-everyone-board-idea-ncna960296) (and little stake in whether or not space stays safe) can afford to send something into orbit. Yet no formal international rules or punishments exist to hold satellite operators accountable for debris creation or general carelessness in space. Some countries, [including the United States](https://www.fcc.gov/document/fcc-launches-review-rules-mitigate-orbital-space-debris), are considering stricter regulations. For now, companies and organizations mostly have to take it upon themselves to research and invest in being good patrons of space. “It’s like any kind of environmental stewardship,” Kelso said. There isn’t always a business incentive to do the right thing, but “you don’t want to reach the point where you’re saying, ‘Gee, I wish we did this earlier.’”

**No impact: space junk doesn’t create very many problems**

**Zielinski 10 – contributing writer in science for Smithsonian.com**

[Sarah, “The Problem with Space Junk,” Smithsonian.com, 5-Aug-10,

https://www.smithsonianmag.com/science-nature/the-problem-with-space-junk-32774755/, accessed 6-26-19]

There's a lot of space junk—or, as NASA calls it, "orbital debris"—circling high above our heads: around 19,000 objects larger than 10 centimeters, 500,000 between 1 and 10 cm in size, and tens of millions of pieces smaller than 1 cm. Generally, all that junk isn't much of a problem. If it falls towards Earth, it burns up before it reaches the surface; **no one has ever been harmed by falling space debris and no property on the surface has ever been destroyed.** **Spacecraft are often hit by tiny bits of junk without any damage, and they have shields to protect from larger debris. The likelihood of collision with one of the larger pieces is low.** It does happen, though: in 2009, a U.S. Iridium satellite was destroyed in a collision with a Russian communications satellite that had been deactivated in 1995. How long a piece stays in orbit depends on its altitude: at 600 kilometers, a piece will stay up for only a few years, but at 1,000 km or higher it can orbit the Earth for a century. The build-up of greenhouse gases in the atmosphere is lengthening the time that all that junk stays in the atmosphere, according to new research. At higher altitudes, excess greenhouse gases cools the air and makes it less dense and decreases the drag on the debris. (This doesn't mean greenhouse gases are causing global cooling. The upper altitudes are cooler because greenhouse gases are trapping heat closer to the surface.) Space.com explains: Even though air density at these altitudes is only about a billionth of that of the Earth's surface, it still provides sufficient drag to slow down objects in low-Earth orbit (LEO), causing their eventual re-entry. As the atmospheric density in the thermosphere decreases, however, debris can remain in orbit up to 25 percent longer, said Hugh Lewis, from the School of Engineering Sciences.There are plenty of ideas on how to clean up the skies: laser brooms, giant helium-filled balloons, rockets filled with water, nanosatellites with solar sails, a ballistic orbital debris removal system. (That list doesn't even include any of the proposed solutions from the science fiction world.) DARPA, the Defense Department's research arm, recently added orbital debris cleaners to its wish list. NASA notes that the best way to deal with space junk it "to prevent the unnecessary creation of additional orbital debris." That isn't always a successful goal, however, as the tale of the astronaut who dropped a $100,000 tool kit illustrates. So if you've got a good solution for getting rid of the millions of pieces that are orbiting overhead, NASA or DARPA just might be interested.

**Century to solve space debris before impact – plan not key**

**Burns quoting Kessler 13**

[Corrinne, Guardian reporter, 11-15-2013, "Space junk apocalypse: just like Gravity?," Guardian, https://www.theguardian.com/science/blog/2013/nov/15/space-junk-apocalypse-gravity, accessed 8-28-2019]

I asked Donald Kessler himself. A former Nasa astrophysicist, it was Kessler who, in 1978, first proposed that a runaway cascade of collisions was a possibility. He'd been studying meteorite collisions and, out of personal curiosity, decided to apply his algorithm to satellites, too. "The results of those calculations surprised me – I didn't realise it could be that bad," he tells me over a crackly telephone line. (Through the wonder of satellite technology, he is speaking to me from the deck of a boat charting the waters of eastern Europe.) "But it's building up as I expected. The cascade is happening right now – the Kosmos-Iridum collision was the start of the process. It has already begun." Are we in trouble? Not yet. Kessler syndrome isn't an acute phenomenon, as depicted in the movie – it's a slow, decades-long process. "It'll happen throughout the next 100 years – we have time to deal with it," Kessler says. "The time between collisions will become shorter – it's around 10 years at the moment. In 20 years' time, the time between collisions could be reduced to five years." Fortunately, communications satellites are, in the main, situated high up in geosynchronous orbit (GEO), whereas the risk of collisions lies mainly in the much lower, and more crowded, low Earth orbit (LEO).

#### No debris cascades—This ev answers all aff warrants

Fange 2017 (Daniel Von Fange, Web Application Engineer, Founder and Owner of LeanCoder, Full Stack, Polyglot Web Developer, “Kessler Syndrome is Over Hyped”, 5/21/2017, http://braino.org/essays/kessler\_syndrome\_is\_over\_hyped/)

Kessler Syndrome is overhyped. A chorus of online commenters great any news of upcoming low earth orbit satellites with worry that humanity will to lose access to space. I now think they are wrong.

What is Kessler Syndrome?

Here’s the popular view on Kessler Syndrome. Every once in a while, a piece of junk in space hits a satellite. This single impact destroys the satellite, and breaks off several thousand additional pieces. These new pieces now fly around space looking for other satellites to hit, and so exponentially multiply themselves over time, like a nuclear reaction, until a sphere of man-made debris surrounds the earth, and humanity no longer has access to space nor the benefits of satellites.

It is a dark picture.

Is Kessler Syndrome likely to happen?

I had to stop everything and spend an afternoon doing back-of-the-napkin math to know how big the threat is. To estimate, we need to know where the stuff in space is, how much mass is there, and how long it would take to deorbit.

The orbital area around earth can be broken down into four regions.

Low LEO

- Up to about 400km. Things that orbit here burn up in the earth’s atmosphere quickly - between a few months to two years. The space station operates at the high end of this range. It loses about a kilometer of altitude a month and if not pushed higher every few months, would soon burn up. For all practical purposes, Low LEO doesn’t matter for Kessler Syndrome. If Low LEO was ever full of space junk, we’d just wait a year and a half, and the problem would be over.

High LEO - 400km to 2000km. This where most heavy satellites and most space junk orbits. The air is thin enough here that satellites only go down slowly, and they have a much farther distance to fall. It can take 50 years for stuff here to get down. This is where Kessler Syndrome could be an issue.

Mid Orbit - GPS satellites and other navigation satellites travel here in lonely, long lives. The volume of space is so huge, and the number of satellites so few, that we don’t need to worry about Kessler here.

GEO - If you put a satellite far enough out from earth, the speed that the satellite travels around the earth will match the speed of the surface of the earth rotating under it. From the ground, the satellite will appear to hang motionless. Usually the geostationary orbit is used by big weather satellites and big TV broadcasting satellites. (This apparent motionlessness is why satellite TV dishes can be mounted pointing in a fixed direction. You can find approximate south just by looking around at the dishes in your northern hemisphere neighborhood.) For Kessler purposes, GEO orbit is roughly a ring 384,400 km around. However, all the satellites here are moving the same direction at the same speed - debris doesn’t get free velocity from the speed of the satellites. Also, it’s quite expensive to get a satellite here, and so there aren’t many, only about one satellite per 1000km of the ring. Kessler is not a problem here.

How bad could Kessler Syndrome in High LEO be?

Let’s imagine a worst case scenario.

An evil alien intelligence chops up everything in High LEO, turning it into 1cm cubes of death orbiting at 1000km, spread as evenly across the surface of this sphere as orbital mechanics would allow. Is humanity cut off from space?

I’m guessing the world has launched about 10,000 tons of satellites total. For guessing purposes, I’ll assume 2,500 tons of satellites and junk currently in High LEO. If satellites are made of aluminum, with a density of 2.70 g/cm3, then that’s 839,985,870 1cm cubes. A sphere for an orbit of 1,000km has a surface area of 682,752,000 square KM. So there would be one cube of junk per .81 square KM. If a rocket traveled through that, its odds of hitting that cube are tiny - less than 1 in 10,000.

So even in the worst case, we don’t lose access to space.

Now though you can travel through the debris, you couldn’t keep a satellite alive for long in this orbit of death. Kessler Syndrome at its worst just prevents us from putting satellites in certain orbits.

In real life, there’s a lot of factors that make Kessler syndrome even less of a problem than our worst case though experiment.

* Debris would be spread over a volume of space, not a single orbital surface, making collisions orders of magnitudes less likely.
* Most impact debris will have a slower orbital velocity than either of its original pieces - this makes it deorbit much sooner.
* Any collision will create large and small objects. Small objects are much more affected by atmospheric drag and deorbit faster, even in a few months from high LEO. Larger objects can be tracked by earth based radar and avoided.
* The planned big new constellations are not in High LEO, but in Low LEO for faster communications with the earth. They aren’t an issue for Kessler.
* Most importantly, all new satellite launches since the 1990’s are required to include a plan to get rid of the satellite at the end of its useful life (usually by deorbiting)

So the realistic worst case is that insurance premiums on satellites go up a bit. Given the current trend toward much smaller, cheaper micro satellites, this wouldn’t even have a huge effect.

I’m removing Kessler Syndrome from my list of things to worry about.

## Militarization

#### Sats key to precision warfare and autonomous systems

Barnes, 18 -- British Army Warrant Officer

[Paul, current Army Visiting Fellow at the Royal United Services Institute, and Alexandra Stickings, Research Analyst for Space Policy and Security within the Military Sciences group at the Royal United Services Institute, "The Death of Precision in Warfare?" War on the Rocks, 11-27-18, https://warontherocks.com/2018/11/the-death-of-precision-in-warfare/, accessed 12-15-19]

As an example of the fragility of precision, consider the congested environment of near earth orbit and specifically the vulnerability of orbiting satellites, particularly those providing vital navigational information to platforms and weapon systems in all three domains of war. The enablement of precision took a step forward with the Global Positioning System (GPS) constellation of satellites, the first of which was launched into orbit in 1989. GPS, operated and maintained by the U.S. Air Force, was the first global navigation satellite system, the others being Russia’s GLONASS, Europe’s Galileo and China’s Beidou (initially a regional system now being expanded to provide global coverage). GPS built on previous U.S. military satellite-based navigation systems, such as Transit, highlighting that the recognition of the potential in this area goes back earlier than is commonly acknowledged. It is generally agreed that the Gulf War of 1991 was the first conflict in which GPS played a significant role, the success of which led to further integration of the technology into military systems. As a result, global navigation satellite systems have become the most important component of precision.

These satellite constellations provide precision position, navigation, and timing signals, which militaries use for a range of capabilities, including maritime navigation, missile targeting, and autonomous systems. Using atomic clocks aboard each satellite, the constellations can be used to pinpoint locations on the ground to within a few meters, a level of accuracy which has exponentially improved since the launch of the initial systems. These signals have become so embedded in daily military and civilian operations that even the most mundane domestic task is reliant on them.

#### That lowers the threshold for war- leads to interventionism

Cortright, 12 -- Director of Policy Studies at the Kroc Institute for International Peace Studies at the University of Notre Dame

[David, "License to Kill," Cato Unbound, 1-9-12, https://www.cato-unbound.org/2012/01/09/david-cortright/license-kill, accessed 12-15-19]

More War?

The rise of drone warfare has stirred strong passions and sparked a vigorous debate about the morality of unmanned weapons systems. The first and most important question is whether drone technology makes war more likely. Are decisionmakers more prone to employ military force if they have accurate weapons that are easier to use and do not risk the lives of their service members? The use of these weapons creates the false impression that war can be fought cheaply and at lower risk. They transform the very meaning of war from an act of national sacrifice and mobilization to a distant, almost unnoticeable process of robotic strikes against a secretive “kill list.” Do these factors lower the political threshold for going to war?

On the surface the question seems naïve. Political scientists argue that decisions about going to war are made on the basis of strategic necessity and perceived threats to security. The act of war is not determined by the type of weapon available. As the eminent political theorist Hans Morgenthau famously said, referring to nuclear weapons, people “do not fight because they have arms. They have arms because they deem it necessary to fight.”[5]

On the other hand, the availability of a particular class of weaponry can influence judgments on the likely costs and viability of military action. U.S. political leaders are able to imagine intervening militarily in other countries because they have advanced weapons systems designed for that purpose.[6] The possession of drone technology increases the temptation to intervene because it removes the risks associated with putting boots on the ground or bombing indiscriminately from the air. Drone systems are “seductive,” writes law professor Mary Ellen O’Connell, because they lower the political and psychological barriers to killing.[7] They induce a false faith in the efficacy and morality of armed attack that could create a greater readiness to use force.

A March 2011 report from the Development, Concepts and Doctrine Centre of the U.K. Ministry of Defence concluded that the availability of drone weapons was indeed a factor in the decision of British leaders to participate in military operations in Pakistan and Yemen. In its study the Center found that manned aircraft and commando raids could have been used for the selected missions but were rejected as too risky. The decision to use force was “totally a function of the existence of an unmanned capability—it is unlikely that a similar scale of force would be used if this capability were not available.” The report urged “removing some of the horror” of these weapons so that “we do not risk losing our controlling humanity and make war more likely.”[8]

A greater readiness to use force may also result from the physical and psychological distance that separates the launching of a strike from its bloody impact. Robotic technology removes the person from the emotional equation of war, reducing human targets to images on a computer screen. This has stretched to the maximum what writer P.W. Singer describes as the disconnection between war and society.[9] Scholar Mary Dudziak agrees, “Drones are a technological step that further isolates the American people from military action, undermining political checks.”[10] U.N. Special Rapporteur Philip Alston warns against “a ‘PlayStation’ mentality to killing” that may induce public callousness and susceptibility to claims about costless warfare.[11]

Any development that makes war appear to be easier or cheaper is deeply troubling. It reduces the political inhibitions against the use of deadly violence. It threatens to weaken the moral presumption against the use of force that is at the heart of the just war doctrine.

#### Status quo solves- resiliency measures deter space attacks

Sankaran, 14 –Harvard Belfer Center for Science and International Affairs postdoctoral fellow

[Jaganath, PhD international security, previously a Stanton Nuclear Security Fellow at the RAND Corporation, "Limits of the Chinese Antisatellite Threat to the United States," Strategic Studies Quarterly, Winter 2014, https://www.cissm.umd.edu/sites/default/files/Limits%20of%20the%20Chinese%20Antisatellite%20Threat%20to%20the%20United%20States.pdf, accessed 7-26-19]

Dissuasion through Technological Innovation

Redundancies and alternate systems give a large measure of operational security to US forces, enabling them to operate in an environment with degraded satellite services. This can be further improved by developing additional redundancies and alternates. The commander of US Strategic Command, Gen C. Robert Kehler, expounding on one of the goals of “mission assurance” in the 2011 National Security Space Strategy, called for actions to prepare US forces to “fight through” any possible degradations or disruptions to US space capabilities.45 Pursuing such actions will enhance deterrence against ASAT attacks by demonstrating the resilience of US forces and thereby diminishing the incentive for an adversary like China to target US space systems.

The United States should also study and improve its ability to use measures like satellite sensor shielding and collision avoidance maneuvers for satellites. These would dilute an adversary’s ASAT operation and increase the apparent uncertainty of the consequences of an ASAT attack.46 Monitoring mechanisms—both technical and nontechnical—that provide long warning times and the ability to definitively identify an attacker in real time should also be a priority. The US Air Force has started to invest in such capabilities on a small scale. Gen William Shelton, head of Air Force Space Command, announced on 21 February 2014 the upcoming launch of the geosynchronous space situational awareness (SSA) system designed to “have a clear, unobstructed and distinct vantage point for viewing resident space objects.”47 Such systems will help in attributing an ASAT attack. Similarly, the ground-based Rapid Attack, Identification, Detection, and Reporting System (RAIDRS) is a valuable US asset to identify, characterize, and geolocate attacks against US satellites.48

#### No ‘space war’ – Insurmountable barriers and everyone has an interest in keeping space peaceful

**Dobos 19**

[(Bohumil Doboš, scholar at the Institute of Political Studies, Faculty of Social Sciences, Charles University in Prague, Czech Republic, and a coordinator of the Geopolitical Studies Research Centre) “Geopolitics of the Outer Space, Chapter 3: Outer Space as a Military-Diplomatic Field,” Pgs. 48-49] TDI

Despite the theorized potential for the achievement of the terrestrial dominance throughout the utilization of the ultimate high ground and the ease of destruction of space-based assets by the potential space weaponry, the utilization of space weapons is with current technology and no effective means to protect them far from fulfilling this potential (Steinberg 2012, p. 255). In current global international political and technological setting, the utility of space weapons is very limited, even if we accept that the ultimate high ground presents the potential to get a decisive tangible military advantage (which is unclear). This stands among the reasons for the lack of their utilization so far. Last but not the least, it must be pointed out that the states also develop passive defense systems designed to protect the satellites on orbit or critical capabilities they provide. These further decrease the utility of space weapons. These systems include larger maneuvering capacities, launching of decoys, preparation of spare satellites that are ready for launch in case of ASAT attack on its twin on orbit, or attempts to decrease the visibility of satellites using paint or materials less visible from radars (Moltz 2014, p. 31). Finally, we must look at the main obstacles of connection of the outer space and warfare. The first set of barriers is comprised of **physical obstructions**. As has been presented in the previous chapter, the outer space is very challenging domain to operate in. Environmental factors still present the largest threat to any space military capabilities if compared to any man-made threats (Rendleman 2013, p. 79). A following issue that hinders military operations in the outer space is the predictability of orbital movement. If the reconnaissance satellite's orbit is known, the terrestrial actor might attempt to hide some critical capabilities-an option that is countered by new surveillance techniques (spectrometers, etc.) (Norris 2010, p. 196)-but the hide-and-seek game is on. This same principle is, however, in place for any other space asset-any nation with basic tracking capabilities may quickly detect whether the military asset or weapon is located above its territory or on the other side of the planet and thus mitigate the possible strategic impact of space weapons not aiming at mass destruction. Another possibility is to attempt to destroy the weapon in orbit. Given the level of development for the ASAT technology, it seems that they will prevail over any possible weapon system for the time to come. Next issue, directly connected to the first one, is the utilization of weak physical protection of space objects that need to be as light as possible to reach the orbit and to be able to withstand harsh conditions of the domain. This means that their protection against ASAT weapons is very limited, and, whereas some avoidance techniques are being discussed, they are of limited use in case of ASAT attack. We can thus add to the issue of predictability also the issue of easy destructibility of space weapons and other military hardware (Dolman 2005, p. 40; Anantatmula 2013, p. 137; Steinberg 2012, p. 255). Even if the high ground was effectively achieved and other nations could not attack the space assets directly, there is still a need for communication with those assets from Earth. There are also ground facilities that support and control such weapons located on the surface. Electromagnetic communication with satellites might be jammed or hacked and the ground facilities infiltrated or destroyed thus rendering the possible space weapons useless (Klein 2006, p. 105; Rendleman 2013, p. 81). This issue might be overcome by the establishment of a base controlling these assets outside the Earth-on Moon or lunar orbit, at lunar L-points, etc.-but this perspective remains, for now, unrealistic. Furthermore, **no contemporary actor will risk full space weaponization in the face of possible competition and the possibility of rendering the outer space useless.** No actor is dominant enough to prevent others to challenge any possible attempts to dominate the domain by military means. To quote 2016 Stratfor analysis, "(a) war in space would be devastating to all, and preventing it, rather than finding ways to fight it, will likely remain the goal" (Larnrani 20 16). This stands true unless some space actor finds a utility in disrupting the arena for others.

**Co-orbital ASATs fail**

**Doboš and Pražák 19** (Bohumil, Institute of Political Studies, Faculty of Social Sciences, Charles University, and Jakub, Institute of Political Studies, Faculty of Social Sciences, Charles University, “To Clear or to Eliminate? Active Debris Removal Systems as Antisatellite Weapons”, Vol. 47, February) DB

The article aimed to assess **the utility of the ADR systems as ASAT weapons**. While looking at the limitations of the currently operational ASAT weapons, we can identify many advantages that the ADR system would hold if used in a harmful manner. **It does not produce additional clouds of orbital debris and is not a military-only technology**. Nevertheless, **ADR systems carry their own set of restrictions if used as an ASAT weapon, namely limited reach and easy destructibility by kinetic ASAT weapons**. This leads us to the consideration that **the technology of the ADR system is probably not practical for the conduct of massive ASAT attacks if developed in a scope proposed by the supporters of active debris mitigation**. As a dual-use technology, its primary function is, nevertheless, determined by the intent of the owner. If the ADR systems are to be effectively utilized in the civil sector, the actor operating them must be perceived as reliable by the vast majority of the international space community. We think that this will be best done by commercialization of the effort in the context of cooperation with state space agencies operating in the sphere—especially civilian ESA—that might help with the technological development. This support should be done under the coordination by the UN as to decrease the negative perception of the operation of such systems.

**Stalkers are peaceful – their author**

Brian G. **Chow**, summer 20**17** (independent policy analyst with over 25 years as a senior physical scientist specializing in space and national security. He holds a PhD in physics from Case Western Reserve University and an MBA with distinction and PhD in finance from the University of Michigan) Stalkers in Space: Defeating the Threat, Strategic Studies Quarterly, https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-11\_Issue-2/Chow.pdf

China’s ASAT developments are comprehensive. In addition to the emerging space stalkers, it continues to develop jammers against communications satellites; powerful lasers to dazzle, blind, or damage space sensors; and cyber capabilities to hack or spoof the control and functioning of satellites. China has also been expanding its space diplomacy. Its space programs have included international cooperation with countries other than Russia. China and the European Space Agency (ESA) are cooperating on a space-weather observatory. ESA personnel have visited Chinese human spaceflight training facilities, with the longterm goal of flying a European astronaut aboard a Shenzhou spacecraft to a Chinese space station.20 These activities help project China as a peaceful and friendly space power. Thus, under the current ambiguity about whether configuring multiple space stalkers or exercising preemptive self-defense is the first act of aggression, the international community might well be on China’s side in a conflict

## Ozone

#### Space exploration is k2 ending climate change

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Space developments in the last two decades have greatly contributed to our understanding of our planet’s climate. Satellite imaging, space exploration, and new technologies give us an idea of the big picture and how we can adapt to address climate change. For example, satellites in space have played a critical role in our understanding of the causes of global warming by providing us with a large body of data to examine the variations in the Earth’s orbit. Data from these capabilities were essential inputs into the Intergovernmental Panel on Climate Change’s (IPCC) recent report that focused on how the physical science of climate change informs likely impacts under five different emissions scenarios. The report also found that climate change is happening quicker than we thought, making the need to reduce emissions imminent. To address this, space infrastructure such as positioning, navigation, and timing (PNT) can help identify efficient transportation routes and sources of emissions, ultimately aiding mitigation efforts.