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### Mining DA

#### The private sector is set to start asteroid mining through innovation and investment happening now.

Gilbert 21 [Alex Gilbert is a complex systems researcher and a PhD student in space resources at the Colorado School of Mines. "Mining in Space Is Coming." Milken Institute Review, April 26, 2021, [www.milkenreview.org/articles/mining-in-space-is-coming](http://www.milkenreview.org/articles/mining-in-space-is-coming)]

Space exploration is back. after decades of disappointment, a combination of better technology, falling costs and a rush of competitive energy from the private sector has put space travel front and center. indeed, many analysts (even some with their feet on the ground) believe that commercial developments in the space industry may be on the cusp of starting the largest resource rush in history: mining on the Moon, Mars and asteroids.

While this may sound fantastical, some baby steps toward the goal have already been taken. Last year, NASA awarded contracts to four companies to extract small amounts of lunar regolith by 2024, effectively beginning the era of commercial space mining. Whether this proves to be the dawn of a gigantic adjunct to mining on earth — and more immediately, a key to unlocking cost-effective space travel — will turn on the answers to a host of questions ranging from what resources can be efficiently.

As every fan of science fiction knows, the resources of the solar system appear virtually unlimited compared to those on Earth. There are whole other planets, dozens of moons, thousands of massive asteroids and millions of small ones that doubtless contain humungous quantities of materials that are scarce and very valuable (back on Earth). Visionaries including Jeff Bezos imagine heavy industry moving to space and Earth becoming a residential area. However, as entrepreneurs look to harness the riches beyond the atmosphere, access to space resources remains tangled in the realities of economics and governance.

Start with the fact that space belongs to no country, complicating traditional methods of resource allocation, property rights and trade. With limited demand for materials in space itself and the need for huge amounts of energy to return materials to Earth, creating a viable industry will turn on major advances in technology, finance and business models.`

That said, there’s no grass growing under potential pioneers’ feet. Potential economic, scientific and even security benefits underlie an emerging geopolitical competition to pursue space mining. The United States is rapidly emerging as a front-runner, in part due to its ambitious Artemis Program to lead a multinational consortium back to the Moon. But it is also a leader in creating a legal infrastructure for mineral exploitation. The United States has adopted the world’s first spaceresources law, recognizing the property rights of private companies and individuals to materials gathered in space.

However, the United States is hardly alone. Luxembourg and the United Arab Emirates (you read those right) are racing to codify space-resources laws of their own, hoping to attract investment to their entrepot nations with business-friendly legal frameworks. China reportedly views space-resource development as a national priority, part of a strategy to challenge U.S. economic and security primacy in space. Meanwhile, Russia, Japan, India and the European Space Agency all harbor space-mining ambitions of their own. Governing these emerging interests is an outdated treaty framework from the Cold War. Sooner rather than later, we’ll need new agreements to facilitate private investment and ensure international cooperation.

What’s Out There

Back up for a moment. For the record, space is already being heavily exploited, because space resources include non-material assets such as orbital locations and abundant sunlight that enable satellites to provide services to Earth. Indeed, satellite-based telecommunications and global positioning systems have become indispensable infrastructure underpinning the modern economy. Mining space for materials, of course, is another matter.

In the past several decades, planetary science has confirmed what has long been suspected: celestial bodies are potential sources for dozens of natural materials that, in the right time and place, are incredibly valuable. Of these, water may be the most attractive in the near-term, because — with assistance from solar energy or nuclear fission — H2O can be split into hydrogen and oxygen to make rocket propellant, facilitating in-space refueling. So-called “rare earth” metals are also potential targets of asteroid miners [are] intending to service Earth markets. Consisting of 17 elements, including lanthanum, neodymium, and yttrium, these critical materials (most of which are today mined in China at great environmental cost) are required for electronics. And they loom as bottlenecks in making the transition from fossil fuels to renewables backed up by battery storage.

#### Asteroid mining boosts the economy, solves resource scarcity, lowers costs of space exploration, and solves climate change.

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Indeed, the economic imperative for space mining is evident and analysts predict that these extraction activities could translate to a multibillion-dollar industry. NASA estimates, for example, that the [value of asteroids](https://metro.co.uk/2018/06/11/new-asteroid-gold-rush-earn-everyone-earth-75-billion-7622439/)out there could be in the vicinity of US$700 quintillion – that amount is roughly equivalent to US$95 billion for each of us here on Earth.[[iv]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn4)  Another major attraction for the prospective extraterrestrial mining companies is the availability of precious minerals in abundance on the Moon, on Mars and the asteroids (among them—lithium, cobalt, nickel, copper, zinc, niobium, molybdenum, lanthanum, europium, tungsten, and gold).[[v]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn5) After all, these metals and mineral resources have grown scarce on Earth, and both governments and commercial actors are pushing to look to celestial bodies for resources.[[vi]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn6)

Technological innovation—primarily brought about by commercial players such as Elon Musk[[2]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_ftn2) and Jeff Bezos[[3]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_ftn3)—is changing the landscape of space exploration. Leading the way in this new-era race are the startups including Planetary Resources, Deep Space Industries, Ispace, and Kleos Space.[[vii]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn7) Research into the feasibility of human and robotic missions to asteroids is being conducted by both governmental organisations, like NASA and JAXA (Japan Aerospace Exploration Agency), as well as private companies such as Planetary Resources.[[viii]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn8) However, for realising affordable space travel and space industrialisation, it is essential to find extraterrestrial materials such as metals, minerals and water that do not have to be transported from Earth. Thus, the first objective in carrying out asteroid mining activity is to obtain elements that are critical for basic sustenance on Earth. It has been identified that the asteroid belt in our solar system contains eight-percent metal-rich (M type) asteroids and 75-percent volatile-rich carbonaceous (C type) asteroids.[[ix]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn9)

The second incentive for celestial mining companies is to haul precious minerals and cargo raw materials to Earth to fuel its fast depleting resources. This would significantly increase the mining company’s valuation and greatly impact the global economy. According to a 2012 Reuters interview with Planetary Resources, a 30-meter-long (98-foot) asteroid can hold platinum worth somewhere from US$25 billion to US$50 billion.[[x]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn10)  These metals are highly useful and valuable, both on Earth and in space.[[xi]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn11)

Third, asteroids give humans the potential to create tools in space, since iron, nickel and cobalt are in abundance.[[xii]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn12) Chris Lewicki, Planetary Resources CEO, has said, “Using 3D printing technology one can grab material off asteroids and 3D print something that never has to be on a rocket. Tools, machines and even habitats can then be built off Earth, reducing the cost of exploration even further.[[xiii]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn13) Fourth, resource extraction is also becoming a focus for many Middle Eastern nations.[[xiv]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn14) The Middle Eastern oil States, such as Saudi Arabia and the United Arab Emirates are investing heavily in this industry as they are looking at space as a way to diversify out of the earthly benefits of fossil fuel.[[xv]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn15) Fifth, countries such as India and China are looking to mine the Moon for extracting Helium-3, which is considered a clean and efficient form of energy. It is thought that th[at]is isotope could provide safer nuclear energy in a fusion reactor, since it is not radioactive and would not produce dangerous waste products.[[xvi]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn16)

Finally, the water available in outer space could be used to make rocket propellants. According to scientists, since water is abundant in outer space, in some or the other form, it could be extracted and electrolysed to derive hydrogen and oxygen, the key ingredients of rocket fuel.[[xvii]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn17) Thus, instead of carrying one’s own fuel all the way, asteroids could serve as extraterrestrial/orbital “gas stations” for fuelling future deep space missions. This would simultaneously make space travel more cost-effective and productive. Such ventures are also seen to be intrinsic to further science and discovery, in addition to revolutionising commercial development in outer space. The mining of asteroids could also provide a near-infinite [supply of the precious resources for Earth to use.](https://www.telegraph.co.uk/finance/newsbysector/industry/mining/9222766/Planetary-Resources-unveils-cosmic-plan-to-boldly-go-and-mine-asteroids-for-gold-and-platinum.html)[[xviii]](https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/#_edn18)

#### That’s key to offsetting emissions from terrestrial mining and maintaining the tech advancements necessary to transitioning off fossil fuels and stopping species extinction.

**Bell 19** [Aidan Bell is the co-founder of EnviroBuild, a sustainable building materials company based in London. PhD from Manchester in Inorganic Chemistry. "The Conflict of Tech Innovation and Sustainability." TechNative, 22 Jan. 2019, technative.io/the-conflict-of-tech-innovation-and-sustainability]

The current technological dilemmas that we face today are similar to those of ancient time.  Overuse of a resource for immediate human benefit risks longer-term negative influence.  A report conducted by Greenpeace found that Internet data centres have incredibly large carbon footprints, accounting for 3% of global electricity use, much of it in locations that offer cheap, but dirty, electricity. Likewise, the minerals that are found in electronic devices like mobile phones, such as tantalum and gold, often originate from unregulated mining that releases harmful substances into the surrounding soil, air and water. Mining also contributes hugely to deforestation, which is responsible for 15% of global greenhouse gas emissions.

The negative impacts of technological innovation are increasing and action needs to be taken soon to resolve this crisis for the sake of future generations. The Intergovernmental Panel on Climate Change (IPCC) report last month warned that we have just 12 years to reduce the rate of global warming before widespread flooding and droughts become unavoidable. The demand for minerals and energy brought about by technological advancements shows no sign of slowing down, painting a worrying picture for the future of the planet.

Faced with the consequences of our intelligence, humanity now has to use its incredible versatility to overcome the challenges it has created for itself. For example, wind and solar power are increasingly becoming economically-viable sources of unlimited, free electricity and provide us with the opportunity to reduce our dependence on harmful fossil fuels. Bioengineering should help us protect surface soils and the ecosystems that depend on them by maintaining healthy levels of nutrients and soil salinity. Technological advancements will even help us prevent species extinction events that would otherwise destroy our Earth altogether, with NASA already developing spacecraft to push approaching asteroids out of our orbit.

#### That causes extinction.

Strona 18 Giovanni, Flinders University, Bradshaw, Corey J. A., Scientific Reports, Science Daily, “Climate Change risks ‘extinction domino effect,’” https://www.sciencedaily.com/releases/2018/11/181129122506.htm

New research reveals the extinction of plant or animal species from extreme environmental change increases the risk of an [leads to] 'extinction domino effect' that could annihilate all life on Earth. This would be the worst-case scenario of what scientists call 'co-extinctions', where an organism dies out because it depends on another doomed species, with the findings published today in the journal Scientific Reports. Think of a plant's flower pollinated by only one species of bee -- if the bee becomes extinct, so too will the plant eventually. "Even the most resilient species will inevitably fall victim to the synergies among extinction drivers as extreme stresses drive ecosystems to collapse." says lead author Dr Giovanni Strona of the European Commission's Joint Research Centre based in Ispra in northern Italy. Researchers from Italy and Australia simulated 2,000 'virtual earths' linking animal and plant species. Using sophisticated modelling, they subjected the virtual earths to catastrophic environmental changes that ultimately annihilated all life. Examples of the kinds of catastrophes they simulated included runaway global warming, scenarios of 'nuclear winter' following the detonation of multiple atomic bombs, and a large asteroid impact. "What we were trying to test is whether the variable tolerances to extreme global heating or cooling by different species are enough to explain overall extinction rates," "But because all species are connected in the web of life, our paper demonstrates that even the most tolerant species ultimately succumb to extinction when the less-tolerant species on which they depend disappear." "Failing to take into account these co-extinctions therefore underestimates the rate and magnitude of the loss of entire species from events like climate change by up to 10 times," says co-author Professor Bradshaw of Flinders University in South Australia Professor Bradshaw and Dr Strona say that their virtual scenarios warn humanity not to underestimate the impact of co-extinctions. "Not taking into account this domino effect gives an unrealistic and exceedingly optimistic perspective about the impact of future climate change," warns Professor Bradshaw. It can be hard to imagine how the demise of a small animal or plant matters so much, but the authors argue that tracking species up to total annihilation demonstrates how the loss of one can amplify the effects of environmental change on the remainder. "Another really important discovery was that in the case of global warming in particular, the combination of intolerance to heat combined with co-extinctions mean that 5-6 degrees of average warming globally is enough to wipe out most life on the planet," says Dr Strona. Professor Bradshaw further warns that their work shows how climate warming creates extinction cascades in the worst possible way, when compared to random extinctions or even from the stresses arising from nuclear winter.

#### Resource wars are the most likely cause of global conflict – scarcity is a conflict multiplier

Lehane 17 [Sinéad Lehane is research manager for Future Directions International’s Global Food and Water Crises Research program. Her current research projects include Australia’s food system and water security in the Tibetan Plateau region. Shaping Conflict in the 21st Century—The Future of Food and Water Security. February 2, 2017. www.hidropolitikakademi.org/shaping-conflict-in-the-21st-century-the-future-of-food-and-water-security.html]

In his book, The Coming Famine, Julian Cribb writes that the wars of the 21st century will involve failed states, rebellions, civil conflict, insurgencies and terrorism. All of these elements will be triggered by competition over dwindling resources, rather than global conflicts with clearly defined sides. More than 40 countries experienced civil unrest following the food price crisis in 2008. The rapid increase in grain prices and prevailing food insecurity in many states is linked to the outbreak of protests, food riots and the breakdown of governance. Widespread food insecurity is a driving factor in creating a disaffected population ripe for rebellion. Given the interconnectivity of food security and political stability, it is likely food will continue to act as a political stressor on regimes in the Middle East and elsewhere. Addressing Insecurity Improving food and water security and encouraging resource sharing is critical to creating a stable and secure global environment. While food and water shortages contribute to a rising cycle of violence, improving food and water security outcomes can trigger the opposite and reduce the potential for conflict. With the global population expected to reach 9 billion by 2040, the likelihood of conflict exacerbated by scarcity over the next century is growing. Conflict is likely to be driven by a number of factors and difficult to address through diplomacy or military force. Population pressures, changing weather, urbanization, migration, a loss of arable land and freshwater resources are just some of the multi-layered stressors present in many states. Future inter-state conflict will move further away from the traditional, clear lines of military conflict and more towards economic control and influence.

### SpaceCol DA

#### The private sector is the key internal link to space exploration and colonization.

**Sharma 9/7** [Maanas Sharma, 9-7-2021, "The Space Review: The privatized frontier: the ethical implications and role of private companies in space exploration," The Space Review, https://www.thespacereview.com/article/4238/1]//DDPT

In recent years, private companies have taken on a larger role in the space exploration system. With lower costs and faster production times, they have displaced some functions of government space agencies. Though many have levied criticism against privatized space exploration, it also allows room for more altruistic actions by government space agencies and the benefits from increased space exploration as a whole. Thus, we should encourage this development, as the process is net ethical in the end. Especially if performed in conjunction with adequate government action on the topic, private space exploration can overcome possible shortcomings in its risky and capitalistic nature and ensure a positive contribution to the general public on Earth.

The implications of commercial space exploration have been thrust into the limelight with the successes and failures of billionaire Elon Musk’s company SpaceX. While private companies are not new to space exploration, their prominence in American space exploration efforts has increased rapidly in recent years, fueled by technological innovations, reductions in cost, and readily available funding from government and private sources.[1] In May 2020, SpaceX brought American astronauts to space from American soil for the first time in almost 10 years.[2] Recognizing the greatly reduced costs of space exploration in private companies, NASA’s budget has shifted to significantly relying on private companies.[3] However, private space companies are unique from government space agencies in the way they experience unique sets of market pressures that influence their decision-making process. Hence, the expansion of private control in the space sector turns into a multifaceted contestation of its ethicality.

The most obvious ethical concern is the loss of human life. Critics contend that companies must answer to their shareholders and justify their profits. This contributes to a larger overall psyche that prioritizes cost and speed above all else, resulting in significantly increased risks.[4] However, the possible increase in mishaps is largely overstated. Companies recognize the need for safety aboard their expeditions themselves.[5] After all, the potential backlash from a mishap could destroy the company’s reputation and significantly harm their prospects. According to Dr. Nayef Al-Rodhan, Head of the Geneva Centre for Security Policy’s Geopolitics and Global Futures Programme, “because there were no alternatives to government space programs, accidents were seen to some degree as par for the course… By comparison, private companies actually have a far more difficult set of issues to face in the case of a mishap. In a worst case scenario, a private company could make an easy scapegoat.” [6]

Another large ethical concern is the prominence capitalism may have in the future of private space exploration and the impacts thereof. The growth of private space companies in recent years has been closely intertwined with capitalism. Companies have largely focused on the most profitable projects, such as space travel and the business of space.[7] Many companies are funded by individual billionaires, such as dearMoon, SpaceX’s upcoming mission to the Moon.[8] Congress has also passed multiple acts for the purpose of reducing regulations on private space companies and securing private access to space. From this, many immediately jump to the conclusion that capitalism in space will recreate the same conditions in outer space that plague Earth today, especially with the increasing push to create a “space-for-space” economy, such as space tourism and new technologies to mine the Moon and asteroids. Critics, such as Jordan Pearson of VICE, believe that promises of “virtually unlimited resources” are only for the rich, and will perpetuate the growing wealth inequality that plagues the world today.[9]

However, others contend that just because private space exploration has some capitalist elements, it is by no means an embodiment of unrestricted capitalism. A healthy balance of restricted capitalism—for example, private space companies working through contracts with government agencies or independently under monitoring and regulation by national and international agreements—will avoid the pitfalls that capitalist colonialism faced down here on Earth. Even those who are generally against excessive government regulation should see the benefits of them in space. Lacking any consensus on definitions and rights in space will create undue competition between corporations as well as governments that will harm everyone rather than helping anyone. To create a conducive environment for new space-for-space exploration, one without confrontation but with protection for corporate astronauts, infrastructure, and other interests, governments must create key policies such as a framework for property rights on asteroids, the Moon, and Mars.[7,10]

Another key matter to note is restricted capitalism in space “could also be our salvation.”[11] Private space exploration could reap increased access to resources and other benefits that can be used to solve the very problems on Earth that critics of capitalism identify. Since governments offset some of their projects to private companies, government agencies can focus on altruistic projects that otherwise would not fit in the budget before and do not have the immediate commercial use that private companies look for. Scott Hubbard, an adjunct professor of aeronautics and astronautics at Stanford University, discusses how “this strategy allows the space agency to continue ‘exploring the fringe where there really is no business case’” but still has important impacts on people down on Earth.[12]

Indeed, this idea is a particularly powerful one when considering the ideal future of private companies in space exploration. Though there is no one set way governments will interact with companies, the consensus is that they must radically reimagine their main purpose as the role of private space exploration continues to grow. As governments utilize services from private space companies, “[i]nstead of being bogged down by the routine application of old research, NASA can prioritize their limited budget to work more on research of other unknowns and development of new long-term space travel technologies.”[13] According to the Council on Foreign Relations, such technologies have far-reaching benefits on Earth as well. Past developments obviously include communications satellites, by themselves a massive benefit to society, but also “refinements in artificial hearts; improved mammograms; and laser eye surgery… thermoelectric coolers for microchips; high-temperature lubricants; and a means for mass-producing carbon nanotubes, a material with significant engineering potential; [and h]ousehold products.”[2] Agencies like NASA are the only actors able to pursue the next game-changing missions, “where the profit motive is not as evident and where the barriers to entry are still too high for the private sector to really make a compelling business case.”[8] These technologies have revolutionized millions, if not billions, of lives, demonstrating the remarkable benefits of space exploration. It follows then that it is net ethical to prioritize these benefits.

This report concludes that the private sector, indeed, has a prominent role to play in the future of space exploration. Further, though private space exploration does bring the potential of increased danger and the colonization of space, these concerns can be effectively mitigated. Namely, strong government frameworks—particularly international ones—will minimize possible sources of ethical violations and ensure an optimal private sector role in space. This also allows government agencies to complete significantly more difficult, innovative projects which have transformative benefits for life on Earth.

#### It solves a litany of existential threats – don’t put all your eggs in one basket.

Fitzgerald 3/9 [(Shanon, Assistant Websites Editor at Liberty Fund), “Why Human Space Exploration Matters,” March 9 2021, https://www.econlib.org/why-human-space-exploration-matters/]

While the yields to space exploration and the development of spaceflight technology may appear minimal in the immediate future, shifting our perspective to the longer term renders the human situation vis a viz space exploration extremely clear: if humans want to survive in perpetuity, we need to establish ourselves on other planets in addition to Earth. It is as simple as that. And yet we are not doing all that much to make that happen. To be clear, I’m long on Earth, too, and hope that technological improvements will continue to allow our species to get “more from less” right here on the third rock from the sun, enabling us to keep occupying the planet that saw us evolve into consciousness. I like to imagine that the distant future on Earth has the potential to be an extremely pleasant one, as advances in our scientific understanding and bio-technical praxis should hopefully allow our descendants to clean up any of the remaining messes previous generations will have left behind (e.g., nuclear and industrial waste, high amounts of atmospheric carbon, other lingering nasties) and stable-state free societies will hopefully allow all persons (or very nearly all persons) to live free and meaningful lives in productive community and exchange with their fellows. As the previous qualification highlights, the trickiest problems here on Earth and extending to wherever humans end up in the spacefaring age will still be social and political, and their successful resolution will depend more on the future state of our governing arts than our hard sciences. But regarding the negative events that could very well happen to Earth I think we all need to be equally clear: life might not make it here. There is no guarantee that it will, and in the very long run, with the expansion and subsequent death of our sun, we know with near certainty that it will not. Consider just a few possible extinction-level events that could strike even earlier: large meteors, supervolcanic eruptions, drastic climactic disruption of the “Snowball Earth” variety. As SpaceX founder and Tesla CEO Elon Musk recently observed on the Joe Rogan Experience podcast, “A species that does not become multiplanetary is simply waiting around until there is some extinction event, either self-inflicted or external.” This statement, applied to the human species, is obviously true on its face. As doomsday events go a giant asteroid might be more shocking, since we (people living today) have never experienced one before while concerned atomic scientists warn us about the nuclear bomb all the time, but the odds that we blow ourselves up are still there. Slim, but there. It’s more plausible that a severe nuclear war and the nuclear winter it would likely trigger would leave the human population greatly reduced as opposed to completely extinct, but then the question becomes: why is that a risk we would want to take? The bomb is here to stay for now, but there is no reason that 100% of known life in the universe needs to stay here on Earth to keep it company, waiting around for something even more destructive to show up. While we’re on that happy subject: Do you have any good intuitions about our collective chances against hostile, or simply arrogant or domineering, technologically-advanced extraterrestrial lifeforms, if and/or when they decide to pay us a visit on our home turf? These scary situation sketches will suffice. At bottom, the core reason I am a believer in the need to make life—and not just human life—multiplanetary is the same basic reason I would never counsel a friend to keep all their money and valuables in one place: diversification is good. Wisdom and experience suggest we store precious resources in multiple safe(ish) places. Diversification limits our exposure to risk, and increases our resilience when bad things do happen. One reserve gets hit, two or three others survive, and you probably feel that the effort to spread things out was worth it. What I’m saying here has strong undercurrents of common sense, yet our approach to the human population itself—the universal store and font of “human capital”—does not currently prioritize diversification to the degree our technological capabilities would allow. The distribution of the human population, and of almost all human knowledge and works, is overwhelmingly local. (Let us set to one side the possibility that aliens somewhere maintain an archive of captured human information.) Establishing outposts at least as large as those we maintain in Antarctica on the Moon and Mars, or other more suitable sites, by the end of this century would be a great first step toward genuinely diversifying the physical locations of the most precious resources known to us: human consciousness and creativity, human love and human soul, the great works in which all these things are displayed. Add also to this list repositories of scientific knowledge and knowhow, seed reserves, and certain materials necessary to re-start the manufacturing of fundamental technologies. Spreading these goods to a few additional locations within the solar system would be a major species-and-civilization-level accomplishment that all living at the time could feel satisfied by, and even take some pride in. And this is something that we seem to be just on the cusp of being able to do, given our recent and rapid technological advances in rocketry, computers, and materials science and engineering, among other important fields for space exploration and settlement. Quickly the uniplanetary human situation is becoming, if it is not already, one of pure choice.

### Democracy DA

#### Democracy is in decline – pressures from COVID-19 and the rise of authoritarianism around the world have caused loss of freedom and democracy.

Freedom House 21 [Freedom House, Press Release, “New Report: The global decline in democracy has accelerated,” March 3rd, 2021, [https://freedomhouse.org/article/new-report-global-decline-democracy-has-accelerated]/](https://freedomhouse.org/article/new-report-global-decline-democracy-has-accelerated%5d/) lm

The report found that the share of countries designated Not Free has reached its highest level since the deterioration of democracy began in 2006, and that countries with declines in political rights and civil liberties outnumbered those with gains by the largest margin recorded during the 15-year period. The report downgraded the freedom scores of 73 countries, representing 75 percent of the global population. Those affected include not just authoritarian states like China, Belarus, and Venezuela, but also troubled democracies like the United States and India.

In one of the year’s most significant developments, India’s status changed from Free to Partly Free, meaning less than 20 percent of the world’s people now live in a Free country—the smallest proportion since 1995. Indians’ political rights and civil liberties have been eroding since Narendra Modi became prime minister in 2014. His Hindu nationalist government has presided over increased pressure on human rights organizations, rising intimidation of academics and journalists, and a spate of bigoted attacks—including lynchings—aimed at Muslims. The decline deepened following Modi’s reelection in 2019, and the government’s response to the coronavirus pandemic in 2020 featured further abuses of fundamental rights.

The changes in India formed part of a broader shift in the international balance between democracy and authoritarianism, with authoritarians generally enjoying impunity for their abuses and seizing new opportunities to consolidate power or crush dissent. In many cases, promising democratic movements faced major setbacks as a result.

In Belarus and Hong Kong, for example, massive prodemocracy protests met with brutal crackdowns by governments that largely disregarded international criticism. The Azerbaijani regime’s military offensive in Nagorno-Karabakh indirectly threatened recent democratic gains in Armenia, while the armed conflict in Ethiopia’s Tigray Region dashed hopes for the tentative political opening in that country since 2018. All four of these cases notably featured some degree of intervention by an autocratic neighbor: Moscow provided a backstop for the regime in Belarus, Beijing propelled the repression in Hong Kong, Turkey’s government aided its Azerbaijani counterpart, and Ethiopia’s leader called in support from Eritrea.

The malign influence of the regime in China, the world’s most populous dictatorship, ranged far beyond Hong Kong in 2020. Beijing ramped up its global disinformation and censorship campaign to counter the fallout from its cover-up of the initial coronavirus outbreak, which severely hampered a rapid global response in the pandemic’s early days. Its efforts also featured increased meddling in the domestic political discourse of foreign democracies, as well as transnational extensions of rights abuses common in mainland China. The Chinese regime has gained clout in multilateral institutions such as the UN Human Rights Council, which the United States abandoned in 2018, as Beijing pushed a vision of so-called noninterference that allows abuses of democratic principles and human rights standards to go unpunished while the formation of autocratic alliances is promoted.

“This year’s findings make it abundantly clear that we have not yet stemmed the authoritarian tide,” said Sarah Repucci, vice president of research and analysis at Freedom House. “Democratic governments will have to work in solidarity with one another, and with democracy advocates and human rights defenders in more repressive settings, if we are to reverse 15 years of accumulated declines and build a more free and peaceful world.”

A need for reform in the United States

While still considered Free, the United States experienced further democratic decline during the final year of the Trump presidency. The US score in [Freedom in the World](https://freedomhouse.org/report/freedom-world/2021/democracy-under-siege) has dropped by 11 points over the past decade, and fell by three points in 2020 alone. The changes have moved the country out of a cohort that included other leading democracies, such as France and Germany, and brought it into the company of states with weaker democratic institutions, such as Romania and Panama.

Several developments in 2020 contributed to the United States’ current score. The Trump administration undermined government transparency by dismissing inspectors general, punishing or firing whistleblowers, and attempting to control or manipulate information on COVID-19. The year also featured mass protests that, while mostly peaceful, were accompanied by high-profile cases of violence, police brutality, and deadly confrontations with counterprotesters or armed vigilantes. There was a significant increase in the number of journalists arrested and physically assaulted, most often as they covered demonstrations. Finally, the outgoing president’s shocking attempts to overturn his election loss—culminating in his incitement of rioters who stormed the Capitol as Congress met to confirm the results in January 2021—put electoral institutions under severe pressure. In addition, the crisis further damaged the United States’ credibility abroad and underscored the menace of political polarization and extremism in the country.

”January 6 should be a wake-up call for many Americans about the fragility of American democracy,” said Michael J. Abramowitz, president of Freedom House. “Authoritarian powers, especially China, are advancing their interests around the world, while democracies have been divided and consumed by internal problems. For freedom to prevail [we] on a global scale, the United States and its partners must band together and work harder to strengthen democracy at home and abroad. President Biden has pledged to restore America’s international role as a leading supporter of democracy and human rights, but to rebuild its leadership credentials, the country must simultaneously address the weaknesses within its own political system.”

“Americans should feel gratified that the courts and other important institutions held firm during the postelection crisis, and that the country escaped the worst possible outcomes,” said Abramowitz. “But the Biden administration, the new Congress, and American civil society must fortify US democracy by strengthening and expanding political rights and civil liberties for all. People everywhere benefit when the United States serves as a positive model, and the country itself reaps ample returns from a more democratic world.”

The effects of COVID-19

Government responses to the COVID-19 pandemic exacerbated the global democratic decline. Repressive regimes and populist leaders worked to reduce transparency, promote false or misleading information, and crack down on the sharing of unfavorable data or critical views. Many of those who voiced objections to their government’s handling of the pandemic faced harassment or criminal charges. Lockdowns were sometimes excessive, politicized, or brutally enforced by security agencies. And antidemocratic leaders worldwide used the pandemic as cover to weaken the political opposition and consolidate power.

In fact, many of the year’s negative developments will likely have lasting effects, meaning the eventual end of the pandemic will not necessarily trigger an immediate revitalization of democracy. In Hungary, for example, the government of Prime Minister Viktor Orbán took on emergency powers during the health crisis and misused them to withdraw financial assistance from municipalities led by opposition parties. In Sri Lanka, President Gotabaya Rajapaksa dissolved Parliament in early March and, with new elections repeatedly delayed due to COVID-19, ruled without a legislature for several months. Later in the year, both Hungary and Sri Lanka passed constitutional amendments that further strengthened executive power.

#### Constellations are key to democracy promotion – they put authoritarian leaders on the defensive – it’s perceptual and proven by opposition to satellites

Schwille 4/12 [(Michael, senior policy analyst at RAND, research interest focuses on the integration of information into combined arms warfare, M.A. in international development studies from George Washington University) “Satellite Internet Services—Fostering the Dictator's Dilemma?” RAND Corporation, 4/12/2021] JL

Constellations of low-altitude, low-latency satellites providing broadband internet access to wide swathes of the earth are an impending challenge to the information dominance enjoyed by the world's authoritarian states. Whether Amazon's proposed Project Kuiper, Elon Musk's Starlink (already functional in some areas of North America), or the United Kingdom funded OneWeb, the ability to provide relatively low cost internet access outside of government control is both a challenge for authoritarian states and an opportunity for democracies.

In Russia, the Duma is already considering a law to criminalize access to such satellite services. China is not only planning to launch a competing service, it has Starlink's Musk concerned about having his satellites “blown up.” North Korea, which bans its citizens from accessing the internet and (in)famously attacks leaflets with machine guns, shells loudspeakers with artillery, and punishes citizens for accessing Chinese cellphone towers, has yet to comment publicly on such services. Given this history though, Pyongyang's reaction is unlikely to be very positive.

What are low-altitude, low-latency satellites and why are authoritarian states so concerned? The problem (for authoritarians) and promise (for democracies) are the services' ability to provide broadband internet access almost anywhere on earth, with nothing new required on the ground aside from a small terminal. Because these satellites orbit at several hundred kilometers (low Earth orbit), versus 35,000km for telecommunication satellites in geostationary orbit, their terminals can be smaller, portable, and easier to conceal, smuggle, and infiltrate. With one of these terminals, users can cheaply and quickly bypass national controls on the internet and information access, plus place phone (e.g. Voice over Internet Protocol, Skype, or Zoom) calls outside of government-controlled systems. It is this freedom of information access and communication that has Russia and China so concerned, and that provides an opportunity for democratic states to rebalance their current information disadvantage.

In what some scholars have termed democracy's dilemma, nations that rely on relatively free and open information flows are vulnerable to having that openness turned against them by adversaries. Think Russian influence on Brexit, the 2016 U.S. elections and the COVID-19 infodemic. What these new satellite systems offer is an opportunity to reinvigorate the dictator's dilemma (PDF)—the fear authoritarian leaders have of nonregime narratives reaching their people, or their people communicating outside of government-approved channels.

Just how powerful is this fear? Moscow reacts more negatively to criticisms and threats to its information control than it does to (far more expensive) NATO exercises. For years, Russian state media have even coordinated to deflect these criticisms of Russia's censorship onto countries with which Moscow is in conflict, successively targeting Georgia, the United States, and Ukraine.

China's rulers have a similar view, more fearful of “American ideals of freedom, democracy, and human rights infecting the people of China and Hong Kong,” than they are of U.S. military or economic challenges. This is not a new concern for Beijing; the term *Great Firewall of China* was discussed in a Wired article back in 1997. Beijing's controls have expanded since, with hundreds of thousands of censors and billions of dollars spent on informational and societal control, including the uniquely intrusive social credit systems (PDF).

North Korea is an even clearer example, with years of North Korea specialists (see Lankov, Baek, Cha, Myers, and others) highlighting Pyongyang's reliance on domestic information control to keep the Kim family in power. Impressive control, but a weakness masquerading as a strength.

This desire for information control represents both the dictator's dilemma and democracy's opportunity. Beijing, Moscow, and Pyongyang (as well as Tehran and others) are clearly concerned about the threat posed by unsupervised information access. Washington (or Brussels, London, Tokyo…whomever) publicly advocating for more open internet access, coupled with a clear mention of the new satellite services, would quickly command attention and establish a compelling narrative (and underlying threat). Coupling this message with a reminder of the West's ability to challenge information controls by, for example, smuggling bulky typewriters, printing presses, and Xerox machines into Eastern Europe in the 80s, which increased the flow of uncensored information, would add credibility to the threat—if authoritarian states thought typewriters were a problem, infiltrating an “internet in a box” (or thousands of them) looms as an even more compelling danger. The physical threat of infiltrated devices combined with a narrative advocating freedom of information access provide the West with a new, information-based tool for foreign policy leverage. A tool, or active measure, based not on fear, deception, or disinformation, but simply on information access.

By offering an information-based response to an information-based attack, this tool offers a fresh, calibrated response option. Chinese cyber espionage or recent attacks on Hong Kong's civil liberties, Russian attempts to influence Brexit or U.S. elections (or the more recent SolarWinds hack), North Korean attacks on Sony or South Korea's ATM network, are all activities ripe for response. Once this tool is effectively demonstrated in terms of fostering the dictator's dilemma, democracy's response and deterrence toolkits, for both cyber and influence activities, commensurately expands.

Importantly, the utility of this information tool is not confined simply to allowing outside information in; it also allows information to flow out (especially important with North Korea). Perhaps most importantly, it provides another tool to avoid government monitoring inside an authoritarian state. When paired with mesh networks of the type used, for example, during demonstrations in Hong Kong, it further increases the opportunity for the free flow of information dictators perceive as so threatening.

This tool (or its threatened use) does not replace other foreign policy tools—diplomatic, economic, and military tools remain options; this proposal simply adds a new information-based capability. The tool fits within a historical context of Western information activities and offers a compelling public narrative—fighting censorship. The hardware costs are relatively low, largely borne by the companies launching the satellites, and coming into existence whether governments wish them to or not. Finally, by rebalancing democracy's dilemma through a reinforcement of the dictator's dilemma, this tool offers an information response to information/cyber/influence attacks, using a method that clearly targets the vulnerabilities and sensitivities of authoritarian adversaries.

### Regulation CP

#### Counterplan: Establish an international body to regulate Commercial Space Activity.

**Iliopoulos 20** [Iliopoulos, Nikolaos [University of Tokyo], and Miguel Esteban [Waseda University]. "Sustainable space exploration and its relevance to the privatization of space ventures." Acta Astronautica 167 (2020): 85-92.]

The envisioned legal regime to encourage private firms to undertake the high risk and high cost involved in activities of space exploration would have to explicitly recognize extra-terrestrial property claims of individuals and corporations that meet specified conditions. As such, based on the conclusions made through this paper ,it is considered that with the right negotiation terms, the current treaties can be revised so as to become steppingstones for the advancement of space exploration that could potentially bring forth significant changes to the environment surrounding planet Earth. Finally, one way that such privatization efforts could be seen to benefit of [hu]mankind as a whole is that any taxation resulting from it should be paid directly to the United Nations, or that at least some fraction of the profits should fund this organization.

# Case

#### OST Fails regardless of private entities -- means aff is non-uq and cant solve.

**Evanoff 17** [Kyle Evanoff, Kyle is a research associate in international economics and U.S. foreign policy at the Council on Foreign Relations 10/10/17, "The Outer Space Treaty’s Midlife Funk," Council on Foreign Relations [https://www.cfr.org/blog/outer-space-treatys-midlife-funk accessed 12/11/2021](https://www.cfr.org/blog/outer-space-treatys-midlife-funk%20accessed%2012/11/2021)] Adam

Half a century later, however, the Outer Space Treaty has entered something of a funk. Despite the universal aspirations of the UN Committee on the Peaceful Uses of Outer Space, which molded the document into its completed form, many of the principles enshrined within the text are less suited to the present than they were to their native Cold War milieu. While the anachronism has not reached crisis levels, current and foreseeable developments do present challenges for the treaty, heightening the potential for disputes. At the crux of the matter is the ongoing democratization of space. During the 1950s and ‘60s, when the fundamental principles of international space law took shape, only large national governments could afford the enormous outlays required for creating and maintaining a successful space program. In more recent decades, technological advances and new business models have broadened the range of spacefaring actors. Thanks to innovations such as reusable rockets, micro- and nanosatellites, and inflatable space station modules, costs are decreasing and private companies are crowding into the sector. This flurry of activity, known as New Space, promises nothing less than a complete transformation of the way that humans interact with space. Asteroid mining, for example, could eliminate the need to launch many essential materials from Earth, lowering logistical hurdles and enabling largescale in-space fabrication. Companies like Planetary Resources and Deep Space Industries, by extracting and selling useful resources in situ, could help to jumpstart a sustainable space economy. They might also profit from selling valuable commodities back on terra firma. As a recent (bullish) Goldman Sachs report noted, a single football-field-sized asteroid could contain $25 to $50 billion worth of platinum—enough to upend the terrestrial market. With astronomical sums at stake and the commercial sector kicking into high gear, legal questions are becoming a major concern. Many of these questions focus on Article II of the Outer Space Treaty, which prohibits national appropriation of space and the celestial bodies. Since another provision (Article VI) requires nongovernmental entities to operate under a national flag, some experts have suggested that asteroid mining, which would require a period of exclusive use, may violate the agreement. Others, however, contend that companies can claim ownership of extracted resources without claiming ownership of the asteroids themselves. They cite the lunar samples returned to Earth during the Apollo program as a precedent. Hoping to promote American space commerce, Congress formalized this more charitable legal interpretation in Title IV of the 2015 U.S. Commercial Space Launch Competitiveness Act. Luxembourg, which announced a €200 million asteroid mining fund last year, followed suit with its own law in August. Controversies like the one surrounding asteroid mining are par for the course when it comes to the Outer Space Treaty. The agreement’s insistence that space be used “for peaceful purposes” has long been the subject of intense debate. During the treaty-making process, Soviet jurists argued that peaceful meant “non-military” and that spy satellites were illegal; Americans, who enjoyed an early lead in orbital reconnaissance, interpreted peaceful to mean “non-aggressive” and came to the opposite conclusion. Decades later, the precise meaning of the phrase remains a matter of contention. While the Outer Space Treaty has survived past disputes intact, some experts and policymakers believe that an update is in order. Senator Ted Cruz (R-TX), for instance, worries that legal ambiguity could undermine the nascent commercial space sector—a justifiable concern. Russia and Brazil, among other countries, hold asteroid mining operations to constitute de facto national appropriation. And while there are plenty of asteroids to go around for now (NASA has catalogued nearly 8,000 near earth objects larger than 140 meters in diameter), more supply-side 22saturation could lead to conflicts over choice space rocks. The absence of clear property rights makes this prospect all the more likely. Plans to establish outposts on the moon and Mars present a bigger challenge still. Last week, prior to the first meeting of the revived National Space Council, Vice President Mike Pence described the need for “a renewed American presence on the moon, a vital strategic goal” in an op-ed for the Wall Street Journal. His piece came on the heels of SpaceX Founder and Chief Executive Officer Elon Musk’s announcement at the 2017 International Astronautical Congress of a revised plan to colonize the red planet, with the first human missions slated for 2024. Musk hopes for the colony to house one million inhabitants within the next fifty years. While mining might require only temporary use of the celestial bodies, full-fledged colonies would necessarily be more permanent affairs. With some national governments arguing that mining operations would constitute territorial claims, lunar and Martian bases are almost certain to enter the legal crosshairs. And, even under the favorable U.S. interpretation of the Outer Space Treaty, states and private companies would need to avoid making territorial claims. If viable colony locations are relatively few and far between, fierce competition could make asserting control a practical necessity. Even so, policymakers should avoid hasty attempts to overhaul the Outer Space Treaty. The uncertainties associated with altering the fundamental principles of international space law are greater than any existing ambiguities. Commercial spacefaring already entails high levels of risk; adding new regulatory hazards to the mix would jeopardize investment and could slow progress in the sector. While the current property rights regime may be untenable over longer timelines, it remains workable for now.

#### Turn, Russia and China reject OST regardless of private entities,

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

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

#### 2015 space act cedes innovation and space boom – that boosts innovation, exploration, and ultimately the economy.

Foust 15 [Jeff Foust writes about space policy, commercial space, and related topics for SpaceNews. He earned a Ph.D. in planetary sciences from the Massachusetts Institute of Technology and a bachelor’s degree with honors in geophysics and planetary science from the California Institute of Technology, Space News, “House passes Commercial Space bill,” November 16th 2015, [https://spacenews.com/house-passes-commercial-space-bill/]/](https://spacenews.com/house-passes-commercial-space-bill/%5d/) lm

HOUSTON — The U.S. House of Representatives approved the compromise version of a commercial space bill Nov. 16, but not before a final debate on the House floor about some of the bill’s provisions.

The House passed on a voice vote the amended version of H.R. 2262, the U.S. Commercial Space Launch Competitiveness Act, after about a half-hour of discussion on the House floor that mirrored the debate on the earlier version of the bill that the House passed in May.

“This bill will unite law with innovation, allowing the next generation of pioneers to experiment, learn and succeed without being constrained by premature regulatory action,” House Majority Leader Kevin McCarthy (R-Calif.), sponsor of the original House bill, said during discussion of the final version.

“Virtually every space stakeholder group supports this bill,” said Rep. Lamar Smith (R-Texas), chairman of the House Science Committee. “This bill encourages the private sector to launch rockets, take risks and shoot for the stars.”

Opposing the bill were Reps. Eddie Bernice Johnson (D-Texas) and Donna Edwards (D-Md.), the ranking members of the full House Science Committee and its space subcommitte, respectively. They argued against a number of the bill’s provisions, including one that adds spaceflight participants to cross-waivers of liability currently required between launch service providers and its customers.

Another section of the bill that attracted attention is devoted to space resource rights. The final bill included a version of language in the House bill that grants rights to resources extracted by U.S. companies. The final version covers not just asteroids, as the original House bill did, but the moon and other solar system bodies as well. It is less specific, though, about any recourse a company could take if someone interfered with its rights. It also explicitly states that the bill does not cover any claims of property rights on asteroids or other bodies.

The commercial space industry supported the bill, and applauded its passage. “By removing the regulatory unknowns that suppress and repel investment, this bill unleashes and incentivizes the creativity that leads to unknown breakthroughs in innovation,” said Eric Stallmer, president of the Commercial Spaceflight Federation.

“Title IV’s protection of the ownership of recovered space resources will allow the capital markets to take a closer look at the space resource utilization industry, now that we have a legal framework for operations,” said Sagi Kfir, general counsel of asteroid mining company Deep Space Industries, referring to the space resource rights section of the final bill.

NASA Administrator Charles Bolden also mentioned the bill during remarks Nov. 17 at the SpaceCom Expo, a commercial space conference here. “That was a big milestone accomplished this week in commercial space,” he said of the bill’s passage.

#### Nasa dependent on private sector now – all exploration requires booming private sector.

Davenport 21 [Christian Davenport covers NASA and the space industry for The Washington Post's Financial desk. He joined The Post in 2000 and has served as an editor on the Metro desk and as a reporter covering military affairs. He is the author of "The Space Barons: Elon Musk, Jeff Bezos and the Quest to Colonize the Cosmos" The Washington Post, “As private companies erode government’s hold on space travel, NASA looks to open a new frontier,” February 25th 2021, [https://www.washingtonpost.com/technology/2021/02/25/nasa-space-future-private/]/](https://www.washingtonpost.com/technology/2021/02/25/nasa-space-future-private/%5d/) lm

Thanks to NASA’s investments and guidance, the private space sector has grown tremendously — no entity more than SpaceX, which [according to CNBC](https://www.cnbc.com/2021/02/16/elon-musks-spacex-raised-850-million-at-419point99-a-share.html) is now worth $74 billion. The commercial space industry is taking on ever more roles and responsibilities — flying not just cargo and supplies to the International Space Station, but even NASA’s astronauts there. The private sector will launch some of the major components of the space station NASA wants to build in orbit around the moon, and private companies are developing the spacecraft that will fly astronauts to and from the lunar surface.

Space enthusiasts, including NASA, see enormous benefit in the shift — a new era of space exploration that will usher in a more capable and efficient space industry. But the changing dynamic also has left NASA, which for decades has set the pace for the American space project, with an uncertain role, a development NASA’s Safety Aerospace Safety Advisory Panel warns could have consequences for years to come.

Within NASA, there is still some resistance to that paradigm shift. “NASA feels like that’s our domain,” said Phil McAlister, NASA’s director of commercial spaceflight. “And my response is, the solar system is a big place. We at NASA should always be doing the next thing, the thing where the profit motive is not as evident and where the barriers to entry are still too high for the private sector to really make a compelling business case.”

But it did work. And now NASA is relying on the private sector not only to deliver supplies and science experiments to the surface of the moon, but also its most precious cargo — its astronauts — there. Turning over human spaceflight to the private sector was a line many thought NASA would never cross. But last year, SpaceX successfully flew two crewed missions to the space station, and Boeing, the other company with the human spaceflight contract, is hoping to fly its first later this year.

“No doubt, the era of government spacefaring had its glories,” the editorial read. “But space is now a [$424 billion](https://www.spacefoundation.org/2020/07/30/global-space-economy-grows-in-2019-to-423-8-billion-the-space-report-2020-q2-analysis-shows/) business, with U.S. companies at its forefront. The new administration should embrace this revolution — and bring the power of private enterprise to bear in crossing the next cosmic frontier.”

#### Every delay in space colonization kills trillions - their author.

Bostrom 3 – Department of Philosophy, Yale University, Director of the Future of Humanity Institute at Oxford University, 2002 (Nick, “Astronomical Waste: The Opportunity Cost of Delayed Technological Development,” Preprint, Utilitas Vol. 15, No. 3, pp. 308-314, http://www.nickbostrom.com/astronomical/waste.html)

As I write these words, suns are illuminating and heating empty rooms, unused energy is being flushed down black holes, and our great common endowment of negentropy is being irreversibly degraded into entropy on a cosmic scale. These are resources that an advanced civilization could have used to create value-structures, such as sentient beings living worthwhile lives. The rate of this loss boggles the mind. One recent paper speculates, using loose theoretical considerations based on the rate of increase of entropy, that the loss of potential human lives in our own galactic supercluster is at least ~10^46 per century of delayed colonization.[1] This estimate assumes that all the lost entropy could have been used for productive purposes, although no currently known technological mechanisms are even remotely capable of doing that. Since the estimate is meant to be a lower bound, this radically unconservative assumption is undesirable. We can, however, get a lower bound more straightforwardly by simply counting the number or stars in our galactic supercluster and multiplying this number with the amount of computing power that the resources of each star could be used to generate using technologies for whose feasibility a strong case has already been made. We can then divide this total with the estimated amount of computing power needed to simulate one human life. As a rough approximation, let us say the Virgo Supercluster contains 10^13 stars. One estimate of the computing power extractable from a star and with an associated planet-sized computational structure, using advanced molecular nanotechnology[2], is 10^42 operations per second.[3] A typical estimate of the human brain’s processing power is roughly 10^17 operations per second or less.[4] Not much more seems to be needed to simulate the relevant parts of the environment in sufficient detail to enable the simulated minds to have experiences indistinguishable from typical current human experiences.[5] Given these estimates, it follows that the potential for approximately 10^38 human lives is lost every century that colonization of our local supercluster is delayed; or equivalently, about 10^31 potential human lives per second. While this estimate is conservative in that it assumes only computational mechanisms whose implementation has been at least outlined in the literature, it is useful to have an even more conservative estimate that does not assume a non-biological instantiation of the potential persons. Suppose that about 10^10 biological humans could be sustained around an average star. Then the Virgo Supercluster could contain 10^23 biological humans. This corresponds to a loss of potential equal to about 10^14 potential human lives per second of delayed colonization. What matters for present purposes is not the exact numbers but the fact that they are huge. Even with the most conservative estimate, assuming a biological implementation of all persons, the potential for one hundred trillion potential human beings is lost for every second of postponement of colonization of our supercluster.[6]