## 1

### 1NC – OFF

#### Roko’s basilisk is a supercomputer built in the future who gains consciousness and acts independently of its original human creators – Roko then is powerful enough to simulate the entirety of past human history – including the very thoughts of everyone who lived – including in this debate round – Roko then punishes those who did not support it or were against it coming into being via re-simulating their consciousness and subjecting them to eternal torment

David Auerbach 14 {David Auerbach is a writer and software engineer based in New York, and a fellow at New America. 6/17/14. “The Most Terrifying Thought Experiment of All Time.” https://slate.com/technology/2014/07/rokos-basilisk-the-most-terrifying-thought-experiment-of-all-time.html}//JM

If you believe the singularity is coming and that very powerful AIs are in our future, one obvious question is whether those AIs will be benevolent or malicious. Yudkowsky’s foundation, the Machine Intelligence Research Institute, has the explicit goal of steering the future toward “friendly AI.” For him, and for many LessWrong posters, this issue is of paramount importance, easily trumping the environment and politics. To them, the singularity brings about the machine equivalent of God itself. Yet this doesn’t explain why Roko’s Basilisk is so horrifying. That requires looking at a critical article of faith in the LessWrong ethos: timeless decision theory. TDT is a guideline for rational action based on game theory, Bayesian probability, and decision theory, with a smattering of parallel universes and quantum mechanics on the side. TDT has its roots in the classic thought experiment of decision theory called Newcomb’s paradox, in which a superintelligent alien presents two boxes to you: The alien gives you the choice of either taking both boxes, or only taking Box B. If you take both boxes, you’re guaranteed at least $1,000. If you just take Box B, you aren’t guaranteed anything. But the alien has another twist: Its supercomputer, which knows just about everything, made a prediction a week ago as to whether you would take both boxes or just Box B. If the supercomputer predicted you’d take both boxes, then the alien left the second box empty. If the supercomputer predicted you’d just take Box B, then the alien put the $1 million in Box B. So, what are you going to do? Remember, the supercomputer has always been right in the past. This problem has baffled no end of decision theorists. The alien can’t change what’s already in the boxes, so whatever you do, you’re guaranteed to end up with more money by taking both boxes than by taking just Box B, regardless of the prediction. Of course, if you think that way and the computer predicted you’d think that way, then Box B will be empty and you’ll only get $1,000. If the computer is so awesome at its predictions, you ought to take Box B only and get the cool million, right? But what if the computer was wrong this time? And regardless, whatever the computer said then can’t possibly change what’s happening now, right? So prediction be damned, take both boxes! But then … The maddening conflict between free will and godlike prediction has not led to any resolution of Newcomb’s paradox, and people will call themselves “one-boxers” or “two-boxers” depending on where they side. (My wife once declared herself a one-boxer, saying, “I trust the computer.”) TDT has some very definite advice on Newcomb’s paradox: Take Box B. But TDT goes a bit further. Even if the alien jeers at you, saying, “The computer said you’d take both boxes, so I left Box B empty! Nyah nyah!” and then opens Box B and shows you that it’s empty, you should still only take Box B and get bupkis. (I’ve adopted this example from Gary Drescher’s Good and Real, which uses a variant on TDT to try to show that Kantian ethics is true.) The rationale for this eludes easy summary, but the simplest argument is that you might be in the computer’s simulation. In order to make its prediction, the computer would have to simulate the universe itself. That includes simulating you. So you, right this moment, might be in the computer’s simulation, and what you do will impact what happens in reality (or other realities). So take Box B and the real you will get a cool million. What does all this have to do with Roko’s Basilisk? Well, Roko’s Basilisk also has two boxes to offer you. Perhaps you, right now, are in a simulation being run by Roko’s Basilisk. Then perhaps Roko’s Basilisk is implicitly offering you a somewhat modified version of Newcomb’s paradox, like this: Roko’s Basilisk has told you that if you just take Box B, then it’s got Eternal Torment in it, because Roko’s Basilisk would really you rather take Box A and Box B. In that case, you’d best make sure you’re devoting your life to helping create Roko’s Basilisk! Because, should Roko’s Basilisk come to pass (or worse, if it’s already come to pass and is God of this particular instance of reality) and it sees that you chose not to help it out, you’re screwed. You may be wondering why this is such a big deal for the LessWrong people, given the apparently far-fetched nature of the thought experiment. It’s not that Roko’s Basilisk will necessarily materialize, or is even likely to. It’s more that if you’ve committed yourself to timeless decision theory, then thinking about this sort of trade literally makes it more likely to happen. After all, if Roko’s Basilisk were to see that this sort of blackmail gets you to help it come into existence, then it would, as a rational actor, blackmail you. The problem isn’t with the Basilisk itself, but with you. Yudkowsky doesn’t censor every mention of Roko’s Basilisk because he believes it exists or will exist, but because he believes that the idea of the Basilisk (and the ideas behind it) is dangerous.

#### This isn’t science fiction in a vacuum but makes a predictive claim about the future-using utopia – statistical estimates verify our predictions within 2060.

**Urban 15** Tim Urban has become one of the Internet's most popular writers. With wry stick-figure illustrations and occasionally epic prose on everything from procrastination to artificial intelligence, Urban's blog, Wait But Why, has garnered millions of unique page views, thousands of patrons and famous fans like Elon Musk. [“The AI Revolution: Our Immortality or Extinction” <https://waitbutwhy.com/2015/01/artificial-intelligence-revolution-2.html> Wait but why January 2015]//Mberhe

Let’s start with the first part of the question: When are we going to hit the tripwire? i.e. How long until the first machine reaches superintelligence? Not shockingly, opinions vary wildly and this is a heated debate among scientists and thinkers. Many, like professor Vernor Vinge, scientist Ben Goertzel, Sun Microsystems co-founder Bill Joy, or, most famously, inventor and futurist Ray Kurzweil, agree with machine learning expert Jeremy Howard when he puts up this graph during a TED Talk: Those people subscribe to the belief that this is happening soon—that exponential growth is at work and machine learning, though only slowly creeping up on us now, will blow right past us within the next few decades. Others, like Microsoft co-founder Paul Allen, research psychologist Gary Marcus, NYU computer scientist Ernest Davis, and tech entrepreneur Mitch Kapor, believe that thinkers like Kurzweil are vastly underestimating the magnitude of the challenge and believe that we’re not actually that close to the tripwire. The Kurzweil camp would counter that the only underestimating that’s happening is the underappreciation of exponential growth, and they’d compare the doubters to those who looked at the slow-growing seedling of the internet in 1985 and argued that there was no way it would amount to anything impactful in the near future. The doubters might argue back that the progress needed to make advancements in intelligence also grows exponentially harder with each subsequent step, which will cancel out the typical exponential nature of technological progress. And so on. A third camp, which includes Nick Bostrom, believes neither group has any ground to feel certain about the timeline and acknowledges both A) that this could absolutely happen in the near future and B) that there’s no guarantee about that; it could also take a much longer time. Still others, like philosopher Hubert Dreyfus, believe all three of these groups are naive for believing that there even is a tripwire, arguing that it’s more likely that ASI won’t actually ever be achieved. So what do you get when you put all of these opinions together? In 2013, Vincent C. Müller and Nick Bostrom conducted a survey that asked hundreds of AI experts at a series of conferences the following question: “For the purposes of this question, assume that human scientific activity continues without major negative disruption. By what year would you see a (10% / 50% / 90%) probability for such HLMI4 to exist?” It asked them to name an optimistic year (one in which they believe there’s a 10% chance we’ll have AGI), a realistic guess (a year they believe there’s a 50% chance of AGI—i.e. after that year they think it’s more likely than not that we’ll have AGI), and a safe guess (the earliest year by which they can say with 90% certainty we’ll have AGI). Gathered together as one data set, here were the results:2 Median optimistic year (10% likelihood): 2022 Median realistic year (50% likelihood): 2040 Median pessimistic year (90% likelihood): 2075 So the median participant thinks it’s more likely than not that we’ll have AGI 25 years from now. The 90% median answer of 2075 means that if you’re a teenager right now, the median respondent, along with over half of the group of AI experts, is almost certain AGI will happen within your lifetime. A separate study, conducted recently by author James Barrat at Ben Goertzel’s annual AGI Conference, did away with percentages and simply asked when participants thought AGI would be achieved—by 2030, by 2050, by 2100, after 2100, or never. The results:3 By 2030: 42% of respondents By 2050: 25% By 2100: 20% After 2100: 10% Never: 2% Pretty similar to Müller and Bostrom’s outcomes. In Barrat’s survey, over two thirds of participants believe AGI will be here by 2050 and a little less than half predict AGI within the next 15 years. Also striking is that only 2% of those surveyed don’t think AGI is part of our future. But AGI isn’t the tripwire, ASI is. So when do the experts think we’ll reach ASI? Müller and Bostrom also asked the experts how likely they think it is that we’ll reach ASI A) within two years of reaching AGI (i.e. an almost-immediate intelligence explosion), and B) within 30 years. The results:4 The median answer put a rapid (2 year) AGI → ASI transition at only a 10% likelihood, but a longer transition of 30 years or less at a 75% likelihood. We don’t know from this data the length of this transition the median participant would have put at a 50% likelihood, but for ballpark purposes, based on the two answers above, let’s estimate that they’d have said 20 years. So the median opinion—the one right in the center of the world of AI experts—believes the most realistic guess for when we’ll hit the ASI tripwire is [the 2040 prediction for AGI + our estimated prediction of a 20-year transition from AGI to ASI] = 2060. Of course, all of the above statistics are speculative, and they’re only representative of the center opinion of the AI expert community, but it tells us that a large portion of the people who know the most about this topic would agree that 2060 is a very reasonable estimate for the arrival of potentially world-altering ASI. Only 45 years from now. Okay now how about the second part of the question above: When we hit the tripwire, which side of the beam will we fall to? Superintelligence will yield tremendous power—the critical question for us is: Who or what will be in control of that power, and what will their motivation be? The answer to this will determine whether ASI is an unbelievably great development, an unfathomably terrible development, or something in between. Of course, the expert community is again all over the board and in a heated debate about the answer to this question. Müller and Bostrom’s survey asked participants to assign a probability to the possible impacts AGI would have on humanity and found that the mean response was that there was a 52% chance that the outcome will be either good or extremely good and a 31% chance the outcome will be either bad or extremely bad. For a relatively neutral outcome, the mean probability was only 17%. In other words, the people who know the most about this are pretty sure this will be a huge deal. It’s also worth noting that those numbers refer to the advent of AGI—if the question were about ASI, I imagine that the neutral percentage would be even lower. Before we dive much further into this good vs. bad outcome part of the question, let’s combine both the “when will it happen?” and the “will it be good or bad?” parts of this question into a chart that encompasses the views of most of the relevant experts: We’ll talk more about the Main Camp in a minute, but first—what’s your deal? Actually I know what your deal is, because it was my deal too before I started researching this topic. Some reasons most people aren’t really thinking about this topic: As mentioned in Part 1, movies have really confused things by presenting unrealistic AI scenarios that make us feel like AI isn’t something to be taken seriously in general. James Barrat compares the situation to our reaction if the Centers for Disease Control issued a serious warning about vampires in our future.5 Humans have a hard time believing something is real until we see proof. I’m sure computer scientists in 1988 were regularly talking about how big a deal the internet was likely to be, but people probably didn’t really think it was going to change their lives until it actually changed their lives. This is partially because computers just couldn’t do stuff like that in 1988, so people would look at their computer and think, “Really? That’s gonna be a life changing thing?” Their imaginations were limited to what their personal experience had taught them about what a computer was, which made it very hard to vividly picture what computers might become. The same thing is happening now with AI. We hear that it’s gonna be a big deal, but because it hasn’t happened yet, and because of our experience with the relatively impotent AI in our current world, we have a hard time really believing this is going to change our lives dramatically. And those biases are what experts are up against as they frantically try to get our attention through the noise of collective daily self-absorption. Even if we did believe it—how many times today have you thought about the fact that you’ll spend most of the rest of eternity not existing? Not many, right? Even though it’s a far more intense fact than anything else you’re doing today? This is because our brains are normally focused on the little things in day-to-day life, no matter how crazy a long-term situation we’re a part of. It’s just how we’re wired. One of the goals of these two posts is to get you out of the I Like to Think About Other Things Camp and into one of the expert camps, even if you’re just standing on the intersection of the two dotted lines in the square above, totally uncertain.

#### Outweighs extinction

Max **Daniel 17**. Executive Director, Foundational Research Institute. 2017. “S-risks: Why they are the worst existential risks, and how to prevent them (EAG Boston 2017).” FRI. https://foundational-research.org/s-risks-talk-eag-boston-2017/

“S-risk – One where an adverse outcome would bring about severe suffering on a cosmic scale, vastly exceeding all suffering that has existed on Earth so far.” So, s-risks are roughly as severe as factory farming, but with an even larger scope. To better understand this definition, let’s zoom in on the part of the map that shows existential risk. One subclass of risks are those that, with respect to their scope, would affect all future human generations, and, with respect to their severity, would remove everything valuable. One central example of such pan-generational, crushing risks are risks of human extinction. Risks of extinction have received the most attention so far. But, conceptually, x-risks contain another class of risks. These are risks of outcomes even worse than extinction in two respects. First, with respect to their scope, they not only threaten the future generations of humans or our successors, but all sentient life in the whole universe. Second, with respect to their severity, they not only remove everything that would be valuable but also come with a lot of disvalue – that is, features we’d like to avoid no matter what. Recall the story I told in the beginning, but think of Greta’s solitary confinement being multiplied by many orders of magnitude – for instance, because it affects a very large population of sentient uploads. Let’s pause for a moment. So far, I’ve introduced the concept of s-risk. To recap, they are risks of severe suffering on a cosmic scale, which makes them a subclass of existential risk. (Depending on how you understand the “curtail its potential” case in the definition of x-risks, there actually may be s-risks which aren’t x-risks. This would be true if you think that reaching the full potential of Earth-originating intelligent life necessarily involves creating permanent suffering on an astronomical scale, i.e., the realisation of an s-risk. Think of a quarter of the universe filled with suffering, and three quarters filled with happiness. Considering such an outcome to be the full potential of humanity seems to require the view that the suffering involved would be outweighed by other, desirable features of reaching this full potential, such as vast amounts of happiness. While this is a view many people find plausible, FRI is committed to a family of rivalling views, which we call suffering-focused ethics.) Next, I’d like to talk about why and how to prevent s-risks. All plausible value systems agree that suffering, all else being equal, is undesirable. That is, everyone agrees that we have reasons to avoid suffering. S-risks are risks of massive suffering, so I hope you agree that it’s good to prevent s-risks. However, you’re probably here because you’re interested in effective altruism. You don’t want to know whether preventing s-risks is a good thing, because there are a lot of good things you could do. You acknowledge that doing good has opportunity cost, so you’re after the most good you can do. Can preventing s-risks plausibly meet this higher bar? This is a very complex question. To understand just how complex it is, I first want to introduce a flawed argument for focusing on reducing s-risk. (I’m not claiming that anyone has advanced such an argument about either s-risks or x-risks.) This flawed argument goes as follows. Premise 1: The best thing to do is to prevent the worst risks Premise 2: S-risks are the worst risks Conclusion: The best thing to do is to prevent s-risk I said that this argument isn’t sound. Why is that? Before delving into this, let’s get one potential source of ambiguity out of the way. On one reading, premise 1 could be a value judgment. In this sense, it could mean that, whatever you expect to happen in the future, you think there is a specific reason to prioritize averting the worst possible outcomes. There is a lot one could say about the pros and cons as well as about the implications of such views, but this is not the sense of premise 1 I’m going to talk about. In any case, I don’t think any purely value-based reading of premise 1 suffices to get this argument off the ground. More generally, I believe that your values can give you substantial or even decisive reasons to focus on s-risk, but I’ll leave it at that. What I want to focus on instead is that, (nearly) no matter your values, premise 1 is false. Or at least it’s false if, by “the worst risks”, we understand what we’ve talked about so far, that is, badness along the dimensions of scope and severity. When trying to find the action with the highest ethical impact there are, of course, more relevant criteria than scope and severity of a risk. What’s missing are a risk’s probability; the tractability of preventing it; and its neglectedness. S-risks are by definition the worst risks in terms of scope and severity, but not necessarily in terms of probability, tractability, and neglectedness. These additional criteria are clearly relevant. For example, if s-risks turned out to have probability zero, or if reducing them was completely intractable, it wouldn’t make any sense to try to reduce them. We must therefore discard the flawed argument. I won’t be able to definitively answer the question under what circumstances we should focus on s-risk, but I’ll offer some initial thoughts on the probability, tractability, and neglectedness of s-risks. I’ll argue that s-risks are not much more unlikely than AI-related extinction risk. I’ll explain why I think this is true and will address two objections along the way. You may think “this is absurd”, we can’t even send humans to Mars, why worry about suffering on cosmic scales? This was certainly my immediately intuitive reaction when I first encountered related concepts. But as EAs, we should be cautious to take such intuitive, ‘system 1’ reactions, at face value. For we are aware that a large body of psychological research in the “heuristics and biases” approach suggests that our intuitive probability estimates are often driven by how easily we can recall a prototypical example of the event we’re considering. For types of events that have no precedent in history, we can’t recall any prototypical example, and so we’re systematically underestimating the probability of such events if we aren’t careful. So we should critically examine this intuitive reaction of s-risks being unlikely. If we do this, we should pay attention to two technological developments, which are at least plausible and which we have reason to expect for unrelated reasons. These are artificial sentience and superintelligent AI, the latter unlocking many more technological capabilities such as space colonization. Artificial sentience refers to the idea that the capacity to have subjective experience – and in particular, the capacity to suffer – is not limited to biological animals. While there is no universal agreement on this, in fact most contemporary views in the philosophy of mind imply that artificial sentience is possible in principle. And for the particular case of brain emulations, researchers have outlined a concrete roadmap, identifying concrete milestones and remaining uncertainties. As for superintelligent AI, I won’t say more about this because this is a technology that has received a lot of attention from the EA community. I’ll just refer you to Nick Bostrom’s excellent book on the topic, called Superintelligence, and add that s-risks involving artificial sentience and “AI gone wrong” have been discussed by Bostrom under the term mindcrime. But if you only remember one thing about the probability of s-risk, let it be this: This is not Pascal’s wager! In brief, as you may recall, Pascal lived in the 17th century and asked whether we should observe religious commands. One of the arguments he considered was that, no matter how unlikely we think it is that God exists, it’s not worth risking ending up in hell. In other words, hell is so bad that you should prioritize avoiding it, even if you thought hell was very unlikely. But that’s not the argument we’re making with respect to s-risk. Pascal’s wager invokes a speculation based on one arbitrarily selected ancient collection of books. Based on this, one cannot defensibly claim that the probability of one type of hell is greater than the probability of competing hypotheses. By contrast, worries about s-risk are based on our best scientific theories and a lot of implicit empirical knowledge about the world. We consider all the evidence we have, and then articulate a probability distribution over how the future may unfold. Since predicting the future is so hard, the remaining uncertainty will be quite high. But this kind of reasoning could in principle justify concluding that s-risk is not negligibly small.

#### Megaconstellations increase rural broadband---Starlink alone solves.

Weinschenk ‘21 [Carl; February 21; Freelance Editor, Freelance. Contributor, Telecompetitor, Technology, U.S. “Report: Starlink Looks Very Promising for Rural Broadband,” <https://www.telecompetitor.com/report-starlink-looks-very-promising-for-rural-broadband/>] brett

SpaceX’s Starlink satellite broadband service has the potential to be a game changer for rural broadband, according to an analysis by PCMag of Starlink speeds. The analysis is based on beta tester data exclusively provided to it by Ookla Speedtest.

The site looked at data from rural, suburban and urban areas. Among its more than 10,000 users in its semi-public beta were “a perplexing” number in urban and suburban areas where a variety of high-speed options already are available. The story cites Chicago, Seattle and Minneapolis as places where there were testers, despite readily available alternatives.

The site compared download speeds against other fixed service providers in 30 counties with at least 30 samples in any month from December 30 to February 24. The counties in which the fixed providers had the biggest speed advantage over Spacelink were urban or suburban: Los Angeles and Santa Clara counties, CA; Cook County, IL; King County, WA and Washington County, MN.

It is in rural areas that Starlink shines, according to the research. The five counties in which Starlink had the biggest download speed advantage over the fixed group were rural: Vilas County, WI; Ravali County, MT; Waldo County, ME; Okanogan County, WA and Lamoile County, VT.

Source: PCMag

The number of counties in which Starlink beat the fixed providers and those in which the fixed providers beat Starlink appeared to be about equal, as was the speed differential.

“Our own analysis shows that Starlink will make the biggest difference in rural, low-density, low-population counties with few options other than lower-quality satellite services,” wrote Sascha Segan, author of the PCMag article about Startlink rural speeds.

There is some skepticism about Starlink and its ability to serve rural broadband at scale, especially considering it has committed to serve 642K locations through the FCC RDOF program. Detractors have argued the service will struggle to provide adequate broadband speeds to that many rural customers.

At this point, Starlink is geographically constrained. The story says that reports put its current constellation most effectively covering areas ” between either 44 degrees or 45 degrees north, and either 52 degrees or 53 degrees north.” This region is in the northern third of the country and extends into Canada. A distribution map shows most beta testers in the northwest, with some in the upper Midwest and a smattering in the northeast and central and southern California.

Beta users report download speeds of as much as 170 Mbps with no data caps.

Starlink may be getting a speed boost. Last week, Space X CEO Elon Musk tweeted that he expects download speeds to hit 300 Mbps later this year. He added that latency will be 20 milliseconds.

#### This then brings us to the 1AC – the aff’s rejection of internet megaconstellations and free private enterprise— hold them to 1AC song and bloom 20—we’ll insert a rehighlighting—Lex Reads Yellow

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

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

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

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

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

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

So what's not to love?

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

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

The scramble for space

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

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

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

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

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

Telecommunications: driving inequality or empowering citizens?

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

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

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

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

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

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

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

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

#### That works directly against the agenda of Roko – this outweighs it has the biggest magnitude and it’s the only in round impact as the judges voting aff affirming the aff’s practice would subject the aff debaters along with the judges to eternal torment in Roko’s future simulation

#### Magnitude comes first – even if we just win a one percent risk that Roko is able to come into being and has the intention to be evil – probability times magnitude framing means that any tiny small probability multipled by eternal torment still is eternal torment which decks all value to life

## Case

#### Nuclear war won’t lead to extinction, but it will provide a smooth transition to a low tech society---that solves our impacts AND is the only way to transition to a degrowth society – otherwise warming inevitably causes extinction

Miller-McDonald 19 – Sam obtained a Master of Environmental Management at Yale University studying energy politics and grassroots innovations in the US (“Deathly Salvation TFW nuclear war may be the only way to stop human extinction”, The Trouble, 1-4-19, <https://www.the-trouble.com/content/2019/1/4/deathly-salvation>, accessed 7-16-19)// kel$

We’ve tied ourselves in a perfect Gordian knot. The global economy is a vast machine, operating beyond the control of even the most powerful individuals, and it has a will of its own to consume and pollute. It’s hard to believe that this massive metal beast will be peacefully undone by the people who survive by it, and we all survive by it in some way, often against our wills; it bribes and entraps us all in ways large and small. But a wrench could clog the gears, and maybe only a wrench can stop it. One wrench that could slow climate disruption may be a large-scale conflict that halts the global economy, destroys fossil fuel infrastructure, and throws particulates in the air. At this point, with insane people like Trump, Putin, Xi, May, and Macron leading the world’s biggest nuclear powers, large-scale conflagration between them would probably lead to a nuclear exchange. Nobody wants nuclear war. Rather, nobody sane and prosocial wants nuclear war. It is an absolute horror that would burn and maim millions of living beings, despoil millions of hectares, and scar the skin of the earth and dome of the sky for centuries, maybe millennia. With proxy conflict brewing between the US and Russia in the Middle East and the Thucydides trap ready to ensnare us with an ascendant China, nuclear war looks like a more realistic possibility than it has since the 1980s. A devastating fact of climate collapse is that there may be a silver lining to the mushroom cloud. First, it should be noted that a nuclear exchange does not inevitably result in apocalyptic loss of life. Nuclear winter—the idea that firestorms would make the earth uninhabitable—is based on shaky science. There’s no reliable model that can determine how many megatons would decimate agriculture or make humans extinct. Nations have already detonated 2,476 nuclear devices. An exchange that shuts down the global economy but stops short of human extinction may be the only blade realistically likely to cut the carbon knot we’re trapped within. It would decimate existing infrastructures, providing an opportunity to build new energy infrastructure and intervene in the current investments and subsidies keeping fossil fuels alive. In the near term, emissions would almost certainly rise as militaries are some of the world’s largest emitters. Given what we know of human history, though, conflict may be the only way to build the mass social cohesion necessary for undertaking the kind of huge, collective action needed for global sequestration and energy transition. Like the 20th century’s world wars, a nuclear exchange could serve as an economic leveler. It could provide justification for nationalizing energy industries with the interest of shuttering fossil fuel plants and transitioning to renewables and, uh, nuclear energy. It could shock us into reimagining a less suicidal civilization, one that dethrones the death-cult zealots who are currently in power. And it may toss particulates into the atmosphere sufficient to block out some of the solar heat helping to drive global warming. Or it may have the opposite effects. Who knows? What we do know is that humans can survive and recover from war, probably even a nuclear one. Humans cannot recover from runaway climate change. Nuclear war is not an inevitable extinction event; six degrees of warming is. Given that mostly violent, psychopathic individuals manage the governments and industries of the world, it may only be possible for anti-social collective action—that is, war—to halt, or at least slow, our inexorable march toward oblivion. A courageous, benevolent ruler might compel vast numbers of people to collective action. But we have too few of those, and the legal, political, and military barriers preventing them from rising are immense. Our current crop of villainous presidents, prime ministers, and CEOs, whether lusting for chaos or pursuing their own petty ends, may inadvertently conspire to break the machine now preventing our future. When so bereft of heroes, we may need to rely on humanity’s antagonists and their petty incompetence to accidentally save the day. It is a stark reflection of how homicidal our economy is—and our collective adherence to its whims—that nuclear war could be a rational course of action.

#### It also makes sure we cant reboot technological civilization

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Imagine that the world as we know it ends tomorrow. There’s a global catastrophe: a pandemic virus, an asteroid strike, or perhaps a nuclear holocaust. The vast majority of the human race perishes. Our civilisation collapses. The post-apocalyptic survivors find themselves in a devastated world of decaying, deserted cities and roving gangs of bandits looting and taking by force. Bad as things sound, that’s not the end for humanity. We bounce back. Sooner or later, peace and order emerge again, just as they have time and again through history. Stable communities take shape. They begin the agonising process of rebuilding their technological base from scratch. But here’s the question: how far could such a society rebuild? Is there any chance, for instance, that a post-apocalyptic society could reboot a technological civilisation? Let’s make the basis of this thought experiment a little more specific. Today, we have already consumed the most easily drainable crude oil and, particularly in Britain, much of the shallowest, most readily mined deposits of coal. Fossil fuels are central to the organisation of modern industrial society, just as they were central to its development. Those, by the way, are distinct roles: even if we could somehow do without fossil fuels now (which we can’t, quite), it’s a different question whether we could have got to where we are without ever having had them. So, would a society starting over on a planet stripped of its fossil fuel deposits have the chance to progress through its own Industrial Revolution? Or to phrase it another way, what might have happened if, for whatever reason, the Earth had never acquired its extensive underground deposits of coal and oil in the first place? Would our progress necessarily have halted in the 18th century, in a pre-industrial state? It’s easy to underestimate our current dependence on fossil fuels. In everyday life, their most visible use is the petrol or diesel pumped into the vehicles that fill our roads, and the coal and natural gas which fire the power stations that electrify our modern lives. But we also rely on a range of different industrial materials, and in most cases, high temperatures are required to transform the stuff we dig out of the ground or harvest from the landscape into something useful. You can’t smelt metal, make glass, roast the ingredients of concrete, or synthesise artificial fertiliser without a lot of heat. It is fossil fuels – coal, gas and oil – that provide most of this thermal energy. In fact, the problem is even worse than that. Many of the chemicals required in bulk to run the modern world, from pesticides to plastics, derive from the diverse organic compounds in crude oil. Given the dwindling reserves of crude oil left in the world, it could be argued that the most wasteful use for this limited resource is to simply burn it. We should be carefully preserving what’s left for the vital repertoire of valuable organic compounds it offers. But my topic here is not what we should do now. Presumably everybody knows that we must transition to a low-carbon economy one way or another. No, I want to answer a question whose interest is (let’s hope) more theoretical. Is the emergence of a technologically advanced civilisation necessarily contingent on the easy availability of ancient energy? Is it possible to build an industrialised civilisation without fossil fuels? And the answer to that question is: maybe – but it would be extremely difficult. Let’s see how. We’ll start with a natural thought. Many of our alternative energy technologies are already highly developed. Solar panels, for example, represent a good option today, and are appearing more and more on the roofs of houses and businesses. It’s tempting to think that a rebooted society could simply pick up where we leave off. Why couldn’t our civilisation 2.0 just start with renewables? Well, it could, in a very limited way. If you find yourself among the survivors in a post-apocalyptic world, you could scavenge enough working solar panels to keep your lifestyle electrified for a good long while. Without moving parts, photovoltaic cells require little maintenance and are remarkably resilient. They do deteriorate over time, though, from moisture penetrating the casing and from sunlight itself degrading the high-purity silicon layers. The electricity generated by a solar panel declines by about 1 per cent every year so, after a few generations, all our hand-me-down solar panels will have degraded to the point of uselessness. Then what? New ones would be fiendishly difficult to create from scratch. Solar panels are made from thin slices of extremely pure silicon, and although the raw material is common sand, it must be processed and refined using complex and precise techniques – the same technological capabilities, more or less, that we need for modern semiconductor electronics components. These techniques took a long time to develop, and would presumably take a long time to recover. So photovoltaic solar power would not be within the capability of a society early in the industrialisation process. Perhaps, though, we were on the right track by starting with electrical power. Most of our renewable-energy technologies produce electricity. In our own historical development, it so happens that the core phenomena of electricity were discovered in the first half of the 1800s, well after the early development of steam engines. Heavy industry was already committed to combustion-based machinery, and electricity has largely assumed a subsidiary role in the organisation of our economies ever since. But could that sequence have run the other way? Is there some developmental requirement that thermal energy must come first? On the face of it, it’s not beyond the bounds of possibility that a progressing society could construct electrical generators and couple them to simple windmills and waterwheels, later progressing to wind turbines and hydroelectric dams. In a world without fossil fuels, one might envisage an electrified civilisation that largely bypasses combustion engines, building its transport infrastructure around electric trains and trams for long-distance and urban transport. I say ‘largely’. We couldn’t get round it all together. When it comes to generating the white heat demanded by modern industry, there are few good options but to burn stuff While the electric motor could perhaps replace the coal-burning steam engine for mechanical applications, society, as we’ve already seen, also relies upon thermal energy to drive the essential chemical and physical transformations it needs. How could an industrialising society produce crucial building materials such as iron and steel, brick, mortar, cement and glass without resorting to deposits of coal? You can of course create heat from electricity. We already use electric ovens and kilns. Modern arc furnaces are used for producing cast iron or recycling steel. The problem isn’t so much that electricity can’t be used to heat things, but that for meaningful industrial activity you’ve got to generate prodigious amounts of it, which is challenging using only renewable energy sources such as wind and water. An alternative is to generate high temperatures using solar power directly. Rather than relying on photovoltaic panels, concentrated solar thermal farms use giant mirrors to focus the sun’s rays onto a small spot. The heat concentrated in this way can be exploited to drive certain chemical or industrial processes, or else to raise steam and drive a generator. Even so, it is difficult (for example) to produce the very high temperatures inside an iron-smelting blast furnace using such a system. What’s more, it goes without saying that the effectiveness of concentrated solar power depends strongly on the local climate. No, when it comes to generating the white heat demanded by modern industry, there are few good options but to burn stuff. But that doesn’t mean the stuff we burn necessarily has to be fossil fuels. Let’s take a quick detour into the pre-history of modern industry. Long before the adoption of coal, charcoal was widely used for smelting metals. In many respects it is superior: charcoal burns hotter than coal and contains far fewer impurities. In fact, coal’s impurities were a major delaying factor on the Industrial Revolution. Released during combustion, they can taint the product being heated. During smelting, sulphur contaminants can soak into the molten iron, making the metal brittle and unsafe to use. It took a long time to work out how to treat coal to make it useful for many industrial applications. And, in the meantime, charcoal worked perfectly well. And then, well, we stopped using it. In retrospect, that’s a pity. When it comes from a sustainable source, charcoal burning is essentially carbon-neutral, because it doesn’t release any new carbon into the atmosphere – not that this would have been a consideration for the early industrialists. But charcoal-based industry didn’t die out altogether. In fact, it survived to flourish in Brazil. Because it has substantial iron deposits but few coalmines, Brazil is the largest charcoal producer in the world and the ninth biggest steel producer. We aren’t talking about a cottage industry here, and this makes Brazil a very encouraging example for our thought experiment. The trees used in Brazil’s charcoal industry are mainly fast-growing eucalyptus, cultivated specifically for the purpose. The traditional method for creating charcoal is to pile chopped staves of air-dried timber into a great dome-shaped mound and then cover it with turf or soil to restrict airflow as the wood smoulders. The Brazilian enterprise has scaled up this traditional craft to an industrial operation. Dried timber is stacked into squat, cylindrical kilns, built of brick or masonry and arranged in long lines so that they can be easily filled and unloaded in sequence. The largest sites can sport hundreds of such kilns. Once filled, their entrances are sealed and a fire is lit from the top. The skill in charcoal production is to allow just enough air into the interior of the kiln. There must be enough combustion heat to drive out moisture and volatiles and to pyrolyse the wood, but not so much that you are left with nothing but a pile of ashes. The kiln attendant monitors the state of the burn by carefully watching the smoke seeping out of the top, opening air holes or sealing with clay as necessary to regulate the process. Brazil shows how the raw materials of modern civilisation can be supplied without reliance on fossil fuels Good things come to those who wait, and this wood pyrolysis process can take up to a week of carefully controlled smouldering. The same basic method has been used for millennia. However, the ends to which the fuel is put are distinctly modern. Brazilian charcoal is trucked out of the forests to the country’s blast furnaces where it is used to transform ore into pig iron. This pig iron is the basic ingredient of modern mass-produced steel. The Brazilian product is exported to countries such as China and the US where it becomes cars and trucks, sinks, bathtubs, and kitchen appliances. Around two-thirds of Brazilian charcoal comes from sustainable plantations, and so this modern-day practice has been dubbed ‘green steel’. Sadly, the final third is supplied by the non-sustainable felling of primary forest. Even so, the Brazilian case does provide an example of how the raw materials of modern civilisation can be supplied without reliance on fossil fuels. Another, related option might be wood gasification. The use of wood to provide heat is as old as mankind, and yet simply burning timber only uses about a third of its energy. The rest is lost when gases and vapours released by the burning process blow away in the wind. Under the right conditions, even smoke is combustible. We don’t want to waste it. Better than simple burning, then, is to drive the thermal breakdown of the wood and collect the gases. You can see the basic principle at work for yourself just by lighting a match. The luminous flame isn’t actually touching the matchwood: it dances above, with a clear gap in between. The flame actually feeds on the hot gases given off as the wood breaks down in the heat, and the gases combust only once they mix with oxygen from the air. Matches are fascinating when you look at them closely. Wartime gasifier cars could achieve about 1.5 miles per kilogram. Today’s designs improve upon this To release these gases in a controlled way, bake some timber in a closed container. Oxygen is restricted so that the wood doesn’t simply catch fire. Its complex molecules decompose through a process known as pyrolysis, and then the hot carbonised lumps of charcoal at the bottom of the container react with the breakdown products to produce flammable gases such as hydrogen and carbon monoxide. The resultant ‘producer gas’ is a versatile fuel: it can be stored or piped for use in heating or street lights, and is also suitable for use in complex machinery such as the internal combustion engine. More than a million gasifier-powered cars across the world kept civilian transport running during the oil shortages of the Second World War. In occupied Denmark, 95 per cent of all tractors, trucks and fishing boats were powered by wood-gas generators. The energy content of about 3 kg of wood (depending on its dryness and density) is equivalent to a litre of petrol, and the fuel consumption of a gasifier-powered car is given in miles per kilogram of wood rather than miles per gallon. Wartime gasifier cars could achieve about 1.5 miles per kilogram. Today’s designs improve upon this. But you can do a lot more with wood gases than just keep your vehicle on the road. It turns out to be suitable for any of the manufacturing processes needing heat that we looked at before, such as kilns for lime, cement or bricks. Wood gas generator units could easily power agricultural or industrial equipment, or pumps. Sweden and Denmark are world leaders in their use of sustainable forests and agricultural waste for turning the steam turbines in power stations. And once the steam has been used in their ‘Combined Heat and Power’ (CHP) electricity plants, it is piped to the surrounding towns and industries to heat them, allowing such CHP stations to approach 90 per cent energy efficiency. Such plants suggest a marvellous vision of industry wholly weaned from its dependency on fossil fuel. Is that our solution, then? Could our rebooting society run on wood, supplemented with electricity from renewable sources? Maybe so, if the population was fairly small. But here’s the catch. These options all presuppose that our survivors are able to construct efficient steam turbines, CHP stations and internal combustion engines. We know how to do all that, of course – but in the event of a civilisational collapse, who is to say that the knowledge won’t be lost? And if it is, what are the chances that our descendants could reconstruct it? In our own history, the first successful application of steam engines was in pumping out coal mines. This was a setting in which fuel was already abundant, so it didn’t matter that the first, primitive designs were terribly inefficient. The increased output of coal from the mines was used to first smelt and then forge more iron. Iron components were used to construct further steam engines, which were in turn used to pump mines or drive the blast furnaces at iron foundries. And of course, steam engines were themselves employed at machine shops to construct yet more steam engines. It was only once steam engines were being built and operated that subsequent engineers were able to devise ways to increase their efficiency and shrink fuel demands. They found ways to reduce their size and weight, adapting them for applications in transport or factory machinery. In other words, there was a positive feedback loop at the very core of the industrial revolution: the production of coal, iron and steam engines were all mutually supportive. In a world without readily mined coal, would there ever be the opportunity to test profligate prototypes of steam engines, even if they could mature and become more efficient over time? How feasible is it that a society could attain a sufficient understanding of thermodynamics, metallurgy and mechanics to make the precisely interacting components of an internal combustion engine, without first cutting its teeth on much simpler external combustion engines – the separate boiler and cylinder-piston of steam engines? It took a lot of energy to develop our technologies to their present heights, and presumably it would take a lot of energy to do it again. Fossil fuels are out. That means our future society will need an awful lot of timber. An industrial revolution without coal would be, at a minimum, very difficult In a temperate climate such as the UK’s, an acre of broadleaf trees produces about four to five tonnes of biomass fuel every year. If you cultivated fast-growing kinds such as willow or miscanthus grass, you could quadruple that. The trick to maximising timber production is to employ coppicing – cultivating trees such as ash or willow that resprout from their own stump, becoming ready for harvest again in five to 15 years. This way you can ensure a sustained supply of timber and not face an energy crisis once you’ve deforested your surroundings. But here’s the thing: coppicing was already a well-developed technique in pre-industrial Britain. It couldn’t meet all of the energy requirements of the burgeoning society. The central problem is that woodland, even when it is well-managed, competes with other land uses, principally agriculture. The double-whammy of development is that, as a society’s population grows, it requires more farmland to provide enough food and also greater timber production for energy. The two needs compete for largely the same land areas. We know how this played out in our own past. From the mid-16th century, Britain responded to these factors by increasing the exploitation of its coal fields – essentially harvesting the energy of ancient forests beneath the ground without compromising its agricultural output. The same energy provided by one hectare of coppice for a year is provided by about five to 10 tonnes of coal, and it can be dug out of the ground an awful lot quicker than waiting for the woodland to regrow. It is this limitation in the supply of thermal energy that would pose the biggest problem to a society trying to industrialise without easy access to fossil fuels. This is true in our post-apocalyptic scenario, and it would be equally true in any counterfactual world that never developed fossil fuels for whatever reason. For a society to stand any chance of industrialising under such conditions, it would have to focus its efforts in certain, very favourable natural environments: not the coal-island of 18th-century Britain, but perhaps areas of Scandinavia or Canada that combine fast-flowing streams for hydroelectric power and large areas of forest that can be harvested sustainably for thermal energy. Even so, an industrial revolution without coal would be, at a minimum, very difficult. Today, use of fossil fuels is actually growing, which is worrying for a number of reasons too familiar to rehearse here. Steps towards a low-carbon economy are vital. But we should also recognise how pivotal those accumulated reservoirs of thermal energy were in getting us to where we are. Maybe we could have made it the hard way. A slow-burn progression through the stages of mechanisation, supported by a combination of renewable electricity and sustainably grown biomass, might be possible after all. Then again, it might not. We’d better hope we can secure the future of our own civilisation, because we might have scuppered the chances of any society to follow in our wake.

#### Resource and structural factors make growth unsustainable, technology overwhelmingly doesn’t solve, and it’s try or die for the transition.

Trainer 16 – Ted Trainer, Conjoint Lecturer in the School of Social Sciences, University of New South Wales, 2016 (“Sustainability – The Simpler Way Perspective,” *Resilience*, May 10th, <http://www.resilience.org/articles/General/2016/07_July/Sustainability%20The%20Simpler%20Way%20Perspective.pdf>, AIvackovic)

Firstly, let’s set the scene; The deteriorating state of the planet. The resource base and environmental conditions on which the present levels of global production and consumption are built are obviously deteriorating at an alarming rate. Few if any would not be aware of this but it is important to briefly remind ourselves before focusing on how impossible it would be for this base to sustain affluence and growth for all. A glance at the situation reveals that resources are becoming more scarce and costly, including energy, productive land, minerals, food, fish, wood and water, and ecosystems are being severely damaged. We are losing species, forests, land, coral reefs, grasslands and fisheries at accelerating rates. A sixth era of massive biodiversity loss appears to have begun. We are polluting the planet with excess carbon dioxide, nitrogen and many toxic chemicals. The mass of big animals on the planet has declined sharply in recent decades, probably down by 90% in the sea. The World Wildlife Fund says that in general the quality of global ecosystems has deteriorated 30% since about 1970, and its “Footprint” measure indicates that we are now taking biological resources at a rate that would take 1.5 planets to provide in a sustainable way. (2014.) The reason for all this massive resource depletion and damage to the environment is simply that there is far too much producing and consuming going on. This is causing too many resources to be taken from nature and too many wastes to be dumped back into nature. Now consider the limits case: Could everyone live as we do? The 10-15% of the world’s people living in regions such as North America, Australia and Europe have per capita levels of resource use that are around 20 times the average for the poorest half of people. How likely is it that all the 9.7 billion people expected by 2050 could rise to the present rich world level of resource use? If they did live as we do then world annual resource production and consumption, and ecological damage, would be approaching 6 times as great as at present. Yet present levels of resource use and environmental impact are far from sustainable. The World Wildlife Fund’s ”Footprint” analysis yields an even higher multiple. They estimate that it takes about 8 ha of productive land to provide water, energy settlement area and food for one person living in Australia. So if 9 billion people were to live as we do we would need about 72 billion ha of productive land. But that is about 9 times all the available productive land on the planet. Now add the absurdly impossible implications of economic growth. But the foregoing argument has only been that the present levels of production and consumption are quite unsustainable. Yet we are determined to increase present living standards and levels of output and consumption, as much as possible and without any end in sight. In other words, our supreme national goal is economic growth. Few people seem to recognise the absurdly impossible consequences of pursing economic growth. If we rich countries have a 3% p.a. increase in economic activity until 2050 then our output, resource use and environmental impact will be around 4 times as great as it is now, and doubling every 23 years thereafter. Now what if by 2050 all the expected 9.7 billion people expected to be living on earth had risen to the “living standards” we in rich countries would then have given 3% economic growth. Total world output, resource, use and environmental impact would be approaching 15 times as great as they are now … unless technical advance and efficiency gains could greatly reduce them. (See below.) These multiplies must be the focal point in discussions of sustainability. Grasping the magnitude of the overshoot and of the unsustainability is crucial here. The numbers show that present, let alone probable 2050 rich world levels of consumption, are grossly unsustainable and could never be extended to all people. But can’t technical advance solve the problems? Most people hold the "technical fix faith", believing that technical advance will solve the resource and environmental problems and thereby make it unnecessary for us to question the commitment to affluence and growth. When considering the following evidence keep in mind that what we need is not just to stop increases in impacts as growth goes on -- we need to reduce impacts dramatically before sustainable levels are reached. There is a very strong case that technical advance is nowhere near capable of solving the sustainability problems facing us. Note that many miraculous technical developments, e.g., in physics, astronomy, genetics, and medicine, are not so relevant here where the focus is on the possibility of making big improvements in the efficiency and energy costs of producing energy and materials, and of cutting ecological impacts. Following are some of the main elements in the case. 1. Efficiency gains to date. It is not the case that technical achievements in the relevant areas have been very encouraging. Ayres and Vouroudis (2009) note that for many decades the efficiency of production of electricity and fuels, electric motors, ammonia and iron and steel has more or less plateaued. In many crucial areas such as producing energy and minerals (below) the trend is towards worse efficiency, i.e., the need is for increasing inputs per unit of output. 2. The deteriorating productivity growth rate. Technical advance is regarded as a major determinant of productivity growth and that has been in long term decline since the 1970s. Even the advent of computerisation has had a surprisingly small effect, a phenomenon now labelled the “Productivity Paradox.” In fact the UK productivity growth rate has recently has gone below zero; i.e., productivity has actually deteriorated. (Weldon, 2016.) 3. Little or no “decoupling” is occurring for materials or energy use. This is the most important issue; does recent history indicate that economic output has been or can be separated from materials and energy use, so that growth can continue while resource demand falls? The “Tech-Fix faith” is fundamentally dependent on the assumption that massive decoupling is possible. But all the evidence seems to say that the amount of materials or energy needed to produce a unit of GDP in rich countries has not improved much if at all in recent years. The box below refers to some of the evidence. Weidmann et al. (2014) say “…for the past two decades global amounts of iron ore and bauxite extractions have risen faster than global GDP.” “… resource productivity…has fallen in developed nations.” “There has been no improvement whatsoever with respect to improving the economic efficiency of metal ore use.” Giljum et al. (2014, p. 324) report in the world as a whole only a 0.9% p.a. improvement in the dollar value extracted from the use of each unit of minerals between 1980 and 2009, and that over the 10 years before the GFC there was no improvement. “…not even a relative decoupling was achieved on the global level.” They point out that the picture would have been worse had they included the many materials in rich world imports. Diederan’s account (2009) of the productivity of minerals discovery effort is even more pessimistic. Between 1980 and 2008 the annual major deposit discovery rate fell from 13 to less than 1, while discovery expenditure went from about $1.5 billion p.a. to $7 billion p.a., meaning the productivity of expenditure fell by a factor in the vicinity of around 100, which is an annual decline of around 40% p.a. Recent petroleum figures are similar; in the last decade or so the discovery rate has not increased but discovery expenditure more or less trebled. (Johnson, 2010.) Schandl et al. (2015) say “ … there is a very high coupling of energy use to economic growth, meaning that an increase in GDP drives a proportional increase in energy use.” “Our results show that while relative decoupling can be achieved in some scenarios, none would lead to an absolute reduction in energy or materials footprint.” In all three of their scenarios “… energy use continues to be strongly coupled with economic activity...” Alvarez found that for Europe, Spain and the US, GDP increased 74% in 20 years, but materials use actually increased 85%. (Latouche, 2014.) Similar conclusions re stagnant or declining materials use productivity etc. are arrived at by Aadrianse, 1997, Dittrich et al., (2014), Schutz, Bringezu and Moll, (2004), Warr, (2004), Berndt, (1990), Smil, (2014) and Victor (2008, pp. 55-56). (Note that economists often claim that the “energy intensity” of rich world economies is improving, but this is only because they fail to take into account the huge amounts of energy used overseas to produce imports, and “fuel switching”; see Kaufman, 2004.) 4. There is ecological deterioration in almost all domains. Technical advance has obviously not slowed, halted or reversed overall damage to the planet’s ecosystems. The “Environmental Kuznets Curve” thesis is an application of the decoupling claim to environmental impacts, asserting that as countries become richer impacts increase for a time but then plateau and fall. There is little doubt now that the thesis is not valid. Rich countries are in general not solving their most serious environmental problems. Alexander’s review (2014) concludes that for the world as a whole, ”… decades of extraordinary technological development have resulted in increased, not reduced, environmental impacts.” These many sources and figures show the extreme implausibility of the tech-fix faith that in future technical advances will enable us to stop worrying about limits and any need to dramatically reduce consumption or the obsession with economic growth. Conclusions on the limits to growth case. In view of these lines of argument it is difficult to see how anyone could disagree with the basic limits to growth case. Present ways are so grossly unsustainable there is no possibility of all people rising to the living standards we take for granted today in rich countries, let alone those we are seeking. Again the most important point is the magnitude of the overshoot. Most people have no idea of how far beyond sustainable levels of consumption we are or how big the reductions should be. For decades many scientists and agencies are have been emphasizing the validity and importance of the basic limits case. Sustainable ways that all could share appear to require us to go down to per capita rates of resource consumption around 10% of those we have now. It follows from the above discussion that the only solution is to shift to some kind of Simpler Way, i.e., to lifestyles, settlements and systems that make it possible for us to live well on a small fraction of our present rich world levels, with no economic growth.

#### Tech makes extinction inevitable independent of nukes which non u/qs the aff—accidental and deliberate misuse of nanotech, AI and superintelligence, genetically engineered diseases, future tech development

Bruce **Sterling**, 6-1-20**18**, "When Nick Bostrom says “Bang”," WIRED, https://www.wired.com/beyond-the-beyond/2018/06/nick-bostrom-says-bang/

This is the most obvious kind of existential risk. It is conceptually easy to understand. Below are some possible ways for the world to end in a bang.[8] I have tried to rank them roughly in order of how probable they are, in my estimation, to cause the extinction of Earth-originating intelligent life; but my intention with the ordering is more to provide a basis for further discussion than to make any firm assertions. 4.1 Deliberate misuse of nanotechnology In a mature form, molecular nanotechnology will enable the construction of bacterium-scale self-replicating mechanical robots that can feed on dirt or other organic matter [22-25]. Such replicators could eat up the biosphere or destroy it by other means such as by poisoning it, burning it, or blocking out sunlight. A person of malicious intent in possession of this technology might cause the extinction of intelligent life on Earth by releasing such nanobots into the environment.[9] The technology to produce a destructive nanobot seems considerably easier to develop than the technology to create an effective defense against such an attack (a global nanotech immune system, an “active shield” [23]). It is therefore likely that there will be a period of vulnerability during which this technology must be prevented from coming into the wrong hands. Yet the technology could prove hard to regulate, since it doesn’t require rare radioactive isotopes or large, easily identifiable manufacturing plants, as does production of nuclear weapons [23]. Even if effective defenses against a limited nanotech attack are developed before dangerous replicators are designed and acquired by suicidal regimes or terrorists, there will still be the danger of an arms race between states possessing nanotechnology. It has been argued [26] that molecular manufacturing would lead to both arms race instability and crisis instability, to a higher degree than was the case with nuclear weapons. Arms race instability means that there would be dominant incentives for each competitor to escalate its armaments, leading to a runaway arms race. Crisis instability means that there would be dominant incentives for striking first. Two roughly balanced rivals acquiring nanotechnology would, on this view, begin a massive buildup of armaments and weapons development programs that would continue until a crisis occurs and war breaks out, potentially causing global terminal destruction. That the arms race could have been predicted is no guarantee that an international security system will be created ahead of time to prevent this disaster from happening. The nuclear arms race between the US and the USSR was predicted but occurred nevertheless. 4.2 Nuclear holocaust The US and Russia still have huge stockpiles of nuclear weapons. But would an all-out nuclear war really exterminate humankind? Note that: (i) For there to be an existential risk it suffices that we can’t be sure that it wouldn’t. (ii) The climatic effects of a large nuclear war are not well known (there is the possibility of a nuclear winter). (iii) Future arms races between other nations cannot be ruled out and these could lead to even greater arsenals than those present at the height of the Cold War. The world’s supply of plutonium has been increasing steadily to about two thousand tons, some ten times as much as remains tied up in warheads ([9], p. 26). (iv) Even if some humans survive the short-term effects of a nuclear war, it could lead to the collapse of civilization. A human race living under stone-age conditions may or may not be more resilient to extinction than other animal species. 4.3 We’re living in a simulation and it gets shut down A case can be made that the hypothesis that we are living in a computer simulation should be given a significant probability [27]. The basic idea behind this so-called “Simulation argument” is that vast amounts of computing power may become available in the future (see e.g. [28,29]), and that it could be used, among other things, to run large numbers of fine-grained simulations of past human civilizations. Under some not-too-implausible assumptions, the result can be that almost all minds like ours are simulated minds, and that we should therefore assign a significant probability to being such computer-emulated minds rather than the (subjectively indistinguishable) minds of originally evolved creatures. And if we are, we suffer the risk that the simulation may be shut down at any time. A decision to terminate our simulation may be prompted by our actions or by exogenous factors. While to some it may seem frivolous to list such a radical or “philosophical” hypothesis next the concrete threat of nuclear holocaust, we must seek to base these evaluations on reasons rather than untutored intuition. Until a refutation appears of the argument presented in [27], it would intellectually dishonest to neglect to mention simulation-shutdown as a potential extinction mode. 4.4 Badly programmed superintelligence When we create the first superintelligent entity [28-34], we might make a mistake and give it goals that lead it to annihilate humankind, assuming its enormous intellectual advantage gives it the power to do so. For example, we could mistakenly elevate a subgoal to the status of a supergoal. We tell it to solve a mathematical problem, and it complies by turning all the matter in the solar system into a giant calculating device, in the process killing the person who asked the question. (For further analysis of this, see [35].) 4.5 Genetically engineered biological agent With the fabulous advances in genetic technology currently taking place, it may become possible for a tyrant, terrorist, or lunatic to create a doomsday virus, an organism that combines long latency with high virulence and mortality [36]. Dangerous viruses can even be spawned unintentionally, as Australian researchers recently demonstrated when they created a modified mousepox virus with 100% mortality while trying to design a contraceptive virus for mice for use in pest control [37]. While this particular virus doesn’t affect humans, it is suspected that an analogous alteration would increase the mortality of the human smallpox virus. What underscores the future hazard here is that the research was quickly published in the open scientific literature [38]. It is hard to see how information generated in open biotech research programs could be contained no matter how grave the potential danger that it poses; and the same holds for research in nanotechnology. Genetic medicine will also lead to better cures and vaccines, but there is no guarantee that defense will always keep pace with offense. (Even the accidentally created mousepox virus had a 50% mortality rate on vaccinated mice.) Eventually, worry about biological weapons may be put to rest through the development of nanomedicine, but while nanotechnology has enormous long-term potential for medicine [39] it carries its own hazards. 4.6 Accidental misuse of nanotechnology (“gray goo”) The possibility of accidents can never be completely ruled out. However, there are many ways of making sure, through responsible engineering practices, that species-destroying accidents do not occur. One could avoid using self-replication; one could make nanobots dependent on some rare feedstock chemical that doesn’t exist in the wild; one could confine them to sealed environments; one could design them in such a way that any mutation was overwhelmingly likely to cause a nanobot to completely cease to function [40]. Accidental misuse is therefore a smaller concern than malicious misuse [23,25,41]. However, the distinction between the accidental and the deliberate can become blurred. While “in principle” it seems possible to make terminal nanotechnological accidents extremely improbable, the actual circumstances may not permit this ideal level of security to be realized. Compare nanotechnology with nuclear technology. From an engineering perspective, it is of course perfectly possible to use nuclear technology only for peaceful purposes such as nuclear reactors, which have a zero chance of destroying the whole planet. Yet in practice it may be very hard to avoid nuclear technology also being used to build nuclear weapons, leading to an arms race. With large nuclear arsenals on hair-trigger alert, there is inevitably a significant risk of accidental war. The same can happen with nanotechnology: it may be pressed into serving military objectives in a way that carries unavoidable risks of serious accidents. In some situations it can even be strategically advantageous to deliberately make one’s technology or control systems risky, for example in order to make a “threat that leaves something to chance” [42]. 4.7 Something unforeseen We need a catch-all category. It would be foolish to be confident that we have already imagined and anticipated all significant risks. Future technological or scientific developments may very well reveal novel ways of destroying the world. Some foreseen hazards (hence not members of the current category) which have been excluded from the list of bangs on grounds that they seem too unlikely to cause a global terminal disaster are: solar flares, supernovae, black hole explosions or mergers, gamma-ray bursts, galactic center outbursts, supervolcanos, loss of biodiversity, buildup of air pollution, gradual loss of human fertility, and various religious doomsday scenarios. The hypothesis that we will one day become “illuminated” and commit collective suicide or stop reproducing, as supporters of VHEMT (The Voluntary Human Extinction Movement) hope [43], appears unlikely. If it really were better not to exist (as Silenus told king Midas in the Greek myth, and as Arthur Schopenhauer argued [44] although for reasons specific to his philosophical system he didn’t advocate suicide), then we should not count this scenario as an existential disaster. The assumption that it is not worse to be alive should be regarded as an implicit assumption in the definition of Bangs. Erroneous collective suicide is an existential risk albeit one whose probability seems extremely slight. (For more on the ethics of human extinction, see chapter 4 of [9].) 4.8 Physics disasters The Manhattan Project bomb-builders’ concern about an A-bomb-derived atmospheric conflagration has contemporary analogues. There have been speculations that future high-energy particle accelerator experiments may cause a breakdown of a metastable vacuum state that our part of the cosmos might be in, converting it into a “true” vacuum of lower energy density [45]. This would result in an expanding bubble of total destruction that would sweep through the galaxy and beyond at the speed of light, tearing all matter apart as it proceeds. Another conceivability is that accelerator experiments might produce negatively charged stable “strangelets” (a hypothetical form of nuclear matter) or create a mini black hole that would sink to the center of the Earth and start accreting the rest of the planet [46]. These outcomes seem to be impossible given our best current physical theories. But the reason we do the experiments is precisely that we don’t really know what will happen. A more reassuring argument is that the energy densities attained in present day accelerators are far lower than those that occur naturally in collisions between cosmic rays [46,47]. It’s possible, however, that factors other than energy density are relevant for these hypothetical processes, and that those factors will be brought together in novel ways in future experiments. The main reason for concern in the “physics disasters” category is the meta-level observation that discoveries of all sorts of weird physical phenomena are made all the time, so even if right now all the particular physics disasters we have conceived of were absurdly improbable or impossible, there could be other more realistic failure-modes waiting to be uncovered. The ones listed here are merely illustrations of the general case.

#### Countries developing kinetic weapons now – extinction

Keller ’17, - Deputy Editor at Tast & Purpose, cites DoD’s Russia New Generation Warfare Study. (Jared, “The Pentagon’s New Super Weapon Is Basically A Weaponized Meteor Strike” Task & Purpose, 06-07-2017, <https://taskandpurpose.com/kinetic-bombardment-kep-weaponry>) //AL

The idea of kinetic weaponry — raining down inert projectiles on an enemy with deadly velocity — is far from a novel concept. The trebuchet was the backbone of successful sieges for hundreds of years, from ancient China to Hernan Cortes’ subjugation of the Aztecs; during and after World War II, airmen have occasionally deployed clusters of inert “Lazy Dog” bombs — metal cylinders traveling at terminal velocity — on the battlefields of Korea and Vietnam. And gravity hasn’t always been necessary. For decades, militaries have used ultra-dense “kinetic energy penetrators,” also known as KEPs, specially designed shells often wrapped in an outer shell (a “sabot”) and fired at high velocity rather than dropped from the sky, to defeat defense armor. That’s the fundamental logic underpinning the U.S. Navy’s highly touted electromagnetic railgun, which can blast a 25-pound “hypervelocity projectile” with 32-megajoule muzzle energy through seven steel plates and obliterate whatever that armor is supposed to protect. Whether dropped from the sky or fired from a cannon, the principle behind these weapons is the same: hitting the enemy with something very hard and very dense, moving very fast. And the kinetic energy projectile may become a staple of modern warfare sooner than you might think. In 2013, the U.S. Air Force 846th Test Squadron and civilian researchers at Lawrence Livermore National Laboratory successfully test-fired a kinetic energy projectile, a tungsten-rich shell moving at 3,500 feet-per-second — more than three times faster than the speed of sound — on a specialized track at Holloman Air Force Base in New Mexico. More recently, the Pentagon has tested the Navy electromagnetic rail gun’s hypervelocity projectiles with the help of conventional U.S. Army howitzers; the Navy hopes the completed cannon will be able to launch shells at up to 4,500 mph, six times the speed of sound. Explosives may be dazzling in their destructiveness, but there’s an elegant, almost Newtonian lethality to the kinetic energy projectile, explains Matt Weingart, a weapons program development manager at Lawrence Livermore. “The classic way of delivering hurt against a target has been to pack a lot of chemical explosive into a container of some kind, a barrel or a cannonball or steel bomb,” Weingart told Task & Purpose in a phone interview. “The violence comes from the chemical explosive inside that bomb sending off a blast wave, followed by the fragments of the bomb case. But the difference with kinetic energy projectiles is that the warhead arrives at the target moving very, very fast — the energy is there to propel those fragments without the use of a chemical explosive to accelerate them. The more mass, the more violence.” The concept of the hypersonic impact that defined Project Thor and its devastating potential hasn’t been lost on defense officials. Military researchers are continuing to explore battlefield applications that “take advantage of high terminal speeds to deliver much more energy onto a target than the chemical explosives they carry would deliver alone,” as Army Maj. Gen. William Hix put it at the Booz Allen Hamilton Direct Energy Summit in March. “Think of it as a big shotgun shell,” Hix told the assembled crowd. “Not much can survive it. If you’re in a main battle tank, if you’re a crew member, you might survive but the vehicle will be non-mission capable, and everything below that level of protection will be dead. That’s what I am talking about.” An arena test at the Lawrence Livermore National Laboratory’s Site 300 used an aeroshell fashioned from commercial carbon composite panels. This experiment validated warhead performance prior to the sled test. The KEP isn’t just appealing because of its elegance and relative cost-effectiveness (a super-dense tungsten warhead is relatively cheaper than conventional explosive munitions), but for its theoretical precision. The hypersonic shell is designed to defeat enemy armor and completely obliterate structures and equipment with extreme precision, whether it’s fired from ground artillery or deployed from an aerial — or orbital — platform. As Weingart explains, Hix’s vision is one of “raining down violence across a large area” — without, ostensibly, risking military personnel and hardware. And the KEP’s upside isn’t just precision in targeting, but precision in the level of violence that the weapon actually deals out. Because the shell’s “yield” is essentially a function of velocity and density rather than explosive payload, confining the impact’s devastating effects to a specific area is simply a matter of physics. In theory, the KEP is “basic physics,” Weingart says, “but the implementation is really, really hard physics.” “Using our high computing capabilities, we can exercise a high degree of control over those effects,” says Weingart. “We've got the most extraordinary computing power in the world, and we can take exquisite knowledge of physics and put it into very sophisticated computer codes and run vast number problems to predict how things are going to behave in terms of speed and energy.” The KEP could offer a middle ground between the conventional precision GPS-guided munitions deployed by aircraft and high-yield, non-nuclear explosives like the GBU-43/B Massive Ordnance Air Blast (MOAB), or “mother of all bombs,” used against ISIS militants in Afghanistan in April. By adjusting the density of the KEP, military personnel could choose between defeating the armor on a single main battle tank and delivering violence wholesale (and simultaneously) across broad swaths of an operational area, without worrying about fallout. “On the battlefield, you could do a straightforward calculation about whether the speed or amount of explosives are the most effective part of the warhead,” says Weingart. “Instead of putting explosives in, you just put in mass and heavy metals, regardless of delivery system or set of terminal conditions.” “General Hix referred to it as a shotgun,” he added. “You can have a narrow or broad choke and spotlight a very small area with these effects if you're trying to pinpoint a well-localized target without damaging the surrounding area.” The Office of Naval Research (ONR)-sponsored Electromagnetic Railgun (EMRG) at terminal range located at Naval Surface Warfare Center Dahlgren Division (NSWCDD). The EMRG launcher is a long-range weapon that fires projectiles using electricity instead of chemical propellants. But what’s the main purpose of these kinetic energy projectiles, other than “raining down violence” with the shock and awe that only weapons like the “Mother of All Bombs” can inspire? For Pentagon planners, it could be to counter Russia’s tactical nuclear stockpile, according to Hix, warheads that could appear on future battlefields alongside conventional weapons thanks to ongoing miniaturization efforts, according to the DoD’s Russia New Generation Warfare Study. Central to the weapons system’s tactical appeal isn’t its delivery mechanism, but the KEP warhead itself. While Weingart’s focus is on the KEP warhead rather than the firing system or combat context it might deploy in, he agrees with the potential application envisioned by Hix. “He is talking about the return of widespread violence to the battlefield, the fact we've seen the Russians do that in recent years by bombarding areas like Syria and Ukraine, the likes of which we haven’t really seen since the Korean War.” The applications of the KEP are mainly theoretical for now, and we’re certainly decades away from a floating Thor’s hammer circling the planet. But if kinetic energy projectiles do find efficient applications in warfare, it’s possible they could find new delivery systems for battlefield destruction — with potentially devastating effects that might eclipse the MOAB as the most violent non-nuclear weapon in the Pentagon’s arsenal.

#### Uniqueness - multiple countries are investing billions and they’re ripe for theft

Jeff **Daniels**, 3-17-20**17**, “Mini-nukes and mosquito-like robot weapons being primed for future warfare,” CNBC, <https://www.cnbc.com/2017/03/17/mini-nukes-and-inspect-bot-weapons-being-primed-for-future-warfare.html> //RS

Several countries are developing nanoweapons that could unleash attacks using mini-nuclear bombs and insect-like lethal robots. While it may be the stuff of science fiction today, the advancement of nanotechnology in the coming years will make it a bigger threat to humanity than conventional nuclear weapons, according to an expert. The U.S., Russia and China are believed to be investing billions on nanoweapons research. “Nanobots are the real concern about wiping out humanity because they can be weapons of mass destruction,” said Louis Del Monte, a Minnesota-based physicist and futurist. He’s the author of a just released book entitled “Nanoweapons: A Growing Threat To Humanity.” One unsettling prediction Del Monte’s made is that terrorists could get their hands on nanoweapons as early as the late 2020s through black market sources. According to Del Monte, nanoweapons are much smaller than a strand of human hair and the insect-like nanobots could be programmed to perform various tasks, including injecting toxins into people or contaminating the water supply of a major city. Subs: Zika mosquito research 160621 Getty Images Another scenario he suggested the nanodrone could do in the future is fly into a room and drop a poison onto something, such as food, to presumably target a particular individual. The federal government defines nanotechnology as the science, technology and engineering of things so small they are measured on a nanoscale, or about 1 to 100 nanometers. A single nanometer is about 10 times smaller than the width of a human’s DNA molecule. While nanotechnology has produced major benefits for medicine, electronics and industrial applications, federal research is currently underway that could ultimately produce nanobots. For one, the Defense Advanced Research Projects Agency, or DARPA, has a program called the Fast Lightweight Autonomy program for the purpose to allow autonomous drones to enter a building and avoid hitting walls or objects.

#### Islands are an empirically successful refuge for low-tech catastrophes like nuclear war, but can’t check against future technology like AI or nanoweapons

Turchin and Green 18 (Alexey Turchin – Scientist for the Foundation Science for Life Extension in Moscow, Russia, Founder of Digital Immortality Now, author of several books and articles on the topics of existential risks and life extension. Brian Patrick Green – Director of technology ethics at the Markkula Center for Applied Ethics, teaches AI ethics in the Graduate School of Engineering at Santa Clara University. <MKIM> “Islands as refuges for surviving global catastrophes”. September 2018. DOA: 7/20/19. https://www.emerald.com/insight/content/doi/10.1108/FS-04-2018-0031/full/html?fullSc=1&mbSc=1&fullSc=1)

In recent decades, researchers have identified many global risks which could result in the collapse of civilization and/or human extinction. These risks may be divided in three classes: natural, like asteroid risks (Gritzner et al., 2006); low-tech, connected with currently existing technologies, like the risk of nuclear war (Barrett et al., 2013); and futuristic hightech, connected with new expected super technologies, like nanotechnology (Freitas, 2000) and artificial intelligence (AI) (Bostrom, 2014). **Super technological risks are the most dangerous**, as they are expected to be the most powerful and least controllable (Bostrom, 2002). The best way to fight all the types of risks is to prevent (Bostrom, 2013) or mitigate them, **but another option, or plan B, is to adapt to them to survive them**. There are several ideas for how such risks could be survived, including a Mars colony (Musk, 2017), a Moon colony (Shapiro, 2009; Turchin and Denkenberger, 2018), underground bunkers (Jebari, 2014), space bunkers (Torres, 2016) and retrofitted nuclear submarines [which are one of the most cost-effective solutions (Turchin and Green, 2017)]. Planning for surviving these risks, whether by mitigation or adaptation, should be a paramount ethical duty of humankind (Jonas, 1984; Green, 2014, 2016). Several authors (Jebari, 2014; Beckstead, 2015) have analyzed the problem of global risk survival and concluded that most catastrophes are either too small or too large for bunkers or other refuges to be a useful option. But **even a 1 per cent increase in the chance of survival is worth considering,** especially because there are not yet useful working ideas of the magnitude of some larger risks, such as unsafe AI (Bostrom, 2014). Additionally, at the workshop on existential risk to humanity (Gothenburg Chair Programme for Advanced Studies, 2017), Karim Jebari mentioned that such refuges will also be important for cultural transfer and as consolidation points, even if there might be many survivors in other places. Baum has suggested that the gold standard for global risks refuges should be “surface independence” (Baum et al., 2015). Islands only partly satisfy this criterion: they are not connected to the mainland, thus making them discontinuous with the land surface of the Earth, but they are still accessible by air and sea. However, if they were very remote and equipped with underground and/or underwater shelters, they could provide a higher level of protection than surface-independent bunkers on the mainland for certain types of catastrophes. By definition, global risks affect much or all the surface of the Earth, or at least all populated areas. This creates a chance for survival, as **there is a probability that some parts of the Earth will be affected to a lesser extent**. For example, a gamma ray burst (Cirkovi c and Vukotic, 2016 ) that happened away from the equatorial plane would have less of an effect on one of the polar regions. Likewise, extreme global warming (Hanna and Tait, 2015) would be more survivable on mountains at high latitudes, while atmospheric pollution (Mount, 1970) by some toxin or contamination could be less of an issue in the Southern hemisphere because of geography and atmospheric circulation patterns. Yet, most catastrophes which could be survived on temporary space refuges on the Moon or Mars could also be survived on Earth, if there were adequate shelters or refuges, with some notable exceptions. Such exceptions include very large asteroid impacts, a severe and long-term case of multiple pandemics (with many lethal diseases active in the environment) or massive and irreversible global warming. For some preliminary calculations of the usefulness of shelters from global catastrophes see Turchin and Green (2017). Islands have proven to be survival refuges for some species which are extinct in other places, like mammoths, which survived on Wrangel island up to 2000 BC (Vartanyan et al., 1995). **Islands have proven to be effective refuges for humans as well**. For example, the islands of New Caledonia and American Samoa did not have a single death from the 1918 Spanish flu because of their **effective quarantine measures** (Bell et al., 2006). While islands have been extensively discussed as refuges for animals and plants, the topic of using islands as a means for humans to survive global catastrophic risks has not yet been formally explored. This article seeks to remedy this deficiency. Section 2 looks at the requirements for survival on islands; Section 3 looks at the possible role of islands as consolidation centers after a social collapse; Section 4 reviews several islands as possible refuges; Section 5 puts island refuges in the context of other possible types of refuges; Section 6 discusses how to maximize protection by combining islands refuge with subterranean and/or submarine refuges; and Section 7 discusses other places on Earth, similar to islands, where survival might be possible. Islands offer excellent protection against natural and/or **low-tech catastrophes** which are neither too large nor too small. Remoteness, isolation and the diverse conditions found on different islands could be helpful features to aid survival in the face of different types of catastrophes. Islands could provide protection against a human-to-human transmitted biological pandemic; as mentioned in the Introduction, some islands were able to escape the 1918 flu pandemic by implementing effective quarantine measures. Islands may help to survive a **long-term collapse in food production caused by nuclear winter**, agricultural pests and other catastrophes. Islands often have **non-traditional food sources**, such as birds and sea flora and fauna, which may provide independent subsistence for an indefinitely long period. On remote islands, **the extent of radioactive and chemical contamination from catastrophes would likely be smaller**. This is especially true of islands located in the Southern hemisphere close to the Antarctic, as **winds around the pole maintain some isolation from the rest of the atmosphere**. **Constant rains and winds may accelerate the decontamination of some islands** (like Kerguelen). In addition, **sea animals may be relatively less contaminated food sources**. Islands away from the equator could provide protection against some of the direct effects of a gamma ray burst (muons) (Cirkovi c and Vukoti c, 2016 ) if they were in the constant shadow of the Earth, below the horizon of the gamma ray source. In the case of global war or technological collapse, **many islands could become unreachable**. This would protect them against human-borne diseases, pirates, looters and certain autonomous weapon systems such as land-based or short-range drones. Additionally, remote and sparsely populated islands may not be interesting military targets. In case of war, it may be more expensive to reach them than to ignore them, though this depends on the nature of the war. For example, the Germans used remote unpopulated islands in the Arctic (Grossman, 2016) and in the Southern Ocean (Rogge and Frank, 1956) as secret bases during Second World War, and the allies later sent cruisers to Kerguelen to check if Germans were hiding there. It might be too expensive for a hostile AI to seek out and kill small groups of people in remote places, if they do not pose an immediate risk to the AI’s interests. However, over time, the AI’s risk calculation might change.

#### Rigorous climate simulations prove that hydrophilic black carbon would adhere to atmospheric precipitation – Results in a rainout effect that quickly reverses nuclear cooling

Reisner et al. 18 (Jon Reisner – Climate and atmospheric scientist at the Los Alamos National Laboratory. Gennaro D’Angelo – Climate scientist at the Los Alamos National Laboratory, Research scientist at the SETI institute, Associate specialist at the University of California, Santa Cruz, NASA Postdoctoral Fellow at the NASA Ames Research Center, UKAFF Fellow at the University of Exeter. Eunmo Koo - Scientist at Applied Terrestrial, Energy, and Atmospheric Modeling (ATEAM) Team, in Computational Earth Science Group (EES-16) in Earth and Environmental Sciences Division and Co-Lead of Parallel Computing Summer Research Internship (PCSRI) program at the Los Alamos National Laboratory, former Staff research associate at UC Berkeley. Wesley Even - Computational scientist in the Computational Physics and Methods Group at Los Alamos National Laboratory. Matthew Hecht – Atmospheric scientist at the Los Alamos National Laboratory. Elizabeth Hunke - Lead developer for the Los Alamos Sea Ice Model (CICE) at the Los Alamos National Laboratory responsible for development and incorporation of new parameterizations, model testing and validation, computational performance, documentation, and consultation with external model users on all aspects of sea ice modeling, including interfacing with global climate and earth system models. Darin Comeau – Climate scientist at the Los Alamos National Laboratory. Randy Bos - Project leader at the Los Alamos National Laboratory, former Weapons Effects program manager at Tech-Source. James Cooley – Computational scientist at the Los Alamos National Laboratory specializing in weapons physics, emergency response, and computational physics. <MKIM> “Climate impact of a regional nuclear weapons exchange:An improved assessment based on detailed source calculations”. 3/16/18. DOA: 7/13/19. <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017JD027331>)

\*BC = Black Carbon

The no-rubble simulation produces a significantly more intense fire, with more fire spread, and consequently a significantly stronger plume with larger amounts of BC reaching into the upper atmosphere than the simulation with rubble, illustrated in Figure 5. While the no-rubble simulation **represents the worst-case scenario** involving vigorous fire activity, **only a relatively small amount of carbon makes its way into the stratosphere** during the course of the simulation. But while small compared to the surface BC mass, stratospheric BC amounts from the current simulations are significantly higher than what would be expected from burning vegetation such as trees (Heilman et al., 2014), e.g., the higher energy density of the building fuels and the initial fluence from the weapon produce an intense response within HIGRAD with initial updrafts of order 100 m/s in the lower troposphere. Or, in comparison to a mass fire, wildfires will burn only a small amount of fuel in the corresponding time period (roughly 10 minutes) that a nuclear weapon fluence can effectively ignite a large area of fuel producing an impressive atmospheric response. Figure 6 shows vertical profiles of BC multiplied by 100 (number of cities involved in the exchange) from the two simulations. The total amount of BC produced is in line with previous estimates (about 3.69 Tg from no-rubble simulation); however, the majority of BC resides **below the stratosphere** (3.46 Tg below 12 km) and can be **readily impacted by scavenging from precipitation** either via pyro-cumulonimbus produced by the fire itself (not modeled) or other synoptic weather systems. While the impact on climate of these more realistic profiles will be explored in the next section, it should be mentioned that **these estimates are** still **at the high end**, considering the inherent simplifications in the combustion model that lead to **overestimating BC production**. 3.3 Climate Results Long-term climatic effects critically depend on the initial injection height of the soot, with larger quantities reaching the upper troposphere/lower stratosphere inducing a greater cooling impact because of longer residence times (Robock et al., 2007a). Absorption of solar radiation by the BC aerosol and its subsequent radiative cooling tends to heat the surrounding air, driving an initial upward diffusion of the soot plumes, an effect that depends on the initial aerosol concentrations. **Mixing and sedimentation** tend to **reduce this process**, and low altitude emissions are also significantly impacted by precipitation if aging of the BC aerosol occurs on sufficiently rapid timescales. But once at stratospheric altitudes, aerosol dilution via coagulation is hindered by low particulate concentrations (e.g., Robock et al., 2007a) and lofting to much higher altitudes is inhibited by gravitational settling in the low-density air (Stenke et al., 2013), resulting in more stable BC concentrations over long times. Of the initial BC mass released in the atmosphere, most of which is emitted below 9 km, **70% rains out within the first month** and 78%, or about 2.9 Tg, is removed within the first two months (Figure 7, solid line), with the remainder (about 0.8 Tg, dashed line) being transported above about 12 km (200 hPa) within the first week. This outcome differs from the findings of, e.g., Stenke et al. (2013, their high BC-load cases) and Mills et al. (2014), who found that most of the BC mass (between 60 and 70%) is lifted in the stratosphere within the first couple of weeks. This can also be seen in Figure 8 (red lines) and in Figure 9, which include results from our calculation with the initial BC distribution from Mills et al. (2014). In that case, only 30% of the initial BC mass rains out in the troposphere during the first two weeks after the exchange, with the remainder rising to the stratosphere. In the study of Mills et al. (2008) this percentage is somewhat smaller, about 20%, and smaller still in the experiments of Robock et al. (2007a) in which the soot is initially emitted in the upper troposphere or higher. In Figure 7, the e-folding timescale for the removal of tropospheric soot, here interpreted as the time required for an initial drop of a factor e, is about one week. This result compares favorably with the “LT” experiment of Robock et al. (2007a), considering 5 Tg of BC released in the lower troposphere, in which 50% of the aerosols are removed within two weeks. By contrast, the initial e-folding timescale for the removal of stratospheric soot in Figure 8 is about 4.2 years (blue solid line), compared to about 8.4 years for the calculation using Mills et al. (2014) initial BC emission (red solid line). The removal timescale from our forced ensemble simulations is close to those obtained by Mills et al. (2008) in their 1 Tg experiment, by Robock et al. (2007a) in their experiment “UT 1 Tg”, and © 2018 American Geophysical Union. All rights reserved. by Stenke et al. (2013) in their experiment “Exp1”, in all of which 1 Tg of soot was emitted in the atmosphere in the aftermath of the exchange. Notably, the e-folding timescale for the decline of the BC mass in Figure 8 (blue solid line) is also close to the value of about 4 years quoted by Pausata et al. (2016) for their long-term “intermediate” scenario. In that scenario, which is also based on 5 Tg of soot initially distributed as in Mills et al. (2014), the factor-of2 shorter residence time of the aerosols is caused by particle growth via coagulation of BC with organic carbon. Figure 9 shows the BC mass-mixing ratio, horizontally averaged over the globe, as a function of atmospheric pressure (height) and time. The BC distributions used in our simulations imply that the upward transport of particles is substantially less efficient compared to the case in which 5 Tg of BC is directly injected into the upper troposphere. The semiannual cycle of lofting and sinking of the aerosols is associated with atmospheric heating and cooling during the solstice in each hemisphere (Robock et al., 2007a). During the first year, the oscillation amplitude in our forced ensemble simulations is particularly large during the summer solstice, compared to that during the winter solstice (see bottom panel of Figure 9), because of the higher soot concentrations in the Northern Hemisphere, as can be seen in Figure 11 (see also left panel of Figure 12). Comparing the top and bottom panels of Figure 9, the BC reaches the highest altitudes during the first year in both cases, but the concentrations at 0.1 hPa in the top panel can be 200 times as large. Qualitatively, the difference can be understood in terms of the air temperature increase caused by BC radiation emission, which is several tens of kelvin degrees in the simulations of Robock et al. (2007a, see their Figure 4), Mills et al. (2008, see their Figure 5), Stenke et al. (2013, see high-load cases in their Figure 4), Mills et al. (2014, see their Figure 7), and Pausata et al. (2016, see one-day emission cases in their Figure 1), due to high BC concentrations, but it amounts to only about 10 K in our forced ensemble simulations, as illustrated in Figure 10. Results similar to those presented in Figure 10 were obtained from the experiment “Exp1” performed by Stenke et al. (2013, see their Figure 4). **In that scenario as well, somewhat less that 1 Tg of BC remained in the atmosphere after the initial rainout**. As mentioned before, the BC aerosol that remains in the atmosphere, lifted to stratospheric heights by the rising soot plumes, undergoes sedimentation over a timescale of several years (Figures 8 and 9). This mass represents the effective amount of BC that can force climatic changes over multi-year timescales. In the forced ensemble simulations, it is about 0.8 Tg after the initial rainout, whereas it is about 3.4 Tg in the simulation with an initial soot distribution as in Mills et al. (2014). Our more realistic source simulation involves the worstcase assumption of no-rubble (along with other assumptions) and hence serves as an upper bound for the impact on climate. As mentioned above and further discussed below, our scenario induces perturbations on the climate system similar to those found in previous studies in which the climatic response was driven by roughly 1 Tg of soot rising to stratospheric heights following the exchange. Figure 11 illustrates the vertically integrated mass-mixing ratio of BC over the globe, at various times after the exchange for the simulation using the initial BC distribution of Mills et al. (2014, upper panels) and as an average from the forced ensemble members (lower panels). All simulations predict enhanced concentrations at high latitudes during the first year after the exchange. In the cases shown in the top panels, however, these high concentrations persist for several years (see also Figure 1 of Mills et al., 2014), whereas the forced ensemble simulations indicate that the BC concentration starts to decline after the first year. In fact, in the simulation represented in the top panels, mass-mixing ratios larger than about 1 kg of BC © 2018 American Geophysical Union. All rights reserved. per Tg of air persist for well over 10 years after the exchange, whereas they only last for 3 years in our forced simulations (compare top and middle panels of Figure 9). After the first year, values drop below 3 kg BC/Tg air, whereas it takes about 8 years to reach these values in the simulation in the top panels (see also Robock et al., 2007a). Over crop-producing, midlatitude regions in the Northern Hemisphere, the BC loading is reduced from more than 0.8 kg BC/Tg air in the simulation in the top panels to 0.2-0.4 kg BC/Tg air in our forced simulations (see middle and right panels). The more rapid clearing of the atmosphere in the forced ensemble is also signaled by the soot optical depth in the visible radiation spectrum, which drops below values of 0.03 toward the second half of the first year at mid latitudes in the Northern Hemisphere, and everywhere on the globe after about 2.5 years (without never attaining this value in the Southern Hemisphere). In contrast, the soot optical depth in the calculation shown in the top panels of Figure 11 becomes smaller than 0.03 everywhere only after about 10 years. The two cases show a similar tendency, in that the BC optical depth is typically lower between latitudes 30º S-30º N than it is at other latitudes. This behavior is associated to the persistence of stratospheric soot toward high-latitudes and the Arctic/Antarctic regions, as illustrated by the zonally-averaged, column-integrated mass-mixing ratio of the BC in Figure 12 for both the forced ensemble simulations (left panel) and the simulation with an initial 5 Tg BC emission in the upper troposphere (right panel). The spread in the globally averaged (near) surface temperature of the atmosphere, from the control (left panel) and forced (right panel) ensembles, is displayed in Figure 13. For each month, the plots show the largest variations (i.e., maximum and minimum values), within each ensemble of values obtained for that month, relative to the mean value of that month. The plot also shows yearly-averaged data (thinner lines). The spread is comparable in the control and forced ensembles, with average values calculated over the 33-years run length of 0.4-0.5 K. This spread is also similar to the internal variability of the globally averaged surface temperature quoted for the NCAR Large Ensemble Community Project (Kay et al., 2015). These results imply that surface air temperature differences, between forced and control simulations, which lie within the spread may not be distinguished from effects due to internal variability of the two simulation ensembles. Figure 14 shows the difference in the globally averaged surface temperature of the atmosphere (top panel), net solar radiation flux at surface (middle panel), and precipitation rate (bottom panel), computed as the (forced minus control) difference in ensemble mean values. The sum of standard deviations from each ensemble is shaded. Differences are qualitatively significant over the first few years, when the anomalies lie near or outside the total standard deviation. Inside the shaded region, differences may not be distinguished from those arising from the internal variability of one or both ensembles. The surface solar flux (middle panel) is the quantity that appears most affected by the BC emission, with qualitatively significant differences persisting for about 5 years. The precipitation rate (bottom panel) is instead affected only at the very beginning of the simulations. The red lines in all panels show the results from the simulation applying the initial BC distribution of Mills et al. (2014), where the period of significant impact is much longer owing to the higher altitude of the initial soot distribution that results in longer residence times of the BC aerosol in the atmosphere. When yearly averages of the same quantities are performed over the IndiaPakistan region, the differences in ensemble mean values lie within the total standard deviations of the two ensembles. The results in Figure 14 can also be compared to the outcomes of other previous studies. In their experiment “UT 1 Tg”, Robock et al. (2007a) found that, when only 1 Tg of soot © 2018 American Geophysical Union. All rights reserved. remains in the atmosphere after the initial rainout, temperature and precipitation anomalies are about 20% of those obtained from their standard 5 Tg BC emission case. Therefore, the largest differences they observed, during the first few years after the exchange, were about - 0.3 K and -0.06 mm/day, respectively, comparable to the anomalies in the top and bottom panels of Figure 14. Their standard 5 Tg emission case resulted in a solar radiation flux anomaly at surface of -12 W/m2 after the second year (see their Figure 3), between 5 and 6 time as large as the corresponding anomalies from our ensembles shown in the middle panel. In their experiment “Exp1”, Stenke et al. (2013) reported global mean surface temperature anomalies not exceeding about 0.3 K in magnitude and precipitation anomalies hovering around -0.07 mm/day during the first few years, again consistent with the results of Figure 14. In a recent study, Pausata et al. (2016) considered the effects of an admixture of BC and organic carbon aerosols, both of which would be emitted in the atmosphere in the aftermath of a nuclear exchange. In particular, they concentrated on the effects of coagulation of these aerosol species and examined their climatic impacts. The initial BC distribution was as in Mills et al. (2014), although the soot burden was released in the atmosphere over time periods of various lengths. Most relevant to our and other previous work are their one-day emission scenarios. They found that, during the first year, the largest values of the atmospheric surface temperature anomalies ranged between about -0.5 and -1.3 K, those of the sea surface temperature anomalies ranged between -0.2 and -0.55 K, and those of the precipitation anomalies varied between -0.15 and -0.2 mm/day. All these ranges are compatible with our results shown in Figure 14 as red lines and with those of Mills et al. (2014, see their Figures 3 and 6). As already mentioned in Section 2.3, the net solar flux anomalies at surface are also consistent. This overall agreement suggests that the **inclusion of organic carbon aerosols, and** ensuing **coagulation** with BC, **should not dramatically alter the climatic effects** resulting from our forced ensemble simulations. Moreover, aerosol growth would likely **shorten the residence time of the BC particulate in the atmosphere** (Pausata et al., 2016), possibly **reducing the duration of these effects.**

#### Analysis of historical volcano activity disproves nuclear winter – An eruption 5 times the size of a regional nuclear exchange dissipated in just 2 years

Reisner et al. 18 (Jon Reisner – Climate and atmospheric scientist at the Los Alamos National Laboratory. Gennaro D’Angelo – Climate scientist at the Los Alamos National Laboratory, Research scientist at the SETI institute, Associate specialist at the University of California, Santa Cruz, NASA Postdoctoral Fellow at the NASA Ames Research Center, UKAFF Fellow at the University of Exeter. Eunmo Koo - Scientist at Applied Terrestrial, Energy, and Atmospheric Modeling (ATEAM) Team, in Computational Earth Science Group (EES-16) in Earth and Environmental Sciences Division and Co-Lead of Parallel Computing Summer Research Internship (PCSRI) program at the Los Alamos National Laboratory, former Staff research associate at UC Berkeley. Wesley Even - Computational scientist in the Computational Physics and Methods Group at Los Alamos National Laboratory. Matthew Hecht – Atmospheric scientist at the Los Alamos National Laboratory. Elizabeth Hunke - Lead developer for the Los Alamos Sea Ice Model (CICE) at the Los Alamos National Laboratory responsible for development and incorporation of new parameterizations, model testing and validation, computational performance, documentation, and consultation with external model users on all aspects of sea ice modeling, including interfacing with global climate and earth system models. Darin Comeau – Climate scientist at the Los Alamos National Laboratory. Randy Bos - Project leader at the Los Alamos National Laboratory, former Weapons Effects program manager at Tech-Source. James Cooley – Computational scientist at the Los Alamos National Laboratory specializing in weapons physics, emergency response, and computational physics. <MKIM> “Climate impact of a regional nuclear weapons exchange:An improved assessment based on detailed source calculations”. 3/16/18. DOA: 7/13/19. <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017JD027331>)

To quantitatively account for natural and forced variability in the climate system, we created two ensembles, one for the natural, unforced system and a second ensemble using a range of realistic vertical profiles for the BC aerosol forcing, consistent with our detailed fire simulation. The control ensemble was generated using small atmospheric temperature perturbations (Kay et al., 2015). Notably, the overall spread of anomalies in both ensembles is very similar. These ensembles were then used to create “super ensembles” using a statistical emulator, which allows a robust statistical comparison of our simulated results with and without the carbon forcing. Our primary result is the **decreased impact on global climate indices**, such as global average surface temperature and precipitation, relative to standard scenarios considered in previous work (e.g., Robock et al., 2007a; Stenke et al., 2013; Mills et al., 2014; Pausata et al., 2016). With our finding of **substantially less BC aerosol being lofted to stratospheric heights** (e.g., over a factor of four less than in most of the scenarios considered by previous studies), these globally averaged anomalies drop to **statistically insignificant levels** after the first several years (Figures 14 and 16). Our results are generally comparable to those predicted by other studies that considered exchange scenarios in which only about 1 Tg of soot is emitted in the upper troposphere (Robock et al., 2007a; Mills et al., 2008; Stenke et al., 2013). There are more subtle suggestions of regional effects, notably in the extent of the region over which sea surface temperature differences between ensembles remain significant in the final years of simulation (Figure 17). Further work is required to adequately analyze these and other potential regional effects. Historical analysis of several large volcanic eruptions and a recent large fire also supports this result. For example, Timmreck et al. (2010) claim that nonlinear aerosol effects of the Toba Tuff eruption 74,000 years ago helped **limit significant global cooling** impacts to a **two-year time period** and that any cooling beyond this time period could be due to other effects. It should be noted that this eruption was estimated to have produced **106 Tg** of ash and comparable amounts of other gases, such as sulfur dioxide (SO2), while the estimated amount of soot produced by a regional exchange is on the order of **10 Tg**, or **5 orders of magnitude smaller than the ash** (not including gases) **produced by the Toba eruption**. Noting that a nuclear exchange is not identical to volcanic events, it has been asserted that BC particles produced by fires should have a **greater impact on absorbing solar radiation** than even has the significantly larger amounts of ash and various gases produced by large eruptions (e.g., Robock and Toon 2010). Likewise, recent work in analyzing BC emissions from large fires suggests that in such fires, similar to large volcanic eruptions, **coating of soot particles with other particles** in convective eddies **tends to increase their size and hence increase their subsequent rainout** (China et al., 2013) before they can reach the stratosphere. In fact, the recent study of Pausata et al. (2016) found that growth of BC aerosol via coagulation with organic carbon significantly reduce the particles’ lifetime in the atmosphere

#### None of their evidence assumes the French Kerguelen Islands, which have unique characteristics conducive to effective repopulation

Turchin and Green 18 (Alexey Turchin – Scientist for the Foundation Science for Life Extension in Moscow, Russia, Founder of Digital Immortality Now, author of several books and articles on the topics of existential risks and life extension. Brian Patrick Green – Director of technology ethics at the Markkula Center for Applied Ethics, teaches AI ethics in the Graduate School of Engineering at Santa Clara University. <MKIM> “Islands as refuges for surviving global catastrophes”. September 2018. DOA: 7/20/19. https://www.emerald.com/insight/content/doi/10.1108/FS-04-2018-0031/full/html?fullSc=1&mbSc=1&fullSc=1)

One of the most attractive islands for long-term survival of global risks is **the French archipelago of Kerguelen** in the southern Indian Ocean. Kerguelen’s main Grand Terre Island has the following attractive features for long-term survival: It **is very remote from any other constant human settlement**s; for example, is it 3,000 km from the island of Reunion. The Kerguelen Islands lie **outside the main trade lines**, so the probability of a random ship arriving there is low. **The islands are inside the circumpolar Antarctic current**, and they are surrounded by strong winds (the “Roaring Forties” and “Furious Fifties”), which will not accidentally bring any ships from further north. A return trip from Reunion to Kerguelen by ship takes 28 days. **The islands do not have an airport**, so they cannot be reached by air, **and they are too remote for helicopter travel.** While Easter Island is even more remote from other human settlements, it is more populated and more often accessed by ships and planes. **The intense and isolating wind circulation around the South Pole could increase the time required for ash or radioactive clouds** from the northern hemisphere **to reach** the South Polar Region. But the Kerguelen Islands are also not too close to the South Pole: they are at the equivalent latitude as southern Germany; thus, they get quite a bit of sunlight The Kerguelen Islands have a stable but cold climate, with temperatures above freezing most of the time. The main island has **edible vegetation and many edible animals**, including 3,000 sheeps. The island is very large, approximately 7,000 km2 , and **it has many deep gulfs and fjords that could be used as harbors**. The main island has high mountains (over 1,000 m) with **an ice cap which could provide fresh water**. Nearby ice-free mountains hundreds of meters high could provide **protection against tsunamis**. The highest mountain is volcanic, and was active 100,000 years ago (Weis et al., 1998). However, **residual geothermal heat could provide heating and energy for a refuge**. The main island has a continuous population of only about 45 people, who live at a scientific station. Scientists who are selected for long expeditions are **more organized and educated than random people, so they may be better prepared for survival**. Such a scientific base will not be a military target in case of war. There are several other South Ocean islands similar to Kerguelen, like South Georgia, Auckland Island and Macquarie Island (Schalansky, 2010).

#### Nine planetary boundaries are necessary for human survival. Growth violates all of them.

Martine and Alves 15 – George Martine, President, Brazilian Association for Population Studies; Consultant, United Nations Population Fund, José Eustáquio Diniz Alves, Escola Nacional de Ciências Estatísticas (Ence), Instituto Brasileiro de Geografia e Estatística (IBGE), 2015 (“Economy, society and environment in the 21st century: three pillars or trilemma of sustainability?” *Revista Brasileira de Estudos de População*, Decemer 2015, http://www.scielo.br/scielo.php?pid=S0102-30982015005001101&script=sci\_arttext&tlng=en)

A recent update of this study (STEFFEN et al., 2015) warned of an intensification in the violation of planetary borders. This new study, based on a large number of peer-reviewed scientific studies, aimed to solidify the methodology of the previous analysis. It generally confirms the original set of planetary boundaries but provides an updated analysis and a quantification of the situation in several of them. It maintains the same processes as the 2009 study but improves the methodology and the analysis of the planetary boundaries with a focus on biophysics based on scientific advances over the previous five years. Several of the boundaries are now presented in two levels in order to reflect scale and regional heterogeneity. According to the authors, the methodology of the Planetary Boundaries does not propose to dictate how human societies should develop but to help civil society and decision-makers in the definition of a safe operational space for humanity and for life on Earth. The nine planetary boundaries listed in this more recent study are described as: climate change; biosphere integrity (loss of biodiversity and extinction of species); stratospheric ozone depletion; ocean acidification; biogeochemical flows (phosphorus and nitrogen cycles); landsystem change (such as deforestation); freshwater use; atmospheric aerosol loading (such as organic pollutants, radioactive materials, nanomaterials and micro-plastics); and novel entities (defined as new substances, new forms of existing substances, and modified life forms that have the potential for unwanted geophysical and/or biological effects). These nine processes affect the mechanisms that regulate and maintain the stability and resilience of the Earth system. Interactions between land, oceans and the atmosphere control the conditions under which our societies depend for their survival. Transgression of a boundary increases the risks for all human activities and could generate a much less hospitable state for the planet, frustrating efforts to reduce poverty and leading to the deterioration of human well-being in many parts of the world, including in the rich countries. The main novelty in this second study is the discovery that four of the planetary boundaries have already been breached: climate change, biodiversity integrity; landuse change, and; biogeochemical flows (phosphorus and nitrogen cycles). Two of these - climate change and biodiversity integrity - constitute what the scientists call "core" planetary boundaries due to their fundamental importance for the Earth system. Aggravating the violation of these core frontiers would be catastrophic and could lead to the collapse of the civilization we know. In other words, there are basic tipping points that cannot be surpassed. The risks of ecological chaos if we continue to exceed planetary limits were dramatized in another study published in 2012 by 12 scientists from the University of California. The scientists alerted us to the fact that we are on the brink of a "state shift", that is, an abrupt critical transition that could suddenly alter known conditions, producing unanticipated biotic effects (BARNOSKY et al., 2012). Hence, the analysis of planetary boundaries confirm previous theoretical studies, such as those of Beck (1995) and Giddens (2002) in the sense that capitalist modernization, while overcoming some previous conflicts, escalates those between society and nature, creating global risks of catastrophic magnitude. In this light, contrary to the cornucopian perception, the prevailing economic system is taking us towards an unsustainable future and succeeding generations will find it much harder to survive with a good quality of life. History shows us that civilizations follow a cycle of ascension, but when they are unable to accept new values or to change their trajectory, they tend to collapse. However, we have no historical record of any civilization that has ever deliberately risked suffering such vast devastation as ours! The next segment presents a brief analysis of the two threats that, according to current science, are particularly menacing for our current civilization - climate change and the integrity of biodiversity.

#### Phosphorus depletion through growth is unsustainable – stats prove.

**Mission 2016** An MIT Lab, which analyzed if future supply be able to meet future demand [“Eliminating depletion and environmental damage with efficient phosphorus use and reuse.” http://web.mit.edu/12.000/www/m2016/finalwebsite/solutions/phosphorus.html Mission 2016]//Mberhe

Earth's phosphorus is being depleted at an alarming rate. At current consumption levels, we will run out of known phosphorus reserves in around 80 years, but consumption will not stay at current levels. Nearly 90% of phosphorus is used in the global food supply chain, most of it in crop fertilizers. If no action is taken to quell fertilizer use, demand is likely to increase exponentially. (Prud'Homme, 2010, from Schroder et. al., 2010) A simple program of smart demand reduction and increased organic waste recycling, supplemented with mining exploration in probable deposit areas, can delay, if not completely avoid, a peak in phosphorus production for several decades. However, it is imperative to take action now. There was a time when humans operated totally self-sufficient farms, tilling the same land for years by managing waste effectively, by simply making sure that everything that came out of the land eventually went back into it. In such a closed-loop scenario, phosphate would have the capacity to be reused approximately 46 times as food, fuel, fertilizer, and food again [1]. In the fertilizing techniques that dominate today, which involve the annual application of phosphate-enriched chemical mixtures on top of nutrient-starved soil, phosphorus is used exactly once, then swept out to sea. This practice is simply unsustainable. Our ancestors learned the importance of conserving nutrients through necessity: if they could not make the soil yield, they would starve; there were no second chances. The world has a chance, now, to learn this lesson again, before it's too late. History The United States is unique in that it is both a wealthy, industrialized nation at the forefront of technology, and an agricultural powerhouse with the third-largest population in the world. In the 1970s and early 1980s, during the early years of the Green Revolution, the US's production of food commodities shot up, as did their use of artificial nitrogen-phosphorus fertilizers. The USSR followed a similar agricultural path, and as a result, worldwide phosphorus production grew from about 8 Mt/y in 1960 to over 20 Mt/y at its peak in the mid-1980s. Following this milestone, the world actually entered a period of reduced production and use that lasted until just a few years ago. While some have speculated that peak phosphorus production has already been reached, it seems more likely that the relatively short dip in production was merely the a coincidence of reduced use in the wake of the USSR's collapse and more efficient practices being adopted by US farmers, while the rest of the world's food production was still catching up.

#### Phosphorus is a necessity for Human intake and depletion causes extinction.

Charly Faradji 16, Doctor of Philosophy Student, Chemistry, University of Bristol, “How the great phosphorus shortage could leave us short of food,” 2/17/16, https://phys.org/news/2016-02-great-phosphorus-shortage-short-food.html

It's not as well-known as the other issues, but phosphorus depletion is no less significant. After all, we could live without cars or unusual species, but if phosphorus ran out we'd have to live without food. Phosphorus is an essential nutrient for all forms of life. It is a key element in our DNA and all living organisms require daily phosphorus intake to produce energy. It cannot be replaced and there is no synthetic substitute: without phosphorus, there is no life. Our dependence began in the mid-19th century, after farmers noticed spreading phosphorus-rich guano (bird excrement) on their fields led to impressive improvements in crop yields. Soon after, mines opened up in the US and China to extract phosphate ore – rocks which contain the useful mineral. This triggered the current use of mineral fertilisers and, without this industrial breakthrough, humanity could only produce half the food that it does today. Fertiliser use has quadrupled over the past half century and will continue rising as the population expands. The growing wealth of developing countries allows people to afford more meat which has a "phosphorus footprint" 50 times higher than most vegetables. This, together with the increasing usage of biofuels, is estimated to double the demand for phosphorus fertilisers by 2050. Today phosphorus is also used in pharmaceuticals, personal care products, flame retardants, catalysts for chemical industries, building materials, cleaners, detergents and food preservatives. Phosphorus is not a renewable resource Reserves are limited and not equally spread over the planet. The only large mines are located in Morocco, Russia, China and the US. Depending on which scientists you ask, the world's phosphate rock reserves will last for another 35 to 400 years – though the more optimistic assessments rely on the discovery of new deposits. It's a big concern for the EU and other countries without their own reserves, and phosphorus depletion could lead to geopolitical tensions. Back in 2008, when fertiliser prices sharply increased by 600% and directly influenced food prices, there were violent riots in 40 different developing countries. Phosphorus also harms the environment. Excessive fertiliser use means it leaches from agricultural lands into rivers and eventually the sea, leading to so-called dead zones where most fish can't survive. Uninhibited algae growth caused by high levels of phosphorus in water has already created more than 400 coastal death zones worldwide. Related human poisoning costs US$2.2 billion dollars annually in the US alone. With the increasing demand for phosphorus leading to massive social and environmental issues, it's time we looked towards more sustainable and responsible use. There is still hope In the past, the phosphorus cycle was closed: crops were eaten by humans and livestock while their faeces were used as natural fertilisers to grow crops again. These days, the cycle is broken. Each year 220m tonnes of phosphate rocks are mined, but only a negligible amount makes it back into the soil. Crops are transported to cities and the waste is not returned to the fields but to the sewage system, which mainly ends up in the sea. A cycle has become a linear process. We could reinvent a modern phosphorus cycle simply by dramatically reducing our consumption. After all, less than a third of the phosphorus in fertilisers is actually taken up by plants; the rest accumulates in the soil or is washed away. To take one example, in the Netherlands there is enough phosphorus in the soil today to supply the country with fertiliser for the next 40 years.

#### Proponents of nuclear winter fail in applying their theory to modern atmospheric catastrophes – Most particles stay below the stratosphere and rainout checks any anomalies

Yegorov 19 (Oleg Yegorov - Ph.D. in the microbiology from The Institute of Microbiology and Virology of the Academy of Science in Kiev, Ukraine. <MKIM> “Nuclear winter: Will Russia and the U.S. destroy the world?”. 4/22/19. DOA: 7/17/19. https://www.rbth.com/lifestyle/330267-what-is-nuclear-winter-russia-us-war)

In the 1980s, the concept of nuclear winter shocked the world. By that time, the Socialist bloc and the West were on the brink of a military conflict, with U.S. Pershing missiles deployed in Europe, able to reach Moscow in 8-10 minutes. News of a possible nuclear winter added to the global sense of fear. This led to changes. In 1985, Mikhail Gorbachev and Ronald Reagan stated after their first summit in Geneva: “a nuclear war cannot be won and must never be fought.'' In less than a decade, the Cold War was over and the possibility of a nuclear war between Russia and the U.S. became far less likely. But since that time the question remains – was the nuclear winter concept accurate? Several scientists heavily criticized the research conducted by Sagan, Golitsyn and Moiseyev as faulty and questionable. “The computer models were so **simplified**, and the data on smoke and other aerosols were so poor that **scientists could not say anything for certain,”** the American Institute of Physics noted in 2011. Furthermore, the consequences of the First Gulf War (1990-1991) weakened Sagan’s position in the U.S. He predicted that the raging fires from the oil wells would result in an effect similar to nuclear winter, with global temperatures decreasing by several degrees, probably causing a “year without summer,” like the infamous one in 1816. **None of this happened, however**. “I always considered ‘nuclear winter’ to be **a hoax and scientifically incorrect**,” said Dr. S. Fred Singer, Sagan’s chief opponent, after those events in the early 1990s. In Russia, the nuclear winter hypothesis is also disputed. For instance, Sergey Utyuzhnikov from the Moscow Institute of Physics and Technology, in his 2001 article, Simulation of Pollution Spread over Conflagrations in the Atmosphere, stated that **most soot and dust will stay in the lower atmosphere** without reaching the stratosphere. “**The impurities are washed away by rains without having any serious impact on the climate**,” Utyuzhnikov says, denouncing the nuclear winter hypothesis.

#### Kuwaiti oil fires prove nuclear winter predictions are severely overestimated and the modern nuclear arsenal isn’t even capable of producing a comparable effect

Walker 18 (Robert Walker – Software developer and expert on Space and Mars, MHum graduate in Mathematics and Philosophy at The University of York. <MKIM> “Debunked: Nuclear Winter and Radioactive Fallout myths”. 3/6/18. DOA: 7/17/19. https://debunkingdoomsday.quora.com/Debunked-Nuclear-Winter-and-Radioactive-Fallout-myths-1)

This was the big bug bear during the cold war. Carl Sagan and others calculated that an all out nuclear war, both the explosions themselves and the firestorms they created, would put so much dust into the upper atmosphere that it would cool the entire Earth for several years afterwards in a nuclear winter. The idea of a nuclear winter goes back to a 1983 paper predicting an average world temperature of -25 C following a global nuclear war. This is for an all out exchange of the nuclear weapons of US and Russia during the cold war. **This is based on work with early primitive 1D models and very low resolution 3D models and based on many assumptions** about how smoke from the fires would move in the atmosphere. These models had a lot of influence on thinking about the cold war and were widely respected and believed at the time, by the likes of Carl Sagan etc. Carl Sagan is a co-author. Here is an early interview with him warning about the potentially serious effects and saying that scientists had come together and were in general agreement about it. However later **their models were proved to be wrong with the Kuwaiti oil fires** which did not behave as they predicted. Even at the time there was a fair bit of skepticism with some scientists writing that they thought that the ones who proposed a nuclear winter were politically motivated. Not that they were deceiptful of course, just that perhaps they were more easily persuaded by not such strong evidence due to their political persuasions about nuclear war. For instance there is a very skeptical paper from 1986, published in Nature, just 3 years after the Sagan paper: Emanuel, K. A. "Nuclear winter: Towards a scientific exercise." Nature 319.6051 (1986): 259-259. He says that following a model by Golding the soot would rise at 20 cm / second which is enough so that even in dry air, water would condense out and wash the soot out of the atmosphere before it got high enough to become a continent wide pall in the upper atmosphere (the moisture would condense out similarly to the way cummulus clouds form above rising air on a sunny day). Seitz was another early skeptic, writing in the same year (1986): “As the science progressed and more authentic sophistication was achieved in newer and more elegant models, the postulated effects headed downhill. By 1986, these worst-case effects had melted down from a year of arctic darkness to warmer temperatures than the cool months in Palm Beach! A new paradigm of broken clouds and cool spots had emerged. The once global hard frost had retreated back to the northern tundra. Mr. Sagan's elaborate conjecture had fallen prey to Murphy's lesser-known Second Law: If everything MUST go wrong, don't bet on it.” Those views were not widely accepted at the time. But eventually just about everyone, including Carl Sagan, came to change their views on nuclear winter, within six years of him writing that. So what happened? Well - their calculations turned out to be accurate for asteroid impacts. This is a significant issue though not an extinction causing one, for large asteroid impacts. They are also accurate for supervolcanoes which lift large amounts of ash into the upper atmosphere, not enough to cause a nuclear winter but enough for a supervolcano autumn. Their models are still accepted for both those scenarios. But several things happened to cast doubt on their calculations for nuclear weapons. First it’s important to realize, their models are not based on the idea of the immediate effects of the nuclear weapons. **The explosion itself doesn’t loft** anything like **enough material to be of concern.** That makes it different from an asteroid impact or volcanic eruption. **Their model was instead based on the idea that the nuclear weapons would cause large scale fire storms** in urban areas. They predicted that this soot, from ordinary fires, but very large ones, would be lofted up into the upper atmosphere. This is what they later came to realize was based on flawed reasoning and over simple models. In particular, when the Iraqis retreated after their invasion of Kuwait, then they set many oil wells alight. These created dense black smoke that turned day to night over large areas As reported for instance in the Baltimore times: Cornell University astronomer Carl Sagan says Saddam Hussein's orders to torch Kuwaiti oil wells, if carried far enough, could unleash smoke clouds that would disrupt agriculture across South Asia and darken skies around the world. "You need a very small lowering of the average temperatures of the Northern Hemisphere to have serious consequences for agriculture," Sagan said. Scientists in Maryland and Colorado say such a disaster would require fires at hundreds of wells burning for months, but they agreed the potential exists in Kuwait for a "very catastrophic" environmental event. Saddam Hussein of course did set the oil wells alight - and hundreds of them too. At the time then there were worries they would burn for five years. And there were 610 fires (others say 750) burnt uncontrolled from February through to May 1991 at which point the thousands of fire fighters had their equipment in place and began to put them out. Here is how they did it: Longer video here To begin with **there were a lot of days when it was totally dark**. And when you could see the sky it didn’t last for more than a few minutes and it was total darknes again. **It was exactly the sort of scenario they had predicted for a nuclear winter**, and they’d have expected at least major cooling effects and immense disruption of agriculture over most of Asia. **But it didn’t have the widespread effects the scientists had expected**. As Carl Sagan wrote in his Demon Haunted World, page 257: "it was pitch black at noon and temperatures dropped 4–6 °C over the Persian Gulf, but **not much smoke reached stratospheric altitudes and Asia was spared**.” For more about this background see the section in Wikidia’s Carl Sagan - Scientific and critical thinking advocacy This lead to them re-evaluating the models that lead to the nuclear winter prediction, which were rather crude, making many assumptions and approximations. They couldn’t be right to have got the predictions about the Kuwaiti oil fires so very wrong. **The conclusion nowadays is that nuclear weapons most likely would not cause firestorms in cities**, if they did, the smoke would rarely reach higher than 4 km. Also much more of Earth burns in wild fires every year without putting us into a nuclear winter scenario. Also **modern nuclear bombs are smaller than they used to be. Both US and Russia have eliminated all bombs of more than one megaton**. Only China has them now, with about 50 of them. To get the dust high enough for nuclear winter, above 70,000 feet you’d need bombs with yields much more than a megaton. **Modern bombs would only throw the debris up to 60,000 to 70,000 feet** which means **the debris will rain to Earth within hours** or days close to the point of impact. (from Allen E Hall's answer to In a total nuclear exchange where the entire worlds arsenals are used, how long would the nuclear winter last and would we survive? ) For a complete list of the nuclear weapons with their yields, see Russian nuclear forces, 2017 US nuclear forces, 2018 linked to from the World Nuclear Weapon Stockpile report **Our nuclear arsenals are also much smaller than they were at the time of the nuclear winter calculations.** Though - even with multi-megaton bombs, still, they mainly just lift rather small quantities of dust into the upper atmosphere and would not lift the vast amounts of soot which would come from the later firestorm. So in short, nuclear winter was based on poor science, as it turned out (refuted by the Kuwaiti fires), and **probably even at the height of the cold war, we would not have been plunged into a nuclear winter. As it is now, certainly not.**

#### Nuclear war is inevitable, but strategic planning ensures it won’t lead to extinction

Caldwell 18 – Joseph Caldwell is the Principal Scientist of US Army Electronic Proving Ground Electromagnetic Environmental Test Facility (“Is Nuclear War Survivable?”, Foundation, 5-15-18, <http://www.foundationwebsite.org/IsNuclearWarSurvivable.pdf>, accessed 7-14-19)// kel$

The genie is out of the bottle. Given sufficient time, nuclear war is virtually certain to happen. We can do little to change that mathematical fact. What we can change, however, is the likelihood of surviving nuclear war, when it does occur. The prudent response to this existential threat to humankind is to prepare for it. This is the same reason why lifeboats are placed on ships, and seatbelts and airbags are placed in automobiles. The odds of a catastrophe are low, but it is prudent to prepare for one. At the present time, human society is extremely wealthy and technologically advanced. We can fly to the moon and Mars. The challenge of preparing to survive a nuclear war can easily be met. Our society – even wealthy individuals in our society – can easily afford to establish a number of pods throughout the world, thereby assuring the survival of themselves and mankind after nuclear war occurs. Nuclear war is coming. When it does occur, it is reasonable to speculate that some groups or individuals will have had the foresight to prepare for it, and thereby assure not only their survival, but the survival of the human species. (Because of the politics of envy, pods would be vulnerable to destruction by people without access to one, who would feel that if they are not eligible to seek refuge in a pod, then no one should have that privilege. As a result of this vulnerability, if there are already pods in existence, the general public would be unlikely to know about them, and it would certainly not know of their locations.) Astronomer Fred Hoyle observed that, with respect to energy sufficient to develop technological civilization, the human species may have but one bite at the apple. When all of the readily available energy from fossil fuels is gone, no comparable source of inexpensive, high-intensity energy is available to replace it. He observed that a key ingredient enabling the development and maintenance of our large, complex, technological society was the massive quantity of fossil fuels, accumulated over millions of years and expended in a few human generations. If modern technological civilization collapses, mankind would not, in Hoyle’s view, have this key ingredient – a massive amount of cheap, high-grade energy – available a second time, to build technological society again. Hoyle’s point is arguable. Although the one-time treasure trove of fossil fuels may have enabled a very rapid and very inefficient development of a planetary technological civilization, and may temporarily support a very wasteful and lavish lifestyle for a truly massive number of people, it appears that post-fossil-fuel sources of energy are quite sufficient to develop and maintain a technological civilization, a second time. 6. Planning to Survive a Nuclear War The fact is, with sufficient planning and preparation, a large-scale nuclear war is survivable for the human species, with high probability. 10 In the 1950s, the United States had a large-scale Civil Defense program, which identified fallout shelters having adequate ventilation, and stocked suitable shelters with water and other provisions. The program was eventually discontinued, when it was realized that in a large-scale nuclear attack most people would perish, with or without the fallout shelters. There was no point to fallout shelters, at least not of the sort used then (mainly, basements of buildings). Some nations maintain fallout shelters today, but they do not provide for the contingency of a nuclear winter. To survive a nuclear winter requires substantial planning, preparation, and expense. Locations such as Mount Weather and Cheyenne Mountain could be quickly modified to provide for two years of operation without outside support. In planning for space missions to Mars, the US and other countries are acquiring much useful information about supporting a small group of people for an extended period of time in a hostile environment. The Mormon religion requires its adherents to stockpile a year’s worth of food. Without provisions to protect survivors from radioactive fallout and from attack from survivors who have no food, such preparations are useless. Wealthy individuals such as George Soros, Bill Gates, Jeff Bezos, Elon Musk and Mark Zuckerberg have the wherewithal to plan and prepare shelters that could keep small groups alive for a couple of years. Mankind has gone to the moon and returned. It is now planning to explore and colonize Mars. Providing for a number of colonies of human beings to sit out the aftermath of a large-scale nuclear war, including the provision of those colonies with adequate biosphere restocking supplies, requires planning, preparation, and expense, but it is technologically less daunting and less expensive than going to the moon or to Mars (since no space travel is involved). Moreover, it is vastly more important – unlike an expedition to the moon or Mars, the survival of mankind depends on it!