I negate

My value is justice as that is what the resolution is about. Unjust is defined as

**Not based on or behaving according to what is morally right and fair**

https://www.lexico.com/en/definition/unjust

Definitions

In order to clarify the debate I offer the following definitions:

**Private entity means any natural person, corporation**, general partnership, limited liability company, limited partnership, joint venture, business trust, public benefit corporation, **nonprofit entity, or other business entity.**

[**https://www.lawinsider.com/dictionary/private-entity**](https://www.lawinsider.com/dictionary/private-entity)

#### **“Appropriation of outer space” by private entities refers to the exercise of exclusive control of space.**

TIMOTHY JUSTIN **TRAPP**, JD Candidate @ UIUC Law, ’13, TAKING UP SPACE BY ANY OTHER MEANS: COMING TO TERMS WITH THE NONAPPROPRIATION ARTICLE OF THE OUTER SPACE TREATY UNIVERSITY OF ILLINOIS LAW REVIEW [Vol. 2013 No. 4]

The issues presented in relation to the nonappropriation article of the Outer Space Treaty should be clear.214 The ITU has, quite blatantly, created something akin to “property interests in outer space.”215 It allows nations to exclude others from their orbital slots, even when the nation is not currently using that slot.216 This is directly in line with at least one definition of outer-space appropriation.217 [\*\*Start Footnote 217\*\*Id. at 236 (“**Appropriation of outer space**, therefore, **is ‘the exercise of exclusive control** or exclusive use’ **with a sense of permanence, which limits other nations’ access** to it.”) (quoting Milton L. Smith, The Role of the ITU in the Development of Space Law, 17 ANNALS AIR & SPACE L. 157, 165 (1992)). \*\*End Footnote 217\*\*]The ITU even allows nations with unused slots to devise them to other entities, creating a market for the property rights set up by this regulation.218 In some aspects, this seems to effect exactly what those signatory nations of the Bogotá Declaration were trying to accomplish, albeit through different means.219

My criterion is minimizing structural violence

Prefer for the following reasons

1. Debating about ideal theories such as Deontology or Util is useless- our discussion should be based around finding changes in the real world that can change conditions of oppression. **Curry 14:**

**Despite the pronouncement of debate as an activity** and intellectual exercise **pointing to the real world consequences of dialogue, thinking, and (personal) politics** when addressing issues of racism, sexism, economic disparity, global conflicts, and death, **many of the discussions concerning these ongoing challenges to humanity are fixed to a paradigm which sees the** adjudication of material disparities and sociological realities as the **conquest of one ideal theory over the other.** In “Ideal Theory as Ideology,” Charles Mills outlines the problem contemporary theoretical-performance styles in policy debate and value-weighing in Lincoln-Douglass are confronted with in their attempts to get at the concrete problems in our societies. At the outset, Mills concedes that “ideal theory applies to moral theory as a whole (at least to normative ethics as against metaethics); since ethics deals by definition with normative/prescriptive/evaluative issues, it is set against factual/descriptive issues.” At the most general level, the conceptual chasm between what emerges as actual problems in the world (e.g.: racism, sexism, poverty, disease, etc.) and how we frame such problems theoretically—the assumptions and shared ideologies we depend upon for our problems to be heard and accepted as a worthy “problem” by an audience—is the most obvious call for an anti-ethical paradigm, since such a paradigm that insists on the actual as the basis of what can be considered normatively. Mills, however, describes this chasm as a problem of an ideal-as-descriptive model which argues that for any actual-empirical-observable social phenomenon (P), an ideal of (P) is necessarily a representation of that phenomenon. In the idealization of a social phenomenon (P), one “necessarily has to abstract away from certain features” of (P) that is observed before abstraction occurs. **This gap between what is actual (in the world), and what is represented by theories and politics of debaters proposed in rounds threatens any real discussions about the concrete nature of oppression.** and the racist economic structures which necessitate tangible policies and reorienting changes in our value orientations. As Mills states: “What distinguishes ideal theory is the reliance on idealization to the exclusion, or at least marginalization, of the actual.,” so what we are seeking to resolve on the basis of “thought” is in fact incomplete, incorrect, or ultimately irrelevant to the actual problems which our “theories” seek to address. Our attempts to situate social disparity cannot simply appeal to the ontologization of social phenomenon—meaning we cannot suggest that the various complexities of social problems (which are constantly emerging and undisclosed beyond the effects we observe) are totalizable by any one set of theories within an ideological frame. be it our most cherished notions of Afro-pessimism, feminism, Marxism, or the like. At best, theoretical endorsements make us aware of sets of actions to address ever developing problems in our empirical world, but even this awareness does not command us to only do X, but rather do X and the other ideas which compliment the material conditions addressed by the action X. As a whole, debate (policy and LD) neglects the need to do X in order to remedy our cast-away-ness among our ideological tendencies and politics. How then do we pull ourselves from this seeming ir-recoverability of thought in general and in our endorsement of socially actualizable values like that of the living wage? It is my position that Dr. Martin Luther King Jr.’s thinking about the need for a living wage was a unique, and remains an underappreciated, resource in our attempts to impose value reorientation (be it through critique or normative gestures) upon the actual world. In other words, King aims to reformulate the values which deny the legitimacy of the living wage, and those values predicated on the flawed views of the worker, Blacks, and the colonized (dignity, justice, fairness, rights, etc.) used to currently justify the living wages in under our contemporary moral parameters.

Tommy J. “The Cost of a Thing: A Kingian Reformulation of a Living Wage Argument in the 21st Century” (2014) Victory Briefs, p. 55-56 Assistant Professor, Department of Philosophy, Texas AandM 

First contention: private appropriation of asteroids solves water and energy crises

#### 

**Kean 15** Sam Kean December 2015 "The End of Thirst"<https://www.theatlantic.com/magazine/archive/2015/12/the-end-of-thirst/413176/> (writer based in Washington DC for the Atlantic)//Elmer

**Imagine turning on your tap and seeing no water come out**. Or looking down into your village’s only well and finding it dust-dry. Much of **the developing world** **could** soon **face such a scenario.** According to the United Nations, **1.2 billion** people already **suffer from** severe **water shortages**, and that number is **expected to increase to 1.8 billion** **over the next decade**, in part because of climate change. **Developed countries probably won’t be immune**. California and other states in the western U.S. are already experiencing extreme drought, and **climate experts warn of** even worse to come—multi-decade **megadroughts**. Mass migrations and wars over freshwater loom as real possibilities. Staving off disaster will require conservation, especially in agriculture, which consumes more than two-thirds of all the water humans use. Basic infrastructure maintenance would also go a long way: Some developing countries lose more than half their water through leaky pipes. But **conservation** and maintenance **won’t solve** all our water woes, especially as the planet warms and people continue to pack into cities. As a result, governments around the world are investing in new water-recycling and water-harvesting technologies. Here’s what the future of water might look like. 1. Drinking From the Sea … One obvious solution would be to drink ocean water. Converting seawater into freshwater by stripping out the salt—a process called desalination—offers several advantages. Roughly half the world’s population lives within 65 miles of an ocean, and saltwater accounts for about 97 percent of all water on Earth. Still, desalination presents obstacles. Older plants that boil seawater and collect the vapors, as many of those in the Middle East do, use ungodly amounts of energy. Newer plants that use reverse osmosis—whereby seawater is forced through membranes at high pressure—are more efficient, but still expensive and energy-intensive. The process also produces a briny waste that can harm marine life if not disposed of properly. We can nevertheless expect to see more desalination plants soon—thanks in part to Israel, which all but eliminated its chronic water shortages in the past decade by building four large reverse-osmosis plants, inspiring other countries to follow suit. A $1 billion plant operated by an Israeli company is about to open north of San Diego; it will be the largest in the Western Hemisphere, providing up to 50 million gallons of water a day to Californians. 2. … Or From the Toilet Instead of desalination, some experts favor recycling wastewater—cleaning the water from showers, washing machines, and, yes, toilets—for human consumption. Most water-recycling plants clean water in two basic ways. First, they force it through filters, some of which have holes hundreds of times narrower than a strand of human hair. These filters remove waste particles, organic chemicals, bacteria, viruses, and other dreck. Second, chemicals like hydrogen peroxide or ozone and pulses of ultraviolet light destroy any pathogens that have slipped through. Water recycling is a proven technology: California recycles hundreds of millions of gallons each day for irrigation and other uses. So what’s stopping recycled wastewater from going directly to our taps? Human psychology. The very idea of drinking it disgusts many people. They view such water as irredeemably dirty, little better than toilet water. In reality, recycled water is some of the cleanest drinking water around—as good as or better than the best bottled water. (Breweries in Oregon and California have plans to make beer with recycled water for this very reason—it’s so clean that it’s tasteless, a blank slate.) More to the point, recycled water is far purer than most tap water. By the time the water in the Mississippi reaches New Orleans, for instance, every drop has been used by cities along the river multiple times, and the treatment it gets before going through the taps is nowhere near as extensive as what a water-recycling plant provides. Singapore and Namibia have recycled water for years with no adverse health effects, and nasa began recycling water on the International Space Station in 2008. (The Russian cosmonauts there don’t recycle their pee, but they give the Americans bags of it to recycle and then drink.) In the United States, a few parched towns in Texas and New Mexico drink recycled wastewater already, and last year the city of San Diego—which gets most of its water from rivers that are running dry—approved a $3 billion recycling plant that would provide one-third of its tap water, 83 million gallons a day, by 2035. San Diego had rejected essentially the same plan in 1998, but this time the city decided it had no other choice. 3. Microbe Power Rather than filtering out organic waste, water-recycling plants might one day be able to break it down with microbes, a process that could bring an ancillary benefit: electric power. As they digest the gunk in wastewater, certain species of bacteria, called electricigens, can liberate electrons, the stuff of electricity. Producing electrons is actually common in nature—much of photosynthesis involves shuttling them around. Unlike plants, though, electricigens don’t store electrons internally. They use microscopic appendages that look like hairs to deposit the electrons onto external surfaces, usually minerals. In experimental fuel cells, scientists have replaced the minerals with wires and harvested electrons. Someday the bacteria might even generate enough power to run a water-recycling plant, making it self-sufficient. 4. Keeping It Simple Some up-and-coming water technologies are startlingly straightforward. People on arid plateaus, for instance, can string a fine plastic mesh between two posts and use it to capture water from fog that rolls through, collecting the drops in storage tanks. Existing systems in one small Guatemalan village can collect 6,300 liters a day, and more during the wet season. Scientists think that updating the mesh with new materials and tighter weaves could dramatically improve yields. People could even channel the water into hydroponic gardens to grow food. Imagine famously foggy San Francisco with a farm on every rooftop. Oil films present another low-tech opportunity. Reservoirs lose appalling amounts of water to evaporation: By some estimates, more water escapes into the air than is used by humans. But covering the surface with an extremely thin layer—even just one molecule thick—of nontoxic chemicals derived from coconut or palm oil can cut evaporative losses. Wind tends to break up layers of oil, re-exposing the water to the elements. But drones or blimps equipped with sensors could someday monitor reservoirs and signal where oil needed to be re-applied. In one recent test, spreading oil over a lake in Texas (via boats) appears to have cut evaporation by about 15 percent. 5. Making It Rain Of course, for every modest proposal to save water, there’s an audacious one floating around. Take weather modification. Advocates of the idea hope to significantly boost precipitation using a process called “cloud seeding”: spraying clouds with a chemical like silver iodide, which acts as a nucleus around which water droplets collect. The droplets then fall to Earth as rain or snow. That’s the theory, at least. The first large-scale experiments, in the 1940s, generated a lot of excitement. More recently, weather modification has been dogged by accusations of hype and questions about its reliability. A six-year program in Wyoming claimed to have squeezed 5 to 15 percent more precipitation out of the clouds it seeded. Unfortunately, conditions were suitable for seeding only 30 percent of the time, so the total increase in precipitation was closer to 3 percent. That’s not nothing, especially during droughts. But weather modification may be the flying car of water technology—a tantalizing idea that’s forever on the horizon. 6. The Moon Shot I**f Earth** does **run dry**, **we might** be able to **save ourselves by mining water from asteroids** and comets. Scientists have landed probes on these space rocks to study them. Future landers could mine them in deep space or possibly even drag them back toward Earth. Though the idea sounds far-fetched, space-mining companies already exist, and one of them, Planetary Resources, expects to start harvesting resources from asteroids in about a decade. According to Planetary Resources, **a single 1,600-foot-wide asteroid could yield** more platinum than has ever been mined in human history. But **water** could prove to be the real prize for space-mining companies. Some astronomers believe that **the asteroid Ceres**, which sits between Jupiter and Mars, may **contain** **more freshwater** (as ice) **than all of Earth does.** In addition to quenching people’s thirst, this water could be turned into fuel for interplanetary spaceships. In that case, an ample supply of water would be the key to a happy future not just down here on the ground, but up among the stars as well.

Subpoint B)

There is currently an energy crisis and its only going to get worse

#### **Horowitz 21**

(Julia Horowitz, a senior writer. She leads CNN Business international coverage of global markets and business , October 7th, 2021, A global energy crisis is coming. There's no quick fix, CNN Business,<https://www.cnn.com/2021/10/07/business/global-energy-crisis/index.html>) SJ

**A global energy crunch caused by weather and a resurgence in demand is getting worse, stirring alarm ahead of the winter, when more energy is needed to light and heat homes**. Governments around the world are trying to limit the impact on consumers, but acknowledge they may not be able to prevent bills spiking. Further complicating the picture is mounting pressure on governments to accelerate the transition to cleaner energy as world leaders prepare for a critical climate summit in November. **In China,** [**rolling blackouts**](https://edition.cnn.com/2021/09/28/economy/china-power-shortage-gdp-supply-chain-intl-hnk/index.html) **for residents have already begun, while in India power stations are scrambling for coal.** [**Consumer advocates in Europe**](https://twitter.com/beuc/status/1445702126336761865?s=20) **are calling for a ban on disconnections if customers can't promptly settle what they owe**. **"This price shock is an unexpected crisis at a critical juncture," EU energy chief Kadri Simson said Wednesday, confirming the bloc will outline its longer-term policy response next week.** "The immediate priority should be to mitigate social impacts and protect vulnerable households." **In Europe, natural gas is now trading at the equivalent of $230 per barrel, in oil terms — up more than 130% since the beginning of September and more than eight times higher than the same point last year, according to data from Independent Commodity Intelligence Services.** **In East Asia, the cost of natural gas is up 85% since the start of September, hitting roughly $204 per barrel in oil terms.** Prices remain much lower in the United States, a net exporter of natural gas, but still have shot up to their highest levels in 13 years. "A lot of it is feeding off of fear about what the winter's going to look like," said Nikos Tsafos, an energy and geopolitics expert at the Center for Strategic and International Studies, a Washington-based think tank. He thinks that anxiety has caused the market to break away from the fundamentals of supply and demand. **The frenzy to secure natural gas is also pushing up the price of coal and oil, which can be used as substitutes in some cases, but are even worse for the climate.** India, which remains extremely dependent on coal, said this week that as many as 63 of its 135 coal-fired power plants have [**two days or less**](https://edition.cnn.com/2021/10/06/energy/india-energy-crisis-coal-hnk-intl/index.html) of supplies. The circumstances are causing central banks and investors to worry. Rising **energy prices are contributing to inflation**, which already was a major concern as the global economy tries to shake off the lingering effects of Covid-19. Dynamics over the **winter could make matters worse.**

#### Subpoint C) Government programs, or public appropriation is ineffective at best

#### **Stossel 20**

(John Stossel, July 29, 2020, The Private Space Race,<https://www.capitalismmagazine.com/2020/07/the-private-space-race/>) SJ

**An Obama administration committee had concluded that launching such a vehicle would take 12 years and cost $36 billion. But this rocket was finished in half that time — for less than $1 billion (1/36th the predicted cost). That’s because it was built by Elon Musk’s private company, Space X. He does things faster and cheaper because he spends his own money.** “This is the potential of free enterprise!” explains aerospace engineer Robert Zubrin in my newest video. Of course, years ago, NASA did manage to send astronauts to the moon. That succeeded, says Zubrin, “because it was purpose-driven. (America) wanted to astonish the world what free people could do.” **But in the 50 years since then, as transportation improved** and computers got smaller and cheaper, **NASA made little progress.** Fortunately, President Obama gave private companies permission to compete in space, saying, “We can’t keep doing the same old things as before.” **Competition then cut the cost of space travel to a fraction of what it was.** Why couldn’t NASA have done that? Because after the moon landing, it became a typical government agency — overbudget and behind schedule. Zubrin says NASA’s purpose seemed to be to “supply money to various suppliers.” Suppliers were happy to go along. Zubrin once worked at Lockheed Martin, where he once discovered a way for a rocket to carry twice as much weight. “We went to management, the engineers, and said, ‘Look, we could double the payload capability for 10% extra cost.’ They said, ‘Look, if the Air Force wants us to improve the Titan, they’ll pay us to do it!'” NASA was paying contractor’s development costs and then adding 10% profit. The more things cost, the bigger the contractor’s profit. So contractors had little incentive to innovate. Even NASA now admits this is a problem. During its 2020 budget request, Administrator Jim Bridenstine confessed, “We have not been good at maintaining schedule and … at maintaining costs.”Nor is NASA good at innovating. **Their technology was so out of date, says Zubrin, that “astronauts brought their laptops with them into space — because shuttle computers were obsolete.”** I asked, “When (NASA) saw that the astronauts brought their own computers, why didn’t they upgrade?” “Because they had an entire philosophy that various components had to be space rated,” he explains. “Space rating was very bureaucratic and costly.” NASA was OK with high costs as long as spaceships were assembled in many congressmen’s districts. “NASA is a very large job program,” says Aerospace lawyer James Dunstan. “By spreading its centers across the country, NASA gets more support from more different congressmen.” Congressmen even laugh about it. Randy Weber, R-Texas, joked, “We’ll welcome (NASA) back to Texas to spend lots of money any time.” Private companies do more with less money. One of Musk’s cost-saving innovations is reusable rocket boosters. For years, NASA dropped its boosters into the ocean. “Why would they throw it away?” I ask Dunstan. “Because that’s the way it’s always been done!” he replies. Twenty years ago, at Lockheed Martin, Zubrin had proposed reusable boosters. His bosses told him: “Cute idea. But if we sell one of these, we’re out of business.” Zubrin explains, “They wanted to keep the cost of space launch high.” **Thankfully, now that self-interested entrepreneurs compete, space travel will get cheaper. Musk can’t waste a dollar. Space X must compete with Jeff Bezos’ Blue Origin, Richard Branson’s Virgin Galactic, Boeing, Lockheed Martin and others.The private sector always comes up with ways to do things that politicians cannot imagine. Government didn’t invent affordable cars, airplanes, iPhones, etc. It took competing entrepreneurs, pursuing profit, to nurture them into the good things we have now.** Get rid of government monopolies.

#### Subpoint D) Solar power satellites solves the energy crisis

#### **Snowden 19**

(Scott Snowden, Mar 12, 2019, has written about science and technology for 20 years for publications around the world, Solar Power Stations In Space Could Supply The World With Limitless Energy, Forbes,<https://www.forbes.com/sites/scottsnowden/2019/03/12/solar-power-stations-in-space-could-supply-the-world-with-limitless-energy/?sh=23471fec4386> ) SJ

**While on the surface of the Earth, society still struggles to adopt solar energy solutions, many scientists maintain that giant, space-based solar farms could provide an environmentally-friendly answer to the world's energy crisis.** Only last week, we reported that China [**was planning to**](https://www.forbes.com/sites/scottsnowden/2019/03/05/china-plans-to-build-the-worlds-first-solar-power-station-in-space/#51f7f9c35c94) build the world's first solar power station to be positioned in Earth's orbit. **Because the sun always shines in space, an orbital solar** power station **is seen as an inexhaustible source of clean energy.** "Above the Earth, there's no day and night cycle and no clouds or weather or anything else that might obstruct the sun's ray, so a constant power source is available," said Ali Hajimiri, professor of electrical engineering at the California Institute of Technology and co-director of the university’s [**Space Solar Power Project**](https://www.spacesolar.caltech.edu/). Collecting solar power in space and wirelessly transmitting was first described by Isaac Asimov in 1941 in his short story Reason. In 1968, American aerospace engineer Peter Glaser published the first technical article on the concept – Power From The Sun: Its Future in the journal [**Science**](http://www.sciencemag.org/). Space-based solar power attracted considerable attention in the 1970s as the necessary individual technical components – in essence, photovoltaic cells, satellite technology and wireless power transmission – were developed. Despite **the concept** being technically feasible, it **was considered economically unrealistic** at the time **and research ultimately stalled. “The idea seems to be going through a resurgence and it’s probably because the technology exists to make it happen,” said John Mankins, a former NASA scientist who was at the forefront of this field in the 1990s, before it was abandoned. Global energy demands are only going to grow, says Hajimiri. The global population is expected to reach a staggering 9.6 billion by 2050, according to a** [**United Nations report**](http://www.un.org/en/development/desa/news/population/un-report-world-population-projected-to-reach-9-6-billion-by-2050.html)**, so methods of generating large quantities of clean energy must be found.** A space-based solar power system could provide energy to everyone, even in places that don't receive sunlight all year round, like northern Europe and Russia. In April of 2015, a research agreement between Northrop Grumman and Caltech provided up to $17.5m for the development of innovations necessary to enable a space solar power system. Three Caltech professors head up the project: joining Hajimiri were Harry Atwater and Sergio Pellegrino. Caltech is just one institution working on developing this technology. We know that scientists at the Chongqing Collaborative Innovation Research Institute for Civil-Military Integration in China are constructing a facility to test the theoretical viability of the concept and plans to develop an orbital photovoltaic array [**were announced**](https://phys.org/news/2009-11-japan-eyes-solar-station-space.html) in Japan some time ago. One of the biggest issues to overcome is that of getting an array of solar panels large enough to make the project viable into orbit. Early concept designs in the 1970s featured giant arrays that would've proved very difficult to actually get into orbit. "The systems of the 70s for solar power satellites, the cost estimates suggested, at that time, that it might be as much as a trillion dollars to get to the first kilowatt hour because of the way the designs worked. Essentially a single satellite, a platform, an integrated, monolithic platform about the size of Manhattan," said Mankins**.However, with SpaceX and Blue Origin** slowly **driving the cost of orbital delivery down,** suddenly **the concept seems** alittle **closer** **to** **reality.** "Going to modular systems to allow mass production, I believe was the answer to how to get solar power satellite costs down to something more reasonable," said Mankins.

#### Subpoint E) Energy crisis results in war

#### **Klare 14**

(Micheal T Klare, July 15, 2014, Twenty-first century energy wars: how oil and gas are fuelling global conflicts, a Five Colleges professor of Peace and World Security Studies,<https://energypost.eu/twenty-first-century-energy-wars-oil-gas-fuelling-global-conflicts/>) SJ

**As these conflicts and others like them suggest, fighting for control over key energy assets or the distribution of oil revenues is a critical factor in most contemporary warfare. While ethnic and religious divisions may provide the political and ideological fuel for these battles, it is the potential for mammoth oil profits that keeps the struggles alive. Without the promise of such resources, many of these conflicts would eventually die out for lack of funds to buy arms and pay troops.** So long as the oil keeps flowing, however, the belligerents have both the means and incentive to keep fighting. **In a fossil-fuel world, control over oil and gas reserves is an essential component of national power.** “Oil fuels more than automobiles and airplanes,” Robert Ebel of the Center for Strategic and International Studies [**told**](http://2001-2009.state.gov/s/p/of/proc/tr/10187.htm) a State Department audience in 2002. “Oil fuels military power, national treasuries, and international politics.” Far more than an ordinary trade commodity, “it is a determinant of well being, of national security, and international power for those who possess this vital resource, and the converse for those who do not.” If anything, that’s even truer today, and as energy wars expand, the truth of this will only become more evident**. Someday, perhaps, the development of renewable**

#### **My second contention is that Asteroid mining can happen with private sector innovation and is key to solve a laundry list of impacts--climate change, economic decline and asteroid collisions. Taylor 19**

Chris Taylor [journalist, was senior news writer for Time.com, San Francisco bureau chief for Time magazine], 19 - ("How asteroid mining will save the Earth — and mint trillionaires," Mashable, 2019, accessed 12-13-2021, https://mashable.com/feature/asteroid-mining-space-economy)//ML

**How much, exactly? We’re only just beginning to guess.** [**Asterank**](http://www.asterank.com/)**, a service that keeps track of some 6,000 asteroids in NASA’s database, prices out the estimated mineral content in each one in the current world market. More than 500 are listed as “>$100 trillion.” The estimated profit on just the top 10 asteroids judged “most cost effective” — that is, the easiest to reach and to mine, subtracting rocket fuel and other operating costs, is around $1.5 trillion.¶ Is it ours for the taking? Well, here’s the thing — we’re taking it already, and have been doing so since we started mining metals thousands of years ago. Asteroid strikes are the only reason rare metals exist in the Earth’s crust; the native ones were all sucked into our planet’s merciless iron core millions of years ago. Why not go to the source?¶ As a side project, space mining can grab water from the rocks and comets — water which, with a little processing makes rocket fuel. Which in turn makes even more currently unimaginable space operations possible, including ones that could give the planet all the energy it needs to avert climate catastrophe. Cislunar space — the bit around us and the moon, the local neighborhood, basically — is about to get very interesting.¶ It’s hard, even for the most asteroid-minded visionaries, to truly believe the full scope of this future space economy right now. Just as hard as it would have been in 1945, when an engineer named Vannevar Bush first proposed** [**a vast library of shared knowledge that people the world over would access via personal computers**](https://en.wikipedia.org/wiki/Memex)**, to see that mushroom into a global network of streaming movies and grandmas posting photos and trolls and spies who move the needle on presidential elections. ¶ No technology’s pioneer can predict its second-order effects.¶ The space vision thing is particularly difficult in 2019. Not only do we have plenty of urgent problems with democracy and justice to keep us occupied, but the only two companies on the planet to have gone public with asteroid-mining business plans, startups that seemed to be going strong and had launched satellites already, were just bought by larger companies that are, shall we say, less comfortable executing on long-term visions.¶ Planetary Resources was founded in 2012 in a blaze of publicity. Its funding came from, among others, Larry Page, Eric Schmidt, Ross Perot, and the country of Luxembourg. It had inked an orbital launch deal with Virgin Galactic. And it was sold last October to a blockchain software company. (To 21st century readers, this paragraph would look like I’m playing tech world mad libs.)¶ In January, the other company, Deep Space Industries, also partly funded by Luxembourg (way to get in the space race, Luxembourg!), was sold to Bradford Space, owned by a U.S. investment group called the American Industrial Acquisition Corporation. Maybe these new overlords plan on continuing their acquisitions' asteroid mining endeavors rather than stripping the companies for parts. Both companies have been notably silent on the subject. “The asteroid mining bubble has burst,”** [**declared The Space Review**](http://www.thespacereview.com/article/3633/1)**, one of the few online publications to even pay attention.¶ That’s also to be expected. After all, anyone trying to build Google in 1945 would go bankrupt. Just as the internet needed a half-dozen major leaps forward in computing before it could even exist, space industry needs its launch infrastructure.¶ Currently, the world’s richest person and its most well-known entrepreneur, Jeff Bezos and Elon Musk, respectively, are working on the relatively cheap reusable rockets asteroid pioneers will need. (As I was writing this, Bezos announced in an email blast that one of his New Shepherd rockets had flown to space and back five times like it was nothing, delivering 38 payloads for various customers while remaining entirely intact.) ¶ Meanwhile, quietly, Earth’s scientists are laying the groundwork of research the space economy needs. Japan’s Hayabusa 2 spacecraft has been in orbit around asteroid Ryugu for the last year and a half, learning everything it can. (Ryugu, worth $30 billion according to Asterank, is the website's #1 most cost-effective target.) The craft dropped** [**tiny hopping robot rovers**](https://www.space.com/41941-hayabusa2-asteroid-rovers-hopping-tech.html) **and a** [**small bomb**](https://www.space.com/japan-hayabusa2-asteroid-bomb-video.html) **on its target; pictures of the small crater that resulted were released afterwards.¶ Officially, the mission is to help us figure out how the solar system formed. Unofficially, it will help us understand whether all those useful metals clump together at the heart of an asteroid, as some theorize. If so, it’s game on for asteroid prospectors. If not, we can still get at the metals with other techniques, such as optical mining (which basically involves sticking an asteroid in a bag and drilling with sunlight; sounds nuts to us, but** [**NASA has proved it in the lab**](https://www.nasa.gov/directorates/spacetech/niac/2017_Phase_I_Phase_II/Sustainable_Human_Exploration/)**). It’ll just take more time.¶ Effectively, we’ve just made our first mark at the base of the first space mineshaft. And there’s more to come in 2020 when Hayabusa 2 returns to Earth bearing samples. If its buckets of sand contain a modicum of gold dust, tiny chunks of platinum or pebbles of compressed carbon — aka diamonds — then the Duchy of Luxembourg won’t be the only deep-pocketed investor to sit up and take notice.¶ The possibility of private missions to asteroids, with or without a human crew, is almost here. The next step in the process that takes us from here to where you are? Tell us an inspiring story about it, one that makes people believe, and start to imagine themselves mining in space. How would you explain the world-changing nature of the internet to 1945? How would you persuade them that there was gold to be mined in Vannevar Bush’s idea? You’d let the new economy and its benefits play out in the form of a novel.¶ As Hayabusa dropped a bomb on Ryugu, Daniel Suarez was making the exact same asteroid the target of his fiction. Suarez is a tech consultant and developer turned New York Times bestselling author. His novels thus far have been techno-thrillers: his debut,** [**Daemon**](https://www.amazon.com/dp/B003QP4NPE/ref=dp-kindle-redirect?_encoding=UTF8&btkr=1)**, a novel of Silicon Valley’s worst nightmare, AI run rampant, made more than a million dollars.¶ So it was a telling shift in cultural mood that Suarez’s latest thriller is also a very in-depth description of — and thinly-disguised advocacy for — asteroid mining. In** [**Delta-v**](https://www.amazon.com/Delta-v-Daniel-Suarez-ebook/dp/B07FLX8V84/ref=sr_1_1?crid=UMNUUSR3NCBX&keywords=delta-v&qid=1556930756&s=digital-text&sprefix=delta-v%2Cdigital-text%2C204&sr=1-1)**, published in April, a billionaire in the 2030s named Nathan Joyce recruits a team of adventurers who know nothing about space — a world-renowned cave-diver, a world-renowned mountaineer — for the first crewed asteroid mission.¶ Elon Musk fans might expect this to be Joyce’s tale, but he soon fades into the background. The asteroid-nauts are the true heroes of Delta-v. Not only are they offered a massive payday — $6 million each for four years’ work — they also have agency in key decisions in the distant enterprise. Suarez deliberately based them on present-day heroes. The mission is essential, Joyce declares, to save Earth from its major problems. First of all, the fictional billionaire wheels in a fictional Nobel economist to demonstrate the actual truth that the entire global economy is sitting on a** [**mountain of debt**](https://www.washingtonpost.com/opinions/the-247-trillion-global-debt-bomb/2018/07/15/64c5bbaa-86c2-11e8-8f6c-46cb43e3f306_story.html?noredirect=on&utm_term=.5fb3ff1155d9)**. It has to keep growing or it will implode, so we might as well take the majority of the industrial growth off-world where it can’t do any more harm to the biosphere.¶ Secondly, there’s the climate change fix. Suarez sees asteroid mining as the only way we’re going to build** [**solar power satellites**](https://en.wikipedia.org/wiki/Space-based_solar_power)**. Which, as you probably know, is a form of uninterrupted solar power collection that is theoretically more effective, inch for inch, than any solar panels on Earth at high noon, but operating 24/7. (In space, basically, it’s always double high noon). ¶ The power collected is beamed back to large receptors on Earth with large, low-power microwaves, which researchers think will be harmless enough to let humans and animals pass through the beam. A space solar power array like** [**the one China is said to be working on**](https://www.forbes.com/sites/scottsnowden/2019/03/12/solar-power-stations-in-space-could-supply-the-world-with-limitless-energy/#2d3f78a54386) **could reliably supply 2,000 gigawatts — or over 1,000 times more power than the largest solar farm currently in existence. ¶ “We're looking at a 20-year window to completely replace human civilization's power infrastructure,” Suarez told me, citing the report of the Intergovernmental Panel on Climate Change on the coming catastrophe. Solar satellite technology “has existed since the 1970s. What we were missing is millions of tons of construction materials in orbit. Asteroid mining can place it there.”¶** The Earth-centric early 21st century can’t really wrap its brain around this, but the idea is not to bring all that building material and precious metals down into our gravity well. Far better to create a whole new commodities exchange in space. You mine the useful stuff of asteroids both near to Earth and far, thousands of them taking less energy to reach than the moon. That’s something else we’re still grasping, how relatively easy it is to ship stuff in zero-G environments. ¶ Robot craft can move 10-meter boulders like they’re nothing. You bring it all back to sell to companies that will refine and synthesize it in orbit for a myriad of purposes. Big pharma, to take one controversial industry, would [benefit by taking its manufacturing off-world](https://medium.com/fitch-blog/why-is-big-pharma-interested-in-the-space-economy-c078ac1bf67c). The molecular structure of many chemicals grows better in microgravity.¶ The expectation is that a lot of these space businesses — and all the orbital infrastructure designed to support them — will be automated, controlled remotely via telepresence, and monitored by AI. But Suarez is adamant that thousands if not millions of actual human workers will thrive in the space economy, even as robots take their jobs in old industries back on Earth.¶ “Our initial expansion into space will most likely be unsettled and experimental. Human beings excel in such environments,” he says. “Humans can improvise and figure things out as we go. Robots must be purpose-built, and it's going to take time and experience for us to design and build them.”¶ Which is another way startups back on Earth will get rich in the new economy: designing and building those robots, the nearest thing to selling picks and shovels to prospectors in the space gold rush. Thousands of humans in space at any one time will also require the design and construction of stations that spin to create artificial gravity. Again, this isn’t a great stretch: Using centrifugal force to simulate gravity in space was first proposed by scientists in the 19th century. NASA has had workable designs for spinning cislunar habitats called [O’Neill cylinders](https://en.wikipedia.org/wiki/O%27Neill_cylinder) since the 1970s. We just haven’t funded them. ¶ But the trillionaires clearly will.¶ In short, Suarez has carefully laid out a vision of the orbital economy that offers something for everyone in our divided society. For Green New Deal Millennials, there’s the prospect of removing our reliance on fossil fuels at a stroke and literally lifting dirty industries off the face of the planet. For libertarians and other rugged individualists, there’s a whole new frontier to be developed, largely beyond the reach of government. ¶ For those who worry about asteroids that could wipe out civilization — though luckily, [this isn't likely to happen any time soon](https://mashable.com/article/armageddon-asteroid-threat) — here is a way for humanity to get proficient in moving them out of the way, fast. Indeed, the National Space Society has offered [a proposal](https://space.nss.org/technologies-for-asteroid-capture-into-earth-orbit/) to capture the asteroid Aphosis (which is set to miss Earth in the year 2029, but [not by a very comfortable margin](https://www.space.com/asteroid-apophis-2029-flyby-planetary-defense.html)), keep it in orbit, and turn it into 150 small solar-power satellites, as a proof of concept. ¶ For the woke folks who care about the bloody history of diamond production, there’s the likelihood that space mining would wipe out Earth’s entire diamond industry. “They will be found in quantities unattainable on Earth,” claims Suarez, with good reason. We are starting to discover that there is more crystalized carbon in the cosmos than we ever suspected. Astronomers have identified one [distant planet made entirely of diamond](https://www.nationalgeographic.com/science/phenomena/2014/06/24/diamond-the-size-of-earth/); there may be more, but they are, ironically, hard to see. ¶ We don’t have diamond planets in our solar system (and we can’t do interstellar missions), but we do have diamond-studded asteroids. Mine them for long enough and you will wear diamonds on the soles of your shoes.¶ For investors and entrepreneurs, there is the thrill of racing to be the first member of the four-comma club. ([Neil deGrasse Tyson believes that the first trillionaire will be an asteroid mining mogul](https://www.nbcnews.com/science/space/neil-degrasse-tyson-says-space-ventures-will-spawn-first-trillionaire-n352271); Suarez isn’t sure whether they’ll be the first, but he suspects that asteroid mining “will mint more trillionaires than any industry in history.”) ¶ For the regular guy or gal with a 401K, there’ll be a fast-rising stock market — inflated not by financial shenanigans this time, but an actual increase in what the world counts as wealth.¶ For workers, there is the promise of sharing in the untold riches, both legally and otherwise. It would be hard to stop miners attaining mineral wealth beyond their paycheck, under the table, when your bosses are millions of miles away. Then there’s the likelihood of rapid advancement in this new economy, where the miners fast gain the knowledge necessary to become moguls.¶ “After several tours in space working for others, perhaps on six-month or year-long contracts, it's likely that some workers will partner to set up their own businesses there,” says Suarez. “Either serving the needs of increasing numbers of workers and businesses in space, marketing services to Earth, or launching asteroid mining startups themselves.” All in all, it’s starting to sound a damn sight more beneficial to the human race than the internet economy is. Not a moment too soon. I’ve written encouragingly about asteroid mining several times before, each time touting the massive potential wealth that seems likely to be made. And each time there’s been a sense of disquiet among my readers, a sense that we’re taking our rapacious capitalist ways and exploiting space.¶ Whereas the truth is, this is exactly the version of capitalism humanity has needed all along: the kind where there is no ecosystem to destroy, no marginalized group to make miserable. A safe, dead space where capitalism’s most enthusiastic pioneers can go nuts to their hearts’ content, so long as they clean up their space junk. ¶ ([Space junk](https://mashable.com/category/space-junk) is a real problem in orbital space because it has thousands of vulnerable satellites clustered closely together around our little blue rock. The vast emptiness of cislunar space, not so much.)¶ And because they’re up there making all the wealth on their commodities market, we down here on Earth can certainly afford to focus less on growing our stock market. Maybe even, whisper it low, we can afford a fully functioning social safety net, plus free healthcare and free education for everyone on the planet.¶ It’s also clearly the area where we should have focused space exploration all along. If we settle on Mars, we may disturb as-yet-undiscovered native bacteria — and as the character Nathan Joyce shouts at a group of “Mars-obsessed” entrepreneurs in Delta-V, Mars is basically filled with toxic sand and is thus looking increasingly impossible to colonize. (Sorry, Mark Watney from The Martian, those potatoes would probably kill you.)

#### Global Warming will cause slow violence and extinction

Bill **McKibben 19**, Schumann Distinguished Scholar at Middlebury College; fellow of the American Academy of Arts and Sciences; holds honorary degrees from 18 colleges and universities; Foreign Policy named him to their inaugural list of the world’s 100 most important global thinkers. "This Is How *Human Extinction* Could Play Out." Rolling Stone. 4-9-2019. https://www.rollingstone.com/politics/politics-features/bill-mckibben-falter-climate-change-817310/

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