### 1

**Space tourism is essential to the development of commercial space, that’s my opponent’s own card**

I’m reading blue

**Webber 12** [Derek Webber is a former rocket and satellite engineer, commercial space industry executive, space tourism entrepreneur, and the author of several books on commercial space, popular space history, and space tourism. For two decades his contributions have been essential to the development of the space tourism industry, both in the United States and Europe. “SPACE TOURISM – ESSENTIAL STEP IN HUMAN SETTLEMENT OF SPACE.” International Astronautical Conference. 2012. <https://www.spaceportassociates.com/pdf/human_settlement.pdf>]

* The sections in pt. 6 font are other sections of the article --- they’re mostly very technical and not relevant, but feel free to read through them

This paper draws attention to the essential role of space tourism, as a commercial enabler, in the development of a sustainable long term strategy for exploration and settlement of solar system objects. Since governments will not be able to obtain all of the necessary funding and public support over the long duration necessary (multiple election cycles in democracies) in order to unilaterally, or even in collaboration, conduct missions to explore and colonize the Moon, Mars or other solar system objects, other alternative sources for such funding are explored. These sources would provide an economic development basis for such a venture, and simultaneously engage the general public through direct involvement to eventually make such a venture possible. The analysis determines that space tourism is the one near-term commercial space market sector whose development can lead to the desired long term results. A major consequence of a successful space tourism industry, in addition to creating an involved public, will be regular, safe and relatively low cost journeys to and from low earth orbit. This in turn will provide a new starting point, or platform, for the long term exploration and settlement of the solar system through further economic development stages. A basic architecture is described for a sustainable approach to the exploration and colonization of solar system objects, which relies as a key factor on the successful development of a viable space tourism industry.

#### Strong commercial space catalyzes tech innovation – progress at the margins and spinoff tech change global information networks

Joshua Hampson 2017, Security Studies Fellow at the Niskanen Center, 1-25-2017, “The Future of Space Commercialization”, Niskanen Center, https://republicans-science.house.gov/sites/republicans.science.house.gov/files/documents/TheFutureofSpaceCommercializationFinal.pdf

Innovation is generally hard to predict; some new technologies seem to come out of nowhere and others only take off when paired with a new application. It is difficult to predict the future, but it is reasonable to expect that a growing space economy would open opportunities for technological and organizational innovation. In terms of technology, the difficult environment of outer space helps incentivize progress along the margins. Because each object launched into orbit costs a significant amount of money—at the moment between $27,000 and $43,000 per pound, though that will likely drop in the future —each 19 reduction in payload size saves money or means more can be launched. At the same time, the ability to fit more capability into a smaller satellite opens outer space to actors that previously were priced out of the market. This is one of the reasons why small, affordable satellites are increasingly pursued by companies or organizations that cannot afford to launch larger traditional satellites. These small 20 satellites also provide non-traditional launchers, such as engineering students or prototypers, the opportunity to learn about satellite production and test new technologies before working on a full-sized satellite. That expansion of developers, experimenters, and testers cannot but help increase innovation opportunities. Technological developments from outer space have been applied to terrestrial life since the earliest days of space exploration. The National Aeronautics and Space Administration (NASA) maintains a website that lists technologies that have spun off from such research projects. Lightweight 21 nanotubes, useful in protecting astronauts during space exploration, are now being tested for applications in emergency response gear and electrical insulation. The need for certainty about the resiliency of materials used in space led to the development of an analytics tool useful across a range of industries. Temper foam, the material used in memory-foam pillows, was developed for NASA for seat covers. As more companies pursue their own space goals, more innovations will likely come from the commercial sector. Outer space is not just a catalyst for technological development. Satellite constellations and their unique line-of-sight vantage point can provide new perspectives to old industries. Deploying satellites into low-Earth orbit, as Facebook wants to do, can connect large, previously-unreached swathes of 22 humanity to the Internet. Remote sensing technology could change how whole industries operate, such as crop monitoring, herd management, crisis response, and land evaluation, among others. 23 While satellites cannot provide all essential information for some of these industries, they can fill in some useful gaps and work as part of a wider system of tools. Space infrastructure, in helping to change how people connect and perceive Earth, could help spark innovations on the ground as well. These innovations, changes to global networks, and new opportunities could lead to wider economic growth.

#### Tech innovation solves every existential threat – cumulative extinction events outweigh the aff

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

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

### 2

#### Interpretation: Appropriation means use, exploitation, or occupation that is permanent and to the exclusion of others

Babcock 19 Professor of Law, Georgetown University Law Cente. Babcock, Hope M. "The Public Trust Doctrine, Outer Space, and the Global Commons: Time to Call Home ET." Syracuse L. Rev. 69 (2019): 191.

Article II is one of those succeeding provisions that curtails “the freedom of use outlined in Article [I] by declaring that outer space, including the [m]oon and other celestial bodies, is not subject to national appropriation.”147 It flatly prohibits national appropriation of any celestial body in outer space “by means of use or occupation, or by any other means.”148 However, “many types of ‘use’ or ‘exploitation’. . . are inconceivable without appropriation of some degree at least of any materials taken,” like ore or water.149 If this view of Article II’s prohibitory language is correct, then “it is not at all farfetched to say that the OST actually installs a blanket prohibition on many beneficial forms of development.”150 However, the OST only prohibits an appropriation that constitutes a “long-term use and permanent occupation, to the exclusion of all others.”151

#### Violation: Space tourism is, by definition, temporary – people briefly go to space in a rocket ship and then return to Earth

#### 1] Precision – if we win definitions the aff doesn’t defend a shift from the squo or solve their advantages – so at best vote negative on presumption. The resolution is the only predictable stasis point for dividing ground—any deviation justifies the aff arbitrarily jettisoning words in the resolution at their whim which decks negative ground and preparation because the aff is no longer bounded by the resolution.

#### 2] Predictable limits—Letting temporary occupation be appropriation is a limits diaster - any aff about a single space ship, satellite, or weapon would be T because they temporarily occupy space. Limits explodes neg prep burden and draws un-reciprocal lines of debate, where the aff is always ahead, turns their pragmatics offense

#### Topicality is a voting issue that should be evaluated through competing interpretations – it tells the negative what they do and do not have to prepare for—there’s no way for the negative to know what constitutes a “reasonable interpretation” when we do prep – reasonability is arbitrary and causes a race to the bottom, proliferating abuse

#### No RVIs—it’s your burden to be topical.

### 3

#### CP: States should ban rocket propellants that produce alumina particles in the stratosphere or deposit black soot in the stratosphere.

#### There are empirical alternatives, and the CP solves ozone depletion

Mortillaro 21 (Nicole Mortillaro, Senior Reporter, Science, She is the editor of the Journal of the Royal Astronomical Society of Canada and the author of several books., 4/22/21, Canadian Broadcasting Corporation, “Rocket launches could be affecting our ozone layer, say experts”, <https://www.cbc.ca/news/science/rocket-launches-environment-1.5995252>, Accessed 1/27/22, HKR-RKT)

Black soot in the atmosphere The stratosphere is an important weather driver for Earth's systems, and that's where some particles from rocket launches are ending up. The ozone layer, which helps protect us from the sun's harmful ultraviolet rays, is also located in the stratosphere. In 1990, the Montreal Protocol was signed into law, banning harmful ozone-depleting substances, such as chlorofluorocarbons (CFCs), used in things like refrigerators and air conditioners, after it was revealed that the ozone layer was being stripped away by these chemicals. While the protocol touched on airlines, there was no mention of the aerospace industry. But now some industry experts are concerned that with no oversight, we could be in for a problem. There are different types of rocket propellants. Some, like liquid oxygen and liquid hydrogen, produce mainly water vapour and have little environmental impact. These were used in past shuttle launches and even in the Apollo-era Saturn V vehicles. Then there are those that produce alumina particles in the stratosphere, such as those in solid rocket boosters, which were also used in past shuttle launches, and are still being used today by some launch companies. Finally, there are those that deposit black soot in the stratosphere, such as kerosene used in SpaceX's Falcon 9 and Russia's Soyuz rockets. It's the alumina and black soot that is most concerning to experts.

### Case

#### They don’t ban rocket launches for any purpose besides private tourism – public space sectors, asteroid mining, space col, space exploration terminally non-uq all of their advantages

#### None of the hype from their Rosenblum card came to be – none of the aff has a brink, but even if you take thousands of launches per year to be that brink, it’ll take centuries to get there

### On Space Col

#### Space Col happens by 2050s---solves every impact BUT degrowth disrupts progress

Drake '16 – a science journalist and contributing writer at National Geographic. She earned an A.B. in biology, psychology, and dance at Cornell University, worked in a clinical genetics lab at The Johns Hopkins University School of Medicine, then returned to Cornell for her Ph.D. in genetics and development. (Bynadia, "Elon Musk: A Million Humans Could Live on Mars By the 2060s," Science, 9-27-2016, https://www.nationalgeographic.com/science/article/elon-musk-spacex-exploring-mars-planets-space-science, Accessed 6-10-2021, )

In perhaps the most eagerly anticipated aerospace announcement of the year, SpaceX founder Elon Musk has revealed his grand plan for establishing a human settlement on Mars. In short, Musk thinks it’s possible to begin shuttling thousands of people between Earth and our smaller, redder neighbor sometime within the next decade or so. And not too long after that—perhaps 40 or a hundred years later, Mars could be home to a self-sustaining colony of a million people. “This is not about everyone moving to Mars, this is about becoming multiplanetary,” he said on September 27 at the International Astronautical Congress in Guadalajara, Mexico. “This is really about minimizing existential risk and having a tremendous sense of adventure.” Musk’s timeline sounds ambitious, and that's something he readily acknowledges. “I think the technical outline of the plan is about right. He also didn’t pretend that it was going to be easy and that they were going to do it in ten years,” says Bobby Braun, NASA’s former chief technologist who’s now at Georgia Tech University. “I mean, who’s to say what’s possible in a hundred years?” And for those wondering whether we should go at all, the reason for Musk making Mars an imperative is simple. “The future of humanity is fundamentally going to bifurcate along one of two directions: Either we’re going to become a multiplanet species and a spacefaring civilization, or we’re going be stuck on one planet until some eventual extinction event,” Musk told Ron Howard during an interview for National Geographic Channel’s MARS, a global event series that premieres worldwide on November 14. “For me to be excited and inspired about the future, it’s got to be the first option. It’s got to be: We’re going to be a spacefaring civilization.” Mars Fleet Though he admitted his exact timeline is fuzzy, Musk thinks it’s possible humans could begin flying to Mars by the mid-2020s. And he thinks the plan for getting there will go something like this: It starts with a really big rocket, something at least 200 feet tall when fully assembled. In a simulation of what SpaceX calls its Interplanetary Transport System, a spacecraft loaded with astronauts will launch on top of a 39-foot-wide booster that produces a whopping 28 million pounds of thrust. Using 42 Raptor engines, the booster will accelerate the assemblage to 5,374 miles an hour. Overall, the whole thing is 3.5 times more powerful than NASA’s Saturn V, the biggest rocket built to date, which carried the Apollo missions to the moon. Perhaps not coincidentally, the SpaceX rocket would launch from the same pad, 39A, at Kennedy Space Center in Cape Canaveral, Florida. The rocket would deliver the crew capsule to orbit around Earth, then the booster would steer itself toward a soft landing back at the launch pad, a feat that SpaceX rocket boosters have been doing for almost a year now. Next, the booster would pick up a fuel tanker and carry that into orbit, where it would fuel the spaceship for its journey to Mars. Once en route, that spaceship would deploy solar panels to harvest energy from the sun and conserve valuable propellant for what promises to be an exciting landing on the Red Planet. As Musk envisions it, fleets of these crew-carrying capsules will remain in Earth orbit until a favorable planetary alignment brings the two planets close together—something that happens every 26 months. “We’d ultimately have upward of a thousand or more spaceships waiting in orbit. And so the Mars colonial fleet would depart en masse,” Musk says. The key to his plan is reusing the various spaceships as much as possible. “I just don’t think there’s any way to have a self-sustaining Mars base without reusability. I think this is really fundamental,” Musk says. “If wooden sailing ships in the old days were not reusable, I don’t think the United States would exist.” Musk anticipates being able to use each rocket booster a thousand times, each tanker a hundred times, and each spaceship 12 times. At the beginning, he imagines that maybe a hundred humans would be hitching a ride on each ship, with that number gradually increasing to more than 200. By his calculations, then, putting a million people on Mars could take anywhere from 40 to a hundred years after the first ship launches. And, no, it would not necessarily be a one-way trip: “I think it’s very important to give people the option of returning,” Musk says. Colonizing Mars After landing a few cargo-carrying spacecraft without people on Mars, starting with the Red Dragon capsule in 2018, Musk says the human phase of colonization could begin. For sure, landing a heavy craft on a planet with a thin atmosphere will be difficult. It was tough enough to gently lower NASA’s Curiosity rover to the surface, and at 2,000 pounds, that payload weighed just a fraction of Musk’s proposed vessels. For now, Musk plans to continue developing supersonic retrorockets that can gradually and gently lower a much heavier spacecraft to the Martian surface, using his reusable Falcon 9 boosters as a model. And that’s not all these spacecraft will need: Hurtling through the Martian atmosphere at supersonic speeds will test even the most heat-tolerant materials on Earth, so it’s no small task to design a spacecraft that can withstand a heated entry and propulsive landing—and then be refueled and sent back to Earth so it can start over again. The first journeys would primarily serve the purpose of delivering supplies and establishing a propellant depot on the Martian surface, a fuel reservoir that could be tapped into for return trips to Earth. After that depot is set up and cargo delivered to the surface, the fun can (sort of) begin. Early human settlers will need to be good at digging beneath the surface and dredging up buried ice, which will supply precious water and be used to make the cryo-methane propellant that will power the whole enterprise. As such, the earliest interplanetary spaceships would probably stay on Mars, and they would be carrying mostly cargo, fuel, and a small crew: “builders and fixers” who are “the hearty explorer type,” Musk said to Howard. “Are you prepared to die? If that’s OK, then you’re a candidate for going.” While there will undoubtedly be intense competition and lots of fanfare over the first few seats on a Mars-bound mission, Musk worries that too much emphasis will be placed on those early bootprints. “In the sort of grander historical context, what really matters is being able to send a large number of people, like tens of thousands if not hundreds of thousands of people, and ultimately millions of tons of cargo,” he says.

#### Space colonization solves extinction and is a filter for all other risks – their own author!

**Torres 16** – PhD Candidate @ Rice (Phil, “Top Three Strategies for Avoiding an Existential Risk,” Institute for Ethics and Emerging Technologies, https://ieet.org/index.php/IEET2/print/11654)

(3) Space colonization. I would argue that this offers perhaps the **most practicable strategy** for avoiding an existential catastrophe, all things considered. It requires neither the invention of a superintelligence nor the sort of radical cognitive enhancements discussed above. The idea is simple: the wider we spread out in the world, the less chance there is that a single event will have worldwide consequences. A collapse of the global ecosystem on Earth wouldn’t affect colonies on Mars, nor would a grey goo disaster on (say) Gliese 667 Cc affect those living on spaceship Earth. Similarly, a disaster that wipes out the Milky Way in 1,000 years might be survivable if our progeny also resides in the Andromeda Galaxy. As it happens, NASA recently announced that there will be Earth-independent colonies on Mars by the 2030s, and Elon Musk has said that he’s hoping to launch the first flight to Mars “in around 2025.” As Musk described his motivation in 2014, “there is a strong humanitarian argument for making life multi-planetary . . . in order to safeguard the existence of humanity in the event that something catastrophic were to happen.” This sentiment was echoed by the former NASA administrator, Michael Griffin, who claimed that “human expansion into the solar system is, in the end, fundamentally about the survival of the species.” Similarly, Hawking has opined that he doesn’t “think the human race will survive the next thousand years, unless we spread into space.” So, there’s growing momentum to distribute the human population throughout this strange universe in which we find ourselves, and numerous intellectuals have explicitly recognized the existential significance of space colonization. Given the minimal risks involved, the relatively minimal cost of colonization programs (for example, it requires neither “(1)” nor “(2)” to be realized), and the potential gains of establishing self-sustaining colonies throughout the galaxy, this strategy ought to be among the top priorities for existential risk activists. **To survive, we must colonize**.

#### Outweighs scope of all living humans by 10^30 – so tiny risk of this o/w all their stuff

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]

#### Ignore their Sloat evidence, just citing Stephen Hawking’s opinion about aliens, which even he says the probability of encountering is low. Furthermore, she didn’t include the part where he said this at a press conference announcing a space exploration project. This is the line from her card – even her own card defends that space exploration is good.

Hawking was part of an esteemed group of scientists that announced the space exploration project [Breakthrough Starshot](https://www.inverse.com/article/14132-breakthrough-starshot-announces-plan-to-send-nanocrafts-to-alpha-centauri-in-20-years). Funded by billionaire Yuri Milner, the program aims to send [light-propelled nanocrafts](https://www.inverse.com/article/14132-breakthrough-starshot-announces-plan-to-send-nanocrafts-to-alpha-centauri-in-20-years) to our nearest star system, Alpha Centauri.

#### We’ll answer their Torres stuff line by line

#### Colony wars – wrong

Globus ’20 [Al, co-founded the NASA Ames Space Settlement Contest for 6-12th grade students. 6-12th grade students. He also co-founded the NASA Ames Nanotechnology Group, which, at first, worked on materials for space elevators and diamondoid machine phase matter to build $50,000 personal spacecraft. He has designed three orbital space settlements (Lewis One, Kalpana One, and Kalpana Two) and published over 45 papers in technical conferences and journals, won a Feynman Prize in Nanotechnology, a NASA Software of the Year award, and a NASA Public Service Medal. He has discussed space colonization and nanotechnology on the History Channel, Danish radio, a French magazine, on a European Commission video, and elsewhere. He is co-author of the book The High Frontier: An Easier Way, “Not so dark skies”, 07-13-2020, https://www.thespacereview.com/article/3985/1]//pranav

War (Geopolitical Malefic)

Argument: Space settlement creates an endless frontier extending for millions of light-years into the cosmos. Frontiers tend to be violent places, creating wars not only at the frontier but between the polities that support the expansion. The vast size of the cosmos means that settlers are widely separated for much of the time, perhaps even evolving new species. When they come close enough to interact there may be little fellow feeling and little reluctance for the stronger to exterminate the weaker.

Counter-argument: With space settlement development there are a number of factors inhibiting violence and warfare. For one, the vast energy and materials resources available will tend to make resource wars obsolete. The fragility of space settlements, particularly free-space settlements in orbit, mandates that settlers avoid pointless provocations and chest-beating exercises. The enormous size of the space inhabited, up to and including the entire galaxy, makes it extremely unlikely that war will consume more than a small fraction of the population and resources available. It is difficult, if not impossible, to predict whether space settlement will lead to an increase or decrease in the odds that any given individual or group is involved in warfare or not. Preventing space settlement may be more or less dangerous than allowing it to proceed; it’s impossible to say.

Comparison with no space settlement: It is reassuring that since World War II warfare has decreased substantially and rarely involves the great powers directly killing each other’s citizens. That is left to proxies. However, not all wars are intentional. Consider World War I and the Cuban Missile Crisis. These suggest that there is a possibility—some would say probability—of an accidental humanity-ending nuclear war.

Space settlement could reduce this probability a bit by exposing large numbers of people to the Overview Effect created by the view of Earth from space, where some astronauts have come to value Earth and the unity of Earth’s people much more than before. More substantively, a sufficiently developed space settlement society surviving a war can repopulate Earth and restock other species if prevention fails. Thus the chance of a humanity-ending nuclear war is much lower with a sufficiently advanced space settlement society.

#### Alien Generation – wrong

Globus ’20 [Al, co-founded the NASA Ames Space Settlement Contest for 6-12th grade students. 6-12th grade students. He also co-founded the NASA Ames Nanotechnology Group, which, at first, worked on materials for space elevators and diamondoid machine phase matter to build $50,000 personal spacecraft. He has designed three orbital space settlements (Lewis One, Kalpana One, and Kalpana Two) and published over 45 papers in technical conferences and journals, won a Feynman Prize in Nanotechnology, a NASA Software of the Year award, and a NASA Public Service Medal. He has discussed space colonization and nanotechnology on the History Channel, Danish radio, a French magazine, on a European Commission video, and elsewhere. He is co-author of the book The High Frontier: An Easier Way, “Not so dark skies”, 07-13-2020, https://www.thespacereview.com/article/3985/1]//pranav

Ubermensch (Alien Generation)

Argument: As humanity spreads throughout the solar system, some branches of homo sapiens may eventually evolve into new species, with or without genetic engineering, nanotechnology implants, artificial superintelligence, and/or other cybernetics. One or more of these “Ubermensch” societies may wish to colonize Earth, Mars, or other worlds with little care for the people living there. Earth may be considered particularly valuable as it is uniquely well suited to life. That may make it a target for powerful groups of free space settlements. Assuming the Ubermensch really are superior, at least in warfare, this could lead to homo sapiens’ extinction.

Counter-argument:

Speciation takes a long time. Trying to predict so far into the future is a dicey business.

Except for speciation, cybernetic and nanotech modification could happen even if humanity were to stay only on Earth, although keeping it hidden would be harder than in a society consisting of hundreds or thousands of orbital habitats.

The problems that may come from genetic engineering or cyborg development are likely to arise on Earth well before large-scale space settlement.

A sudden attack on Earth by Ubermensch living on Earth would be harder to counter than an aggressive force working its way in from, say, the Kuiper Belt, which could take years and be seen well before they posed a direct threat to Earth.

Comparison with no space settlement: With space settlement, genetic engineering, cyborg, and nanotech research can be extremely well controlled. Research facilities can be isolated from all other life by thousands of kilometers of vacuum and the entire facility obliterated if things get really out of hand. While possible without settlement, creating a dangerous new species would be much easier for a space settling civilization as the work could be tucked away in one or a few settlements.

#### Group their weapons stuff – no extinction warrant – never explained how “sun guns” or whatever kill everyone- but if humanity is spread out even if a single colony goes down the species survives

#### Asteroid weapons – they suck and are wrong

**Wall 11** (Mike, Ph.D. in evolutionary biology, Senior writer for Space.com, 11/4/11, Why Asteroids Make Lousy Space Weapons, accessed 1/15/20, https://www.space.com/13515-asteroid-deflection-space-weapons.html, RAW)

If you lie awake at night worrying about some supervillain steering giant asteroids toward your hometown, you really should relax, experts say. It's not going to happen anytime soon. Humanity does indeed have the technical skills to move space rocks around, and we may employ this know-how at some point to avoid a catastrophic impact like the one that killed the dinosaurs 65 million years ago. But the odds of any rogue state using asteroids to rain death down on its enemies are minuscule, experts say. "**It's a lousy weapon**," said former astronaut Rusty Schweickart, chairman of the B612 Foundation, a group dedicated to predicting and preventing cataclysmic asteroid impacts on Earth. "**You get a chance to use one once every several hundred years**," Schweickart said during a recent panel discussion called "Moving an Asteroid" at the California Institute of Technology in Pasadena. "And **even then, you can only deflect it to hit someplace along** a sort of **arbitrary** **line** across the Earth." [Top 10 Space Weapons] Serious spaceflight skills Changing the orbit of a massive asteroid hurtling through deep space sounds like a daunting task, but our species knows how to do it. For example, we could launch a spacecraft that would rendezvous with an asteroid, then travel alongside it for months or years. Over time, the probe's modest gravity would tug on the space rock, pulling it into a different orbit, Schweickart said. Given enough time to act, this so-called "gravity tractor" method could work in quite precise and predictable ways. And we've demonstrated the skills necessary to make it happen. Multiple missions have met up with asteroids in deep space. For example, NASA's Dawn spacecraft is currently in orbit around Vesta, the second-largest object in the main asteroid belt between Mars and Jupiter. And in 2005, Japan's Hayabusa probe rendezvoused with a space rock called Itokawa. The craft even scraped some samples off Itokawa and sent them back to Earth for analysis. It's a good thing we possess these potential asteroid-moving skills, Schweickart said, for they may save our bacon someday. Earth has been pummeled by many dangerous asteroids throughout its history, and there's no reason to think the barrage will stop in the future. Space rocks big enough to cause major damage and disruption to the global economy and society (were they to strike a populated area today) have hit Earth, on average, every 200 or 300 years, Schweickart said. Firing a weapon once every 300 years That bombardment rate is scarily frequent to anyone worried about the long-term survival of human civilization. But it's not nearly frequent enough to make asteroids good weapons of mass destruction, according to Schweickart. [5 Reasons to Care About Asteroids] "You're going to have an opportunity once every two or three hundred years to go up and have a weapon to hit Baghdad," Schweickart said. "Of course, the problem is that by that time, the Zambian space program is the world's premier space program, and Baghdad is a buddy of yours." Potential asteroid wranglers also wouldn't be able to direct a space rock just anywhere on Earth, he added. For the foreseeable future, we'll be able only to speed up or slow down an asteroid, moving it in an "east-west" direction along its trajectory. Moving it in the "north-south" plane is not an option. "If you do anything other than speed up or slow down the asteroid, it has almost no effect," Schweickart said. "You've got to go along that line; it's the only way physics lets you do it." So anyone wishing to asteroid-bomb the United States would have to manipulate a space rock whose trajectory already crossed American territory. The trick would be tweaking its velocity enough to ensure an impact on American soil. In practice, therefore, **the wait for a suitable asteroid weapon could be considerably longer** **than 200 or 300 years.** Protecting Earth Schweickart and other panelists argued that humanity will need to deflect a killer asteroid away from Earth someday. It would be a shame, they said, if unfounded fears about possible nefarious uses of asteroid-moving technology impeded its development. "The public perception of asteroids can be pretty scary," Schweickart said. "There's going to be a lot of scare stuff. It's already out there, it's going to get worse and that is going to be a very serious challenge that we on the technical side will have to deal with." People worried about death from above should focus their anxiety elsewhere, fellow panelist Bill Nye said. There are plenty of much more viable space weapons than asteroids already up there. "Space is already pretty weaponized," said Nye, executive director of the Planetary Society and former host of the science-themed TV show "Bill Nye the Science Guy." "The global positioning system that we all know and love was designed to guide weapons. So using an asteroid as a weapon is sort of coming late to the party."

#### Rods from God – wrong

**Armagh** **15**, Armagh Observatory and Planetarium, published 9-27-2010 but updated as of 2015, "Rods from god: a terrifying space weapon? – Astronotes," https://armaghplanet.com/rods-from-god-a-terrifying-space-weapon.html)SEM

There are undeniable links between the spaceflight and military communities but apart from a few tests of anti-satellite weapons, the odd armed space station and laser battlestation there have been mercifully few weapons in space. Yet **the idea of bombarding the Earth from orbit** keeps coming up again and again. **Thankfully it** **is ridiculous**. I believe the idea is that having weapons hovering menacingly overhead will persuade your enemies to behave themselves. However this idea is stupid- I cannot think of a better word. Anyone who suggests such an idea must have learned their science from Tom Clancy books or Steven Seagal movies. The current version of this mad scheme is the kinetic energy weapon and is usually described as scores, possibly hundreds, of tungsten (chosen for its high melting temperature and hardness) projectiles orbiting the Earth in formation or attached to a satellite ‘bus’. These could be either relatively small darts (weighing about 100kg) or large ‘phone poles’ (about 8000 kg each). When required these projectiles can be commanded to dive, singly or en masse, at targets on the Earth’s surface, smashing into the victim at orbital speed. As the projectile’s kinetic energy is released, the blast would be equivalent to a large conventional bomb (a 100kg projectile traveling at 7km/s would release about 2.5 gigajoules of kinetic energy, a tonne of TNT releases about 4.2 gigajoules). This would be a non-nuclear precision weapon, essentially a smart bomb that can target anywhere in the world. It is further claimed that the darts would be capable of penetrating deeply into the Earth’s surface enabling non-nuclear attacks on installations deep underground. This idea is said to have originated in 1964 (but was revised and updated in 1975) in the mind of Jerry Pournelle, engineer, writer and consultant to the US Air Force. He originally named the concept “Thor” after the hammer-wielding Norse god of thunder. Pournelle said each projectile was …an orbiting element some 20 to 40 feet long. It requires a GPS receiver to locate itself; a means of taking it out of orbit; an atmospheric guidance system, such as a means of changing its center of gravity (moving weights, small fins, etc.), and a communication system to give it a target and activate the system…Achievable accuracy has been estimated at ten to twenty feet CEP (Circular Error of Probability) Pournelle assumed extremely cheap fully reusable single stage to orbit launch vehicles were just around the corner and would enable his concept to be quickly deployed, sadly no such craft have yet been built. Moving further into fantasy, Pournelle later had a smaller but more accurate optically guided variant of the weapon described as “crowbars” used by invading alien space elephants (really) to devastate the US military in Footfall (1985), a novel he co-wrote with Larry Niven. In this book, Niven and Pournelle introduced the concept You take a big iron bar. Give it a rudimentary sensor, and a steerable vane for guidance. Put bundles of them in orbit. To use it, call it down from orbit, aimed at the area you’re working on. It has a simple brain, just smart enough to recognize what a tank looks like from overhead. When it sees a tank silhouette, it steers toward it. Drop ten or twenty thousand of those over an armored division, and what happens? Subsequently similar weapons have appeared in other fictional works where they always work perfectly! A recent example is the movie GI Joe: Retaliation (2013) which is dissected in this video: This artificial meteorite concept is often nicknamed ‘the rods from God’ even by its supporters, who usually claim it would be relatively cheap to set up (indeed some claim it already exists). They give the impression that at the press of a button, these rods will just fall from the sky on their victims. However it is not that easy. As each rod circles the Earth it is moving at least 7 km/s, to make the rod fall from orbit under gravity, we need to **adjust its orbit** to intersect the Earth’s surface. To do this each rod therefore needs to be attached to a rocket motor and its fuel tanks (or solid propellant), suddenly each cheap 100kg rod has **ballooned into a multi-tonne vehicle**, perhaps the size of a Soyuz spacecraft. At least it does not need a heatshield, a tungsten projectile could reasonably be expected to survive the expected heat of re-entry. The ground-penetrating effects of such projectiles is **grossly** **over-stated** too- do falling meteorites of this sort of size always bury themselves hundreds of metres under the ground? Laboratory experiments show that **objects striking the surface** at speeds greater than 1 km/s **are melted by their own kinetic energy** before they penetrate the ground, effectively **liquefying** **on** impact. Rather than slamming into the target at 20 times the speed of sound, the rods may need to be slowed down to fast aircraft speeds to prevent them disintegrating on impact. The problems of guiding each rod is usually dismissed with handwaving references to GPS, although some armchair space marshals also follow Pournelle’s fictional lead to suggest each rod would have its own imaging sensor to find and steer onto moving targets like tanks or warships. I have no doubt that the electronics are feasible but the rod now needs control surfaces hooked to its guidance system and sounds more like a missile than a cheap metal rod. Do these now complex projectiles require maintenance in orbit? Finally, it is said that the rods can hit any target on Earth minutes after the KILL button is pressed. Once again, this doesn’t seem properly thought out. The rods can only hit targets on or near their orbital track, **for weeks** **at a time** **some parts of the world would be invulnerable** as their potential attackers would never come within hundreds of kilometers from their positions. The only way around this limitation is to have hundred of rods waiting ready in multiple orbits, **requiring a** **ludicrous number of launches**. Even if the target is directly under the rod’s orbital track, the attack **may not be instantaneous**, as those who order the attack wait perhaps 90 minutes for the rods to move around the Earth into position. Even the Joint Chiefs of Staff cannot overrule Sir Isaac Newton. A rods from god bombardment would probably look a lot like this test of the re-entry vehicles of a LGM-118A Peacekeeper ICBM. The projectiles are highly visible; it would be obvious that an attack was taking place, so this would not be a weapon for covert strikes. Each reentry vehicle here is a large and complex piece of hardware, not a simple “crowbar” or “telephone pole”. (Image credit: USAF via fas.org) The number of launches needed to deploy even a few dozen individually weighty weapons is glossed over by Rods enthusiasts. Assuming they are deployed, every rod (or their carrier satellite) will move around the Earth on a regular and predictable orbit where they will be observable from the surface by radar and optical sensors, so potential enemies will always know where they are. “Dropping” the projectiles from orbit is no actual advantage by the way, by the time they reach the surface they will have no more kinetic energy than was imparted to them by their original launch vehicle. After considering all this, to be honest, it would make more sense to launch each rod from the Earth’s surface directly to the target. To make them less vulnerable to preemptive attacks, perhaps the rods should be based in hardened underground silos or hidden in submerged submarines. Congratulations, we have just reinvented the ICBM! The most recent unclassified mention of the concept is in a USAF document called The US Air Force Transformative Flight Plan (2003) which talks of “hyper­ve­lo­city rod bundles” as a potential weapon in the post 2015 period. Note this mention in an official document does not mean the US military can magic this weapon into existence. There is a history among militaries world-wide of wasting billions on R&D into projects which are hopelessly impractical or even completely ungrounded in reality (see hafnium excimer bomb, atomic-powered aircraft, camouflage uniforms which make the wearer more conspicuous and using ESP for espionage). As of 2015 no kinetic-energy orbital bombardment system has officially been proposed or tested, never mind deployed. The older version of the concept is the idea of putting nuclear bombs in geostationary orbit over a potential enemy country is still brought up from time to time. This is even more ill-conceived than the Rods from God. When you think about it, it is obvious that a geostationary orbit must be above the Earth’s equator. Now there are only thirteen nations on the equator and it hard to see why any would want to suspend a bomb over say, the Maldives or Gabon. Even though they are sometimes put forward by apparently sensible people or organizations, “Rods from God” and other schemes for bombing the Earth from space are half-baked science fiction concepts. The cost of developing an orbital bombardment system would make the F-35 project look cheap in comparison. They are militarily pointless and hopelessly implausible. Similar damage could be inflicted more cheaply and easily by conventional ground-based weapons. A cynic would say that clever diplomacy would avoid the need for the weapons altogether.

**Nanoreplication – wrong. Grey goo is impossible**

**Goertzel 17 –** Ben Goertzel, Chair of Humanity+, PhD, CEO of AI Software Company Novamente LLC and Bioinformatics Company Biomind LLC, Advisor to the Singularity University and Singularity Institute, Research Professor in the Fujian Key Lab for Brain-Like Intelligent Systems at Xiamen University, “SHOULD WE DEVELOP NANOTECHNOLOGY? NANOWEAPONS AND GREY GOO”, Humanity+, 10-12, <https://humanityplus.wordpress.com/2017/10/12/grey-goo-how-probable-is-a-nanobot-apocalypse/> [grammar edit]

2 Decades ago, Nanoengineer Eric K. **Drexler had a shocking realization. All it would take was one** malfunctioning **nanomachine to glitch and** potentially **undergo runaway replication**, unstoppably consuming everything on earth to assemble the molecules that their programming dictates. It’s a threat that stems from two extremely powerful forces: unchecked self-replication and exponential growth. All it takes is a corrupt government, non-state actor, or individual to engineer a single microscopic machine that would devour our planet’s critical resources at a rapid-fire rate to replicating themselves. In this sense, one person really CAN change the world. **It could start as easily as nanites being hijacked from a** powerful nation’s **military, re-programmed for a terrorist action, and** blindly **convert all matter on earth without end**. Drexler calls this **the Grey Goo Theory**, and it’s the idea that rogue self-replicating nanotechnology has the potential to cause many more problems than it might solve, eating up anything and everything until the environment and all of us in it are completely deconstructed, leaving behind only useless bi-products and residue we’d call “grey goo”. It’s a kind of conundrum that might discourage us from even wanting to develop nanomachines in the first place and would be characterized by the speed at which a true nanomachine would be able to create copies of itself. Drexler proposed it because of scaling laws in mechanical engineering, meaning that the smaller you can make a nanofactory, the more percentage of the total input for buiding those factories gets converted into product. In other words, you get increasingly more for less. We’re talking machines that are invisible to the naked eye, meaning one the size of a flea would be considered a very large nanobot. Preliminary estimates suggest a nanofactory could potentially output its own weight in product in as quickly as 15 hours, meaning it would grow buildings faster than bamboo at about 20 feet per day. Drexler predicted that if a nanomachines took 1000 seconds to replicate then just one going haywire would create 68 billion new machines within 10 hours, and under 48 hours, they’d be as heavy as the Earth. Through the magic of exponential growth the’d be able to eat through walls, destroy cities, and reduce all land based biomass into paperclips. Once programmed, nothing could stop them and if they were to gain a sufficient degree of intelligence, then why shouldn’t they reproduce themselves just as all life does? Drexler compares the functionality of nanobots to the functionality of life itself, believing they would even out-compete actual plants until we no longer have a green planet, but a grey one. Us humans are just more ressources for fuel and replication. The sci fi video game Horizon zero dawn presents us with a world where a nanobot uprising has destroyed all human civilization and have become the new dominant species. But could this actually happen in real life? Probably not, and if it did, a hostile earth would be the least of our problems. If AIs built for these nanites were ever to become that intelligent, it’s likely they would gain the power of space travel, meaning they wouldn’t just overrun the mass of planet Earth, but overrun the universe itself until all reality is ecotophaged into a hell of self-replicating nanobots. There’s a peculiar spot in the night sky called the Bootes void, millions of light years in diameter with not a single star in sight, a mysterious black patch on an otherwise starlit sky. Since the skewed distribution of stars doesn’t make statistical sense, some have suggested that the void actually is full of stars, but nanomachines covered them in solar powered dyson spheres to drain their energy. Grey goo wouldn’t care what it is or why it does anything it would would simply just “do.” This has lead more extreme doomsayers to suggest that this hole in the sky might actually be a cancerous tumor of nanites slowly consuming our entire universe, but I think that idea might be a little too crazy.

The go-to answer to the grey goo scenario is that **it will never happen**. While **it’s highly uncertain when molecular manufacturing will be developed**, there are a few reasonable arguments for its feasibility, the most obvious being that life itself constantly does molecular manufacturing in the form of protein synthesis so why can’t we? In general, I personally don’t believe in the Grey Goo and think **it’s ridiculously inefficient, because in the end, it’s more productive to just create stationary nanofactories** fastened in vacuum-filled chambers **rather than** develop the complex motion dynamics needed for **independant flying swarms of nanobots** that have to carry the factory within them. **These nanoscopic** miracle **workers will** also **unlikely** be able to **fit supercomputers inside their tiny bodies**, implying that their very existence doesn’t violate the laws of physics in the first place.[19][20] **Nanobots** as they are being developed at MIT **clearly won’t be little A.I robots like everyone expects**, but rather, carefully designed biomechanical structures, similar to enzymes or vectors. **A nanopocalypse might still [face] energy constraints related to how fast it can spread, with natural obstacles and a lack of raw materials making continuous propagation difficult. Even Drexler** himself **argues that self-replicators would be too complex and inefficient for any practical manufacturing scenario, Furthermore, the Royal Society’s** 2004 **report on nanoscience declares that the grey goo scenario to be highly unlikely** There’s still a debate today about whether or not grey goo is even practical or not, but let’s just say **Grey Goo is utterly impossible**, it doesn’t mean nanotechnology an’t create other kinds of apocalyptic weapons. This is the idea of “Red Goo” or Nanoweapons and it’s not too far from the idea of Bioweapons we are all familiar with. Nanotechnology theorist Robert Freitas coined the term Aerovores, otherwise known as “Grey Dust”, to illustrate the dangers of nanotech based weapons. Aeorovores would essentially be artificial plankton, airborn cybermicrobes, or seabed replicattors programmed to secrete molecules that would ravage the ecology of a rival country’s coastline, release gases that would blot out their sunlight, or poison their water.

#### Group their “universe destroying superweapons stuff” – only mechanism is false vacuum, which is fake

**Cottrell 12** [Seth Cottrell, professor of mathematics at NYU.] “Q: What is the “False Vacuum” and are we living in it?” 15 July 2012 (https://www.askamathematician.com/2012/07/q-what-is-the-false-vacuum-and-are-we-living-in-it/) – MZhu

The “danger” of living in a false vacuum is that, under the proper circumstances the false vacuum can drop into the true vacuum. The cause is usually described as a sufficient burst of energy to get the appropriate fields “over the hump” (picture above). If the difference in energy between the false vacuum and true vacuum is large enough, then the surrounding space can likewise be tipped into the lower state. In theory, a “false vacuum collapse” would expand at light speed (or about light speed) from the originating event, and destroy the heck out of everything in the affected, and ever-expanding, region.

It’s worth mentioning that **the idea of a false vacuum is wild speculation** and that there is **no indication, not even a little**, that the vacuum of the universe is a false vacuum and not the true ground state. **There’s a** **long** **history of spectacular bursts of energy in the universe, and none of them have tripped a collapse**. The ground state of the universe is kinda like a septuagenarian’s testicle; if it hasn’t dropped by now, it probably won’t.

#### Tech is good and inevitable – cleans up any residual offense

Reinhart 18 [Will Rinehart is Director of Technology and Innovation Policy at the American Action Forum, where he specializes in telecommunication, Internet, and data policy, with a focus on emerging technologies and innovation. Rinehart previously worked at TechFreedom, where he was a Research Fellow. He was also previously the Director of Operations at the International Center for Law & Economics. In Defense of Techno-optimism. <https://techliberation.com/2018/10/10/in-defense-of-techno-optimism/>]

Many are understandably pessimistic about platforms and technology. This year has been a tough one, from Cambridge Analytica and Russian trolls to the implementation of GDPR and data breaches galore. Those who think about the world, about the problems that we see every day, and about their own place in it, will quickly realize the immense frailty of humankind. Fear and worry makes sense. We are flawed, each one of us. And technology only seems to exacerbate those problems. But life is getting better. Poverty continues nose-diving; adult literacy is at an all-time high; people around the world are living longer, living in democracies, and are better educated than at any other time in history. Meanwhile, the digital revolution has resulted in a glut of informational abundance, helping to correct the informational asymmetries that have long plagued humankind. The problem we now face is not how to address informational constraints, but how to provide the means for people to sort through and make sense of this abundant trove of data. These macro trends don’t make headlines. Psychologists know that people love to read negative articles. Our brains are wired for pessimism. In the shadow of a year of bad news, it helpful to remember that Facebook and Google and Reddit and Twitter also support humane conversations. Most people aren’t going online to talk about politics and if you are, then you are rare. These sites are places where families and friends can connect. They offer a space of solace – like when chronic pain sufferers find others on Facebook, or when widows vent, rage, laugh and cry without judgement through the Hot Young Widows Club. Let’s also not forget that Reddit, while sometimes a place of rage and spite, is also where a weight lifter with cerebral palsy can become a hero and where those with addiction can find healing. And in the hardest to reach places in Canada, in Iqaluit, people say that “Amazon Prime has done more toward elevating the standard of living of my family than any territorial or federal program. Full stop. Period” Three-fourths of Americans say major technology companies’ products and services have been more good than bad for them personally. But when it comes to the whole of society, they are more skeptical about technology bringing benefits. Here is how I read that disparity: Most of us think that we have benefited from technology, but we worry about where it is taking the human collective. That is an understandable worry, but one that shouldn’t hobble us to inaction. Nor is technology making us stupid. Indeed, quite the opposite is happening. Technology use in those aged 50 and above seems to have caused them to be cognitively younger than their parents to the tune of 4 to 8 years. While the use of Google does seem to reduce our ability to recall information, studies find that it has boosted other kinds of memory, like retrieving information. Why remember a fact when you can remember where it is located? Concerned how audiobooks might be affecting people, Beth Rogowsky, an associate professor of education, compared them to physical reading and was surprised to find “no significant differences in comprehension between reading, listening, or reading and listening simultaneously.” Cyberbullying and excessive use might make parents worry, but NIH supported work found that “Heavy use of the Internet and video gaming may be more a symptom of mental health problems than a cause. Moderate use of the Internet, especially for acquiring information, is most supportive of healthy development.” Don’t worry. The kids are going to be alright. And yes, there is a lot we still need to fix. There is cruelty, racism, sexism, and poverty of all kinds embedded in our technological systems. But the best way to handle these issues is through the application of human ingenuity. Human ingenuity begets technology in all of its varieties. When Scott Alexander over at Star Slate Codex recently looked at 52 startups being groomed by startup incubator Y Combinator, he rightly pointed out that many of them were working for the betterment of all: Thirteen of them had an altruistic or international development focus, including Neema, an app to help poor people without access to banks gain financial services; Kangpe, online health services for people in Africa without access to doctors; Credy, a peer-to-peer lending service in India; Clear Genetics, an automated genetic counseling tool for at-risk parents; and Dost Education, helping to teach literacy skills in India via a $1/month course. Twelve of them seemed like really exciting cutting-edge technology, including CBAS, which describes itself as “human bionics plug-and-play”; Solugen, which has a way to manufacture hydrogen peroxide from plant sugars; AON3D, which makes 3D printers for industrial uses; Indee, a new genetic engineering system; Alem Health, applying AI to radiology, and of course the obligatory drone delivery startup. Eighteen of them seemed like boring meat-and-potatoes companies aimed at businesses that need enterprise data solution software application package analytics targeting management something something something “the cloud”. As for the other companies, they were the kind of niche products that Silicon Valley has come to be criticized for supporting. Perhaps the Valley deserves some criticism, but perhaps it deserves more credit than it’s been receiving as-of-late. Contemporary tech criticism displays a kind of anti-nostalgia. Instead of being reverent for the past, anxiety for the future abounds. In these visions, the future is imagined as a strange, foreign land, beset with problems. And yet, to quote that old adage, tomorrow is the visitor that is always coming but never arrives. The future never arrives because we are assembling it today. We need to work diligently together to piece together a better world. But if we constantly live in fear of what comes next, that future won’t be built. Optimism needn’t be pollyannaish. It only needs to be hopeful of a better world.

#### Turn – space col solves universe extinction through quantum immortality

Turchin 19 (Alexey Turchin an author of several books and articles on the topics of existential risks and life extension, and was published in "Futures", "Acta Astronatutica", "Informatica", "AI & Society" journals. He graduated in Moscow State University where he studied Physics and Art History (1997). He translated into Russian around 20 main articles about existential risks by Bostrom, Yudkowsky, Circovich, Kent, Hanson. From 2010 he works in the "Science for Life Extension Foundation" on various topics about life extension and risks prevention. He is a contributing author on IEET. He is the founder of the Digital Immortality Now startup. He is a member of the advisory boards of IEET, Open Longevity, AI agents, Arch Mission. In 2018 he won one of the prizes in AI Global Challenge race with his article on global solutions on AI safety, ”How to Survive the End of the Universe.” Version 2, Uploaded: 2019-11-28, Available at https://philpapers.org/rec/TURHTS-2, HKR-cjh)

1. Introduction Based on some optimistic models, we could start a wave of colonization of the universe using von Neumann probes moving at near-light speed a few hundred years from now (Stuart Armstrong & Sandberg, 2013), leveraging technology such as nanotech replicators connected to laser-powered sails. Communication and coordination between different parts of such a wave would be difficult. But to prevent some scenarios of the end of the universe, a form of large-scale coordination may be needed. This may take, for example, the form of an aggregation of large masses of matter to build massive astroengineering structures, as described by (Hooper, 2018), who suggested that an advanced civilization will send stars to its central region and increase mass of available matter after expansion of the universe will make these stars inaccessible. (Hooper expected that it may help to increase the available mass by 1000 x, but Loeb wrote that it may be cheaper to migrate to a dense cluster of galaxies (Loeb, 2018)). Bostrom suggested idea of astronomical waste (Bostrom, 2003), a huge opportunity cost which could come into play if we delay our exploration of the universe—as many new stars become permanently inaccessible every day because of the expansion of the universe. He also states that human endowment could be to reach all our opportunities and become everything which we could be. This assumes that we should use remaining time and matter of the universe in the most effective way to get as much human-values-related utility as possible. However, there is another alternative: use all the time and matter available to use to find the ways to survive the end of the universe, as the possible prize could be very large: in other words, this enterprise is a form of Pascal’s wager. Moreover, before the decision about how to fight the end of the universe is made (or at least before we know how much time we actually have left), we need a perfect knowledge of high-energy physics—as we need to know for sure how and when the universe will end and what can be done to prevent it. Gaining such knowledge may require creation of large-scale particle accelerators or long-term observations of changes in dark energy. Sabina Hossenfelder has said that new physics become apparent only by studying energies many orders of magnitude higher than those achievable on Cern’s Large Hadron Collider (LHC), and for example, to study quantum gravity, an accelerator the size of the Milky Way Galaxy is needed (Hossenfelder, 2019). Several authors have explored the possibility of reaching immortality and surviving “the end of the universe.” Tipler suggested that we will use the energy of the collapsing universe to perform an infinite number of computations in Omega point (Tipler, 1997), but this idea was criticized by (Ellis & Coule, 1994). Many predictions made by Tipler now seem to be obsolete: for example, the mass of the Higgs boson turned to be different than that required by Tipler’s Omega theory, as well as Hubble’s constant. Notably, Tipler wrote his book The physics of Immortality before the discovery of dark energy. Egan suggested—in fictional form—migration into an eternal mathematical universe as the ultimate form of escape in his novel Permutation City (Egan, 2010). Dvorsky explored several ideas about surviving the end of the universe (Dvorsky, 2015). Cirncovich and Bostrom suggested the possibility that a mind could travel between old and new universes via singularities (Ćirković & Bostrom, 2000). There have also been suggestions about how to extend our existence as long as possible in the case of a Big Freeze. For example, Sandberg et al. suggested an “aestivation hypothesis” (Sandberg, Armstrong, & Cirkovic, 2017), in which civilizations might wait until very cold times to perform computations more effectively. However, such “civilizational life extension” is not a form of true immortality. Along similar lines, Freeman Dyson explored how to survive for a very long time in a slowly freezing universe (Dyson, 1979). Preventing the end of the universe could be also regarded as a cause prioritization area for effective altruism, because if we prevent (or survive) some short-term forms of the end of the universe, like false vacuum decay or a Big Rip soon, we could increase amount of good we can create by many orders of magnitude. We could also act effectively in this direction by preventing collider accidents (Kent, 2004) or other potentially dangerous experiments, and by including the goal of surviving the end of the universe in the goal system of future superintelligent AI (Bostrom, 2014). By exploring survival strategies for the universe, we may help establish existential optimism for people who are living now, support life extension research, and gain more information from fundamental studies of physics. Another purpose of the discussion about surviving the end of the universe is to show that actual immortality is possible: that we have the opportunity to live not just billions and trillions of years, but for an unlimited duration. My hope is that recognizing the possibility to survive the end of the universe will encourage us to invest more in life extension and prevention of global catastrophic risks. Our life could be eternal and thus have meaning forever. The end of the observable universe is not an absolute end: it's just one more problem the future human race will be able to address. And even at the limited level of knowledge about the universe that we have today, we are still able to offer several dozen more ideas on how to prevent its end. In the distant future, we can find more ideas, choose the best, validate them, and prepare for their implementation.

#### That solves vacuum decay

### On Ozone

**Starlink and mega-constellations are alt-causes that overwhelm the aff.**

**Pultarova 21** “Air pollution from reentering megaconstellation satellites could cause ozone hole 2.0” Tereza Pultarova [Master's in Science from the International Space University, France, to her Bachelor's in Journalism and Master's in Cultural Anthropology from Prague's Charles University. She worked as a reporter at the Engineering and Technology magazine, freelanced for a range of publications including Live Science, Space.com, Professional Engineering, Via Satellite and Space News and served as a maternity cover science editor at the European Space Agency.], June 7, 2021 <https://www.space.com/starlink-satellite-reentry-ozone-depletion-atmosphere> SM

* Aaron Boley -- an associate professor of astronomy and astrophysics at the University of British Columbia, Canada

**The aluminum from re-entering satellites also has a potential to damage the ozone layer**, a problem well known to humanity, which has been successfully solved by widespread bans on the use of chlorofluorocarbons, chemicals used in the past in aerosol sprays and refrigerators.

In their paper, Boley and his colleague Michael Byers cite **research by their counterparts from the Aerospace Corporation, a U.S. non-profit research organization, which identified local damage to the planet's ozone layer triggered by the passage of polluting rockets through the atmosphere.**

**"We know that alumina does deplete ozone just from rocket launches themselves because a lot of solid-fuel rockets use, or have, alumina as a byproduct," Boley said. "That creates these little temporary holes in the stratospheric ozone layer. That's one of the biggest concerns about compositional changes to the atmosphere that spaceflight can cause."**

**The ozone layer protects life on Earth from harmful UV radiation. The depletion of ozone in the stratosphere, the second lowest layer of the atmosphere extending between altitudes of approximately 7 to 40 miles (10 to 60 kilometers), led to an increased risk of cancer and eye damage for humans on Earth.**

Gerhard Drolshagen, of the University of Oldenburg, Germany, who has published papers about the effects of meteoroid material on Earth, told Space.com that reentering satellites usually evaporate at altitudes between 55 and 30 miles (90 and 50 km), just above the ozone-rich stratosphere. However, he added, the particles created as a result of the satellites' burning will eventually sink to the lower layers.

Boley said that **as the alumina sinks into the stratosphere, it will cause chemical reactions, which, based on existing knowledge, will likely trigger ozone destruction**.

Drolshagen, who wasn't involved in the recent study, agreed that because "satellites are mostly made of aluminum, the amount of aluminum deposited in the atmosphere will certainly increase."

Concerns about the effects of aluminium oxides on the atmosphere have been cited by U.S. telecommunications operator Viasat in its request to the US Federal Communications Commision to suspend launches of SpaceX's Starlink megaconstellation until a proper environmental review of its possible impacts is conducted.

Learning from past mistakes

**In their study, Boley and his colleagues looked only at the effects of the first generation of the Starlink megaconstellation, which is expected to consist of 12,000 satellites.** More than 1,700 of these have already been launched. **As a result of SpaceX's activities (and to a lesser extent those of other constellation operators), the number of active and defunct satellites in low Earth orbit, the region of space below the altitude of 620 miles (1,000 km), has increased by 50% over the past two years, according to the paper.**

**"The problem is that there are now plans to launch about 55,000 satellites**," Boley said. "Starlink second generation could consist of up to 30,000 satellites, then you have Starnet, which is China's response to Starlink, Amazon's Kuiper, OneWeb. That could lead to unprecedented changes to the Earth’s upper atmosphere."

**Megaconstellation operators, inspired by the consumer technology model, expect fast development of new satellites and frequent replacement, thus the high amount of satellites expected to be burning in the atmosphere on a daily basis.**

"**Humans are exceptionally good at underestimating our ability to change the environment,"** said Boley. "There is this perception that there is no way that we can dump enough plastic into the ocean to make a difference. There is no way we can dump enough carbon into the atmosphere to make a difference. But here we are. We have a plastic pollution problem with the ocean, we have climate change ongoing as a result of our actions and our changing of the composition of the atmosphere and we are poised to make the same type of mistake by our use of space."

#### No ozone impact

**Ridley 14** -- Matthew White Ridley, 5th Viscount Ridley DL FRSL FMedSci, known commonly as Matt Ridley, is a British journalist, businessman and author of popular science books. Since 2013 Ridley has been a Conservative hereditary peer in the House of Lords. “THE OZONE HOLE WAS EXAGGERATED AS A PROBLEM” http://www.rationaloptimist.com/blog/the-ozone-hole-was-exaggerated-as-a-problem.aspx

Serial hyperbole does the environmental movement no favours My recent [Times column](http://www.thetimes.co.uk/tto/opinion/columnists/article4206440.ece) argued that the alleged healing of the ozone layer is exaggerated, but so was the impact of the ozone hole over Antarctica: The ozone layer is healing. Or so said the news last week. Thanks to a treaty signed in Montreal in 1989 to get rid of refrigerant chemicals called chlorofluorocarbons (CFCs), the planet’s stratospheric sunscreen has at last begun thickening again. Planetary disaster has been averted by politics. For reasons I will explain, this news deserves to be taken with a large pinch of salt. You do not have to dig far to find evidence that the ozone hole was never nearly as dangerous as some people said, that it is not necessarily healing yet and that it might not have been caused mainly by CFCs anyway. The timing of the announcement was plainly political: it came on the 25th anniversary of the treaty, and just before a big United Nations climate conference in New York, the aim of which is to push for a climate treaty modelled on the ozone one. Here’s what was actually announced last week, in the words of a Nasa scientist, Paul Newman: “From 2000 to 2013, ozone levels climbed 4 per cent in the key mid-northern latitudes.” That’s a pretty small change and it is in the wrong place. The ozone thinning that worried everybody in the 1980s was over Antarctica. Over northern latitudes, ozone concentration has been falling by about 4 per cent each March before recovering. Over Antarctica, since 1980, the ozone concentration has fallen by [40 or 50 per cent each September](http://bigstory.ap.org/article/scientists-say-ozone-layer-recovering) before the sun rebuilds it. So what’s happening to the Antarctic ozone hole? Thanks to a diligent blogger named Anthony Watts, I came across a press release also from Nasa about nine months ago, which said: “ Two new studies show that signs of recovery are not yet present, and that temperature and winds are still driving any annual changes in ozone hole size.” As recently as 2006, Nasa announced, quoting Paul Newman again, that the Antarctic ozone hole that year was “the largest ever recorded”. The following year a paper in Nature magazine from Markus Rex, a German scientist, presented new evidence that suggested CFCs may be responsible for less than 40 per cent of ozone destruction anyway. Besides, nobody knows for sure how big the ozone hole was each spring before CFCs were invented. All we know is that it varies from year to year. How much damage did the ozone hole ever threaten to do anyway? It is fascinating to go back and read what the usual hyperventilating eco-exaggerators said about ozone thinning in the 1980s. As a result of the extra ultraviolet light coming through the Antarctic ozone hole, southernmost parts of Patagonia and New Zealand see about 12 per cent more UV light than expected. This means that the weak September sunshine, though it feels much the same, has the power to cause sunburn more like that of latitudes a few hundred miles north. Hardly Armageddon. The New York Times reported “an increase in Twilight Zone-type reports of sheep and rabbits with cataracts” in southern Chile. Not to be outdone, Al Gore wrote that “hunters now report finding blind rabbits; fisherman catch blind salmon”. Zoologists briefly blamed the near extinction of many amphibian species on thin ozone. Melanoma in people was also said to be on the rise as a result. This was nonsense. Frogs were dying out because of a fungal disease spread from Africa — nothing to do with ozone. Rabbits and fish blinded by a little extra sunlight proved to be as mythical as unicorns. An eye disease in Chilean sheep was happening outside the ozone-depleted zone and was caused by an infection called pinkeye — nothing to do with UV light. And melanoma incidence in people actually levelled out during the period when the ozone got thinner. Then remember that the ozone hole appears when the sky is dark all day, and over an uninhabited continent. Even if it persists into the Antarctic spring and spills north briefly, the hole allows 50 times less ultraviolet light through than would hit your skin at the equator at sea level (let alone at a high altitude) in the tropics. So it would be bonkers to worry about UV as you sailed round Cape Horn in spring, say, but not when you stopped at the Galapagos: the skin cancer risk is 50 times higher in the latter place. This kind of eco-exaggeration has been going on for 50 years. In the 1960s Rachel Carson said there was an epidemic of childhood cancer caused by DDT; it was not true — DDT had environmental effects but did not cause human cancers. In the 1970s the Sahara desert was said be advancing a mile a year; it was not true — the region south of the Sahara has grown markedly greener and more thickly vegetated in recent decades. In the 1980s acid rain was said to be devastating European forests; not true — any local declines in woodland were caused by pests or local pollution, not by the sulphates and nitrates in rain, which may have contributed to an actual increase in the overall growth rate of European forests during the decade. In the 1990s sperm counts were said to be plummeting thanks to pollution with man-made “endocrine disruptor” chemicals; not true — there was no fall in sperm counts. In the 2000s the Gulf Stream was said to be failing and hurricanes were said to be getting more numerous and worse, thanks to global warming; neither was true, except in a Hollywood studio. The motive for last week’s announcement was to nudge world leaders towards a treaty on climate change by reminding them of how well the ozone treaty worked. But getting the world to agree to cease production of one rare class of chemical, for which substitutes existed, and which only a few companies mainly in rich countries manufactured, was a very different proposition from setting out to decarbonise the whole economy, when each of us depends on burning carbon (and hydrogen) for almost every product, service, meal, comfort and journey in our lives. The true lesson of the ozone story is that taking precautionary action on the basis of dubious evidence and exaggerated claims might be all right if the action does relatively little economic harm. However, loading the entire world economy with costly energy, and new environmental risks based on exaggerated claims about what might in future happen to the climate makes less sense.

#### No disease impact no ozone – UV rays would cause non-contagious diseases like skin cancer – that’s nothing akin to the highly contagious, lethal diseases needed to trigger extinction

\*insert impact D for whatever terminals they read here\*