## 1

#### [a] Interpretation: debaters cannot specify parts of the resolution. To clarify, they can’t spec forms of appropriation.

#### [b] Violation: They specified.

#### [c] Standards:

#### 1] Topic education – If the other debater specifies something not mentioned in the res, then it’s extra topical. Making the debate around whatever they specified kills actual topic education. IE. they specified a specific part of appropriation, which means that they aren’t negating as per NSDA rules. They’ll say we get more education by specifying but that’s wrong since they can go for anything, and I won’t be able to engage as effectively since there is good lit for an infinite number of affs. Decks fairness and education.

#### 2] Predictability – Moves the debate into unpredictable ground which destroys clash. I don’t know what they are going to specify, and this means I have a short time to come up with responses that won’t be as good which means we are getting less education. TVA solves. Because TVA solves it’s DTD. Not fair that they get access to grounds on stuff that isn’t part of the NSDA rules. They’ll say it is predictable, but it isn’t because we never know what they specify, but even then, their model of debate allows for specifying anything. They kill education and fairness.

#### 3] Prep Burdens – I can’t possibly prep for every single potential specification in the world. Their position advocates that I should. Now my responses can’t be as good which harms the education we receive from the round since they have the ability to literally go for anything. DTD again cause they choose to specify and not be topical. They’ll say disclosing solves, but no because 30 minutes etc isn’t enough for the days of prep you have with this plan. I can’t find as good cards, and the alt is a better more educational debate since we both know the topic. Kills education and fairness.

#### 4] Topicality – If it isn’t in the res, it isn’t topical which means their advocacy isn’t topical. Giving them the win for something that’s against NSDA rules doesn’t make sense, and I shouldn’t lose for following the rules. Their role is to affirm the resolution as it is, and that’s set by NSDA. Not being topical decks fairness. They’ll say that people already don’t follow NSDA rules because of K’s and other of case positions, but the argument is about models of debate, is ought gap. We ought to have discussions about the topic, DTD means we get closer to this since it would discourage off topic positions.

#### 5] Limits and Ground – Even if they read evidence that they are topical because of a subset, they still can’t resolve the fact that I lost ground in the debate because of their action. Their plan imposes a model of debate wherein they can specify whatever they want and not debate the topic as is on the tourney invite page. Ie. their model means that they can continue to shift the limit of the debate to parts where they have more ev and prep which devastates my prep and ev burdens because I spent time prepping and cutting ev for other parts of the res which means my responses will be less in depth which takes out your inevitable claims to education. You’ll always destroy me on this debate which means no substantive education.

#### I LOST ACCESS TO LINK TO THE MINING DA, SATS DA, ASAT WAR DA, COLINIZATION DA, AND MORE. THIS IS 99% OF THE TOPIC THAT THEY PERCLUDED ME FROM.

#### [d] Voters:

#### 1] Education – is a voter because it is the goal and purpose of debate.

#### 2] Fairness – is a voter because it is necessary in any competition.

#### It’s DTD; DTA illogical, time skew, you can’t drop their adovacy without dropping the debater since the advocacy control the round, and dropping the argument would turn it condo which is bad because condo advocacies allow them to kick out midway through and moot my speeches which decks fairness. No RVIs; chills checking of abuse, baiting, illogical, you don’t win for being fair. It’s CI; reasonability is arbitrary and encourages judge intervention since there’s no clear norm, but CI causes a race to the top with the best norms for debate.

## Case

### 1NC-Climate

#### Best science proves no warming impact.

**Idso et al 18** (Craig, Geography@ArizonaState, David Legates, Climatology@ Delaware, ProfClimatology@ Deleware, Fred Singer, Physics@ Princeton, ProfEnviroScience@ Virginia, Climate Change Reconsidered II: Fossil Fuels, NIPCC, Ch.2, p. 108-109, http://climatechangereconsidered.org/climate-change-reconsidered-ii-fossil-fuels/)

Methodology The Scientific Method is a series of requirements imposed on scientists to ensure the integrity of their work. **The IPCC has not followed established rules** that guide scientific research. Appealing to consensus may have a place in science, but not as a means of shutting down debate. Uncertainty in science is unavoidable but must be acknowledged. Many declaratory and predictive statements about the global climate are **not warranted by science**. Observations Surface air temperature is governed by energy flow from the Sun to Earth and from Earth back into space. Whatever diminishes or intensifies this energy flow can change air temperature. Levels of carbon dioxide and methane in the atmosphere are governed by processes of the carbon cycle. Exchange rates and other climatological processes are poorly understood. The geological record shows temperatures and CO2 levels in the atmosphere **have not been stable**, making untenable the IPCC’s assumption that they would be stable in the future in the absence of human emissions. Water vapor is the dominant greenhouse gas owing to its abundance in the atmosphere and the wide range of spectra in which it absorbs radiation. Carbon dioxide (CO2) absorbs energy only in a very narrow range of the longwave infrared spectrum. Controversies Reconstructions of average global surface temperature differ depending on the methodology used. The warming of the twentieth and early twenty-first centuries has **not been shown to be beyond the bounds of natural variability.** General circulation models (GCMs) are unable to accurately depict complex climate processes. They do not accurately hindcast or forecast the climate effects of human-related greenhouse gas emissions. Estimates of equilibrium climate sensitivity (the amount of warming that would occur following a doubling of atmospheric CO2 level) range widely. The IPCC’s estimate is higher than many recent estimates. **Solar irradiance, magnetic fields, UV fluxes, and cosmic rays** are poorly understood and may have greater influence on climate than general circulation models currently assume. Climate Impacts There is **little evidence** that the warming of the twentieth and early twenty-first centuries has caused a general increase in severe weather events. Meteorological science suggests a warmer world will see **milder weather patterns**. Arctic ice is losing mass, but melting commenced before there was a human impact on climate and is not unprecedented. Antarctica is either gaining ice mass or is unchanged. Best available data show **sea-level rise is not accelerating**. Local and regional sea levels continue to exhibit typical natural variability. The link between warming and drought is weak, and by some measures drought decreased over the twentieth century. Changes in the hydrosphere of this type are regionally highly variable and show a closer correlation with multidecadal climate rhythmicity than they do with global temperature. Plants have responded positively to rising temperatures and carbon dioxide levels in the atmosphere, a trend that is likely to continue beyond the twenty-first century. Why Scientists Disagree Climate is an interdisciplinary subject requiring insights from many fields of study. Very few scholars have mastery of more than one or two of these disciplines. Fundamental uncertainties arise from insufficient observational evidence and disagreements over how to interpret data and how to set the parameters of models. Many scientists trust the Intergovernmental Panel on Climate Change (IPCC) to objectively report the latest scientific findings on climate change, but it has failed to produce balanced reports and has allowed its findings to be misrepresented to the public. Climate scientists, like all humans, can have tunnel vision. Bias, even or especially if unconscious, can be especially pernicious when data are equivocal and allow multiple interpretations, as in climatology. Appeals to Consensus Surveys and abstract-counting exercises that are said to show a “scientific consensus” on the causes and consequences of climate change **invariably ask the wrong questions or the wrong people**. No survey data exist that support claims of consensus on important scientific questions. Some survey data, petitions, and peer-reviewed research show deep disagreement among scientists on issues that must be resolved before the man-made global warming hypothesis can be accepted. Some **31,000 scientists** have signed a petition saying “there is no convincing scientific evidence that human release of carbon dioxide, methane, or other greenhouse gases is causing or will, in the foreseeable future, cause catastrophic heating of the Earth’s atmosphere and disruption of the Earth’s climate.” Prominent climate scientists have said repeatedly that there is no consensus on the most important issues in climate science.

#### Zero impact to warming – there’s a laundry list of reasons

**Goklany 15** (Indur, PhD from Michigan State, Assistant Director of Programs, Science and Technology Policy at the DOI, represented the United States at the Intergovernmental Panel on Climate Change (IPCC) and during the negotiations that led to the United Nations Framework Convention on Climate Change, “CARBON DIOXIDE: The good news”, The Global Warming Policy Foundation, GWPF Report 18)

[figures omitted]

The **impacts of global warming** are generally estimated using chains of linked computer models. Each chain begins with a climate model, which itself is driven by a set of socioeconomic scenarios based on assumptions for population, economic development and technological change over the entire period of the analysis (often 50– 100 years or more). The climate model is followed by various biophysical, economic and other downstream models to estimate changes in different aspects of human 23 activity or welfare, for example agriculture, forestry, health or biodiversity. The **uncertain outputs** of each upstream model serve as the inputs of the subsequent downstream model, with the uncertainties **cascading down** the chain so that the individual streams of uncertainty combine into a regular torrent. For example, to estimate the impacts on agriculture and food security, the outputs of the climate model are fed into various crop models to estimate yields, which then are linked to economic models to estimate supply and demand for the various crops. Supply and demand are then reconciled via national, regional and global scale trade models.142 Notably, despite the cascade of uncertainties, to date **no climate change impact assessment** has provided an **objective estimate** of the cumulative uncertainty, starting with the socioeconomic scenarios through to the impact estimate. The ranges of uncertainty presented in the IPCC impact reports are generally based on the uncertainties only from using different climate scenarios. But these are much narrower than the true uncertainties that would have been estimated had the full cascade of uncertainties been considered. Models have not been validated One reason that doom-laden predictions about human wellbeing have failed is that orthodox climate scientists have neglected to apply the scientific method: specifically they have not checked their hypotheses and biases embodied in their models against empirical reality. As we have seen, simple reality checks show that environmental and human wellbeing is not currently deteriorating. Validation of these models using such reality checks would have limited their divergence from reality, and also reduce the uncertainties that are inevitably compounded as one progresses down the chain of models. Climate models overstate global warming Firstly, the global climate has not been warming as rapidly as projected in the IPCC assessment reports. Figure 5 compares observed global surface temperature data from 1986 through 2012 versus modelled results. It confirms that models have been running hotter than reality. But these are the projections that governments have relied on to justify global warming policies, including subsidies for biofuels and renewable energy while increasing the overall cost of energy to the general consumer – costs that disproportionately burden those that are poorer. A comparison of performance of 117 simulations using 37 models versus empirical data from the HadCRUT4 surface temperature data set indicates that the vast majority of the simulations/**models** have **overestimated warming**.143 The models indicated that the average global temperature would increase by 0.30±0.02◦Cper decade during the period from 1993 to 2012 but empirical data show an increase of only 0.14±0.06◦C per decade.144 Model performance was even worse for the more recent 15-year period of 1998–2012. Here the average modelled trend was 0.21±0.03◦C per decade, **quadruple the observed trend** of 0.05±0.08◦C. Considering the confidence interval, the observed trend is indistinguishable from no trend at all; that is, warming has, for practical purposes, halted. Even the IPCC acknowledges the existence of this ‘hiatus’.145 Moreover, the HadCRUT4 temperature database indicates that the global warming rate declined from 0.11◦C per decade from 1951–2012 to 0.04◦C per decade from 1998–2012.146 This is despite the fact that, per the IPCC, the anthropogenic greenhouse gas forcing for 2010 (2.25 W/m2) exceeded what was used in the models for 2010 (1.78–1.84 W/m2) by around 25%.147 Some have argued that satellite temperature data should be preferred over surface datasets. In fact, satellite coverage is more comprehensive and more representative of the Earth’s surface than is achievable using surface stations, even if the latter were to number in the thousands. A recent review paper notes that satellites can provide ‘unparalleled global- and fine-scale spatial coverage’ presumably because of ‘more frequent and repetitive coverage over a larger area than other observation means’.148 In addition, surface measurements are influenced by the measuring stations’ microenvironments, which will vary not only from station to station at any given time, but also over time at the very same station, as vegetation and man-made structures in their vicinity spring up, evolve and change.149 Satellite temperature data indicates that the globe has been warming at the rate of 0.12–0.14◦C per decade since 1979;150 by contrast, the IPCC assessments over the last 25 years have been projecting a warming trend of 0.2–0.4◦C per decade.151,152 The 25 differences between modelled trends and those from satellites and weather balloons are shown in Figures 6 and 7.153 Nevertheless, based on these chains of unvalidated computer models, orthodox thinkers on climate change claim that global warming will, among other things, lower food production, increase hunger, cause more extreme weather, increase disease, and threaten water supplies. The cumulative impact will, they claim, diminish living standards and threaten species, and if carbon dioxide and other greenhouse gases are not curbed soon, pose an existential threat to humanity and the rest of nature. Some claim it may already be too late.154 The group 350.org, for instance, agitates for reducing atmospheric carbon dioxide levels, currently at 400 ppm, to 350 ppm, a level the earth last experienced in 1988.155 But since then, **global GDP** per capita **has increased** 60%, infant **mortality** has **declined** 48%, **life expectancy** has **increased** by 5.5 years, **and the poverty headcount has dropped** from 43% to 17% despite a population increase of 40%. Nostalgia for a 350 ppm world seems somewhat misplaced, if not **downright perverse**.156,157 Climate models don’t do local well It is not clear what logical process was used to arrive at these allegations. It may stem from the fact that orthodox thinkers on climate, in the grip of confirmation bias, are unable or unwilling to acknowledge that, unless a climate or weather event is truly unprecedented then the default assumption – the ‘null hypothesis’ in scientific parlance – should be that it is part of normal climate variability rather than manmade global warming. Some have used the results of modelling exercises that purport to assess the future impacts, usually in the latter part of this century, and then ‘interpolated’ these results back to the present day.158,159,160 The first step in such an exercise relies on climate models to project the future climate. But we have seen that these models have failed the reality test with respect to globally averaged surface temperature over the past two decades or more. To compound matters, the performance of climate models relative to reality worsens as one attempts to project surface temperatures at smaller geographical scales. 27 Climate models don’t do precipitation well More importantly, the wellbeing of human beings and the rest of nature is probably more sensitive to changes in precipitation than to temperature, and **precipitation is highly variable** from spot to spot. But climate models perform even **worse for precipitation** than they do for temperature, regardless of the geographic scale. In fact, for several areas many models are unable to reliably hindcast past precipitation, let alone forecast the future.161,162 Notsurprisingly, precipitation projections using different models often contradict each other. For example, a recent study of annual precipitation changes in California using 25 model projections indicates that ‘12 projections show drier annual conditions by the 2060s and 13 show wetter.’163 Thus impact assessments that use as their starting point the outputs of these climate models cannot and should not be relied upon to develop policies, although they may have scientific diagnostic value for improving our understanding of climate mechanisms and processes. Adaptation methodology is flawed Failure to properly account for adaptation Even if climate models represented reality perfectly and were able to foretell the future climate, impact assessments would still be suspect. This is because most global warming impact assessments assume little or no endogenous (or autonomous) **adaptation**. For example, the vast majority of studies of global warming impacts on water resources do not incorporate any allowance for adaptive measures that might be taken to reduce those impacts, despite the fact that steps of this nature have been taken since time immemorial.164,165 For instance, the world’s oldest functioning dam, at Lake Homs in Syria, dates back to 1319 BC,166 and qanats, underground canals to convey water for human settlements and irrigation, were built in Persia as long ago as the first millennium BC.167 Similarly, of the many studies used by the IPCC to estimate future impacts on crop yields, 63% did not consider improvements in the agricultural sector’s adaptive capacity.168 Moreover, specific adaptive measures used in many global warming impact studies are based on surveys of available technologies from the 1990s. However, today suitable adaptation measures are both more **numerous and cheap**er.169 And because we are wealthier, these options are even more affordable.170 Consequently, our ability to adapt has **improved** markedly just in the past few decades or so.171 As proof, consider the previously noted global **increases in**, for example, **crop yields,** access to safer **water,** and **life expectancy** on one hand, and **reductions in poverty and mortality from** vector-borne **diseases and** extreme **weather** events on the other. These examples suggest that neglecting adaptive capacity and technological change can, over the course of several decades, lead to estimates of impacts that are too pessimistic by an order of magnitude or more.172 28 Another factor that is ignored in impacts assessments is the tremendous increase in our interconnectedness due to the internet, e-mail, text messages, and cell phones. As a result, the dissemination of knowledge is today far faster and wider than what was possible two or three decades ago. This increase in connectivity alone has **considerably enhanced** humanity’s adaptive capacity.173 Also ignored is the array of technologies that are collectively called ‘precision farming’: the growing ability to monitor plant growth, nutrient deficiencies and the environmental conditions at finer scales, combined with techniques that use GPS and drones to more precisely deliver nutrients and water to crops. Today these technologies can be afforded by wealthy farmers in rich countries. Over time, they should, like all other technologies, also diffuse around the world as their costs drop and as rising incomes make them more affordable. Such techniques should reduce agriculture’s demand for water. Because agriculture is responsible for about 70% of global water consumption, this ought to free up water for other human uses and substantially reduce water stress.174 A 20% increase in global agricultural water-use efficiency should, for example, translate into a global increase of 39% in water available for nonagricultural use.

#### Theiessen 11/2 Climate change not scary

https://www.aei.org/op-eds/climate-change-is-not-an-existential-threat/

At the Glasgow climate conference, President Biden declared climate change an “existential threat to human existence as we know it.” No, it’s not. **Climate change is** not a meteor hurtling toward Earth to destroy humanity. Rather, it is a chronic, **manageable** condition humanity can live with.

So argues Bjorn Lomborg, author of the book “[False Alarm: How Climate Change Panic Costs Us Trillions, Hurts the Poor, and Fails to Fix the Planet](https://www.amazon.com/gp/product/B0827TL851/ref=as_li_tl?ie=UTF8&camp=1789&creative=9325&creativeASIN=B0827TL851&linkCode=as2&tag=copenhagencon-20&linkId=1c425324307e54a40dd022056ccc776d).” “Fundamentally, we’ve got to stop the alarmists,” he tells me. A recent poll [found](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3918955) almost half of young Americans believe “**humanity is doomed**” because of climate change. This **is not true**. “Climate change is a problem, but not the end of the world,” Lomborg says. In fact, “things are a lot better than you think.”

**Even if we do nothing to reduce emissions, the world will not end**. Lomborg [points out](https://twitter.com/BjornLomborg/status/1449733794106384393) that, according to the **UN Intergovernmental Panel on Climate Change, “the impact of climate change is equivalent to 2.6 percent of GDP by the end of the century.** Instead of being 450 percent as rich in 2100, we’ll ‘only’ be 434 percent as rich.” By contrast, he says, a Nature study [finds](https://www.wsj.com/articles/climate-change-cost-economy-emissions-tax-per-person-net-zero-joe-biden-11634159179?mod=hp_opin_pos_3#cxrecs_s) that even if we fall short of Biden’s plan for net-zero American carbon emissions by 2050, and reduce emissions by 95 percent, we would end up losing 11.9 percent of US gross domestic product — or $11,300 per person per year — to avert a 2.6 percent loss in global GDP.

Climate change is reversible

Herring 21

https://www.climate.gov/news-features/climate-qa/can-we-slow-or-even-reverse-global-warming

Yes.  While we cannot stop global warming overnight, or even over the next several decades, **we can slow the rate and limit the amount of global warming** by reducing human emissions of heat-trapping gases and soot (“black carbon”). If all human emissions of heat-trapping gases were to stop today, Earth’s temperature would continue to rise for a few decades as ocean currents bring excess heat stored in the deep ocean back to the surface.  Once this excess heat radiated out to space, **Earth’s temperature would stabilize**. Experts think the additional warming from this “hidden” heat are unlikely to exceed 0.9° Fahrenheit (0.5°Celsius). With no further human influence, natural processes would begin to slowly remove the excess carbon dioxide from the atmosphere, and **global temperatures would gradually begin to decline.** It’s true that without dramatic action in the next couple of decades, we are unlikely to keep global warming in this century below 2.7° Fahrenheit (1.5° Celsius) compared to pre-industrial temperatures—a threshold that experts say offers a lower risk of serious negative impacts. But the more we overshoot that threshold, the more serious and widespread the negative impacts will be, which means that **it is never “too late”** to take action. In response to a request from the U.S. Congress, the **U.S. National Academy of Sciences** published a series of peer-reviewed **reports**, titled [*America's Climate Choices*](https://www.nap.edu/catalog/12781/americas-climate-choices), to provide authoritative analyses to inform and guide responses to climate change across the nation. Relevant to this question, the NAS report titled [*Limiting the Magnitude of Future Climate Change*](https://www.nap.edu/catalog/12785/limiting-the-magnitude-of-future-climate-change) explains policies that could be adopted to **slow or even reverse global warming.** The report says, "Meeting internationally discussed targets for limiting atmospheric greenhouse gas concentrations and associated increases in global average temperatures will require a major departure from business as usual in how the world uses and produces energy."

### 1NC-Volcanoes

Newitz 13 [(Annalee, is the author, most recently, of the science fiction novel The Future of Another Timeline, a contributing opinion writer at the New York Times, and co-host of the podcast Our Opinions Are Correct.), “Escape Plans,” Slate, 5/15/13, https://slate.com/technology/2013/05/surviving-the-next-mass-extinction-humans-will-need-to-leave-earth-for-space-colonies.html] MN

There is a pattern to how mass extinctions happen. A calamity like an asteroid strike or an enormous **volcanic eruption causes** an **initial disaster** that kills a lot animals and plants at once. And this leads to climate changes that eventually kill more than 75 percent of all species on the planet, usually in less than a million years—the blink of an eye in geological time. There is a pattern to survival, too**. Every mass extinction has its survivors**. A group of furry, mouselike mammals took over the planet after the dinosaurs’ heyday and eventually evolved into us. What these **survivors have** in common are **three abilities** encapsulated by the title of my book: They are able to scatter to many places in the world, adapt to them, and remember how to avoid danger. **Humans are exceptionally good at all three**, but perhaps our greatest strength is an ability to reconstruct the deep history of our planet—and to plan for the future.

### 1NC-Nuclear War Good

#### Isolated civilizations survive nuclear war, but industry is destroyed

**Beckstead 15.** Nick Beckstead, Professor at Oxford University, Future of Humanity Institute, (2015), “How much could refuges help us recover from a global catastrophe?,” https://sci-hub.se/https://www.sciencedirect.com/science/article/abs/pii/S0016328714001888 //MK

*[‘isolated peoples’ refers to populations unconnected from global society, such as Amazonian tribes]*

A global catastrophe could disrupt global food production for two reasons. First, as noted a few times above, some global catastrophes—such as supervolcanic eruptions, **nuclear wars**, and asteroid collisions—**might** put enough dust in the atmosphere to interfere with photosynthesis and **disrupt global food production.** Second, an initial catastrophe could kill enough people and do enough damage to infrastructure to shut down global food production. Conceivably, stocking refuges with a very large food supply or method of making food—over and above what is necessary to survive the initial catastrophe—might help a small group to survive and recover if a global catastrophe disrupts global food production. A first issue is that a global food crisis **would not** necessarily **result in extinction**. Extinction may even be extremely unlikely in such cases. The closest historical precedent to these crises was the supervolcanic Toba eruption that took places about 74,000 years ago. Many eruptions of this kind have taken place in the last tens of millions of years, but they did not extinguish our pre-human ancestors (Shulman, 2012a). Humans may now be in many ways worse prepared for such a crisis, with a much larger percentage of the population without hunting and agricultural skills, but we have many advantages in terms of technology and coordination. **The 100+ isolated peoples would be** relatively **similar to** pre-human **ancestors who survived supervolcanic eruptions** in the past, though—as noted above—they may have a notable disadvantage in reestablishing an advanced industrial civilization. Second, in any of the global food crisis scenarios noted above, **there would be** a **substantial** amount of remaining **food reserves** in the form of grain stockpiles, livestock, fisheries, foods stored at retailers and private homes, and wild land animals that could be hunted (Shulman, 2012b). Therefore, if a refuge helps humanity survive a global food crisis, the mechanism could not be conceived of as ‘‘adding enough to the global food stock to help with survival.’’ More plausibly, there could be a scenario where there is not enough food for everyone to survive the global food crisis, but there would be enough food for some people to survive if they got a disproportionate share of the food. However, conflict (e.g., as in McCarthy’s postapocalyptic novel The Road) and/or egalitarian pressures could prevent a distribution that would allow at least some of the population to survive the crisis. Conceivably, if the refuge were sufficiently secret, isolated, and well-stocked, it might be the only place where these pressures could be abated, making the people in refuges the sole survivors of the global food crisis. While conceivable and perhaps plausible, refuges’ unique success in this kind of case is not automatic and perhaps unlikely. If some small, well-armed group seizes some grain elevators, refuses to share their bounty, and successfully defends what they have claimed, they could also survive the global food crisis. Alternatively, a single survivalist community might be isolated and well-defended enough to achieve the same purpose. This potential use case may deserve more detailed analysis. As noted above, even if some initial catastrophe failed to kill everyone, it could lead to a collapse of the modern world order. This type of scenario might accompany a global food crisis, or could arise independently in cases of an unprecedentedly bad pandemic or global war that decimates the population. Conceivably, such a collapse to lead to extinction or a failure to recover industrial civilization. In this kind of scenario, people in refuges are not the sole survivors of our hypothetical global catastrophe. Instead, **it seems extremely likely that, some non-negligible fraction of civilization** (greater than 1 in 10,000, say) **would survive. But a greatly reduced global population would be unable to sustain many aspects of modern industry**, manufacturing, trade, and agricultural production, and may be forced to retrace a substantial part of past **technological development** (see Hanson (2008) quotation below).

#### No famine

David **Denkenberger et al. 17** {International Journal of Disaster Risk Reduction, Global Catastrophic Risk Institute. 1-5-2017. “Feeding Everyone if the Sun is Obscured and Industry is Disabled [Shut Down].” https://www-sciencedirect-com.proxy.lib.umich.edu/science/article/pii/S2212420916305453}//JM

For combined sun blocking and industrial failure scenarios, the reduced output of conventional agriculture would present a threat of causing mass starvation. This study showed that one solution in the short term is extracting edible calories from killed leaves using distributed mechanical processes. Then a constrained food web could be formed where part of the remainder from this could be fed to chickens, and the rest coupled with leaf litter could have mushrooms grown on it. A second group of solutions is growing mushrooms on dead trees and the residue going to cellulose digesting animals such as cattle and rabbits. Typically, in these catastrophes the sun is not blocked completely, so some agriculture would be possible based off of existing farming in extreme environments (e.g. growing UV and cold tolerant crops in the tropics). Furthermore, the cooling climate would cool the upper layer of the ocean, causing upwelling of nutrient-rich deep ocean water. This would facilitate algae growth in the ocean, feeding fish; retrofitting of ships to be sail powered could enable significant fishing. The results of this study show these solutions could enable the feeding of everyone given minimal preparation, and this preparation should be a high priority now.

#### No radiation

Keir A. **Lieber &** Daryl G. **Press 17**. Keir A. Lieber is Associate Professor in the Edmund A. Walsh School of Foreign Service and the Department of Government at Georgetown University. Daryl G. Press is Associate Professor in the Department of Government at Dartmouth College. 04/01/2017. “The New Era of Counterforce: Technological Change and the Future of Nuclear Deterrence.” International Security, vol. 41, no. 4, pp. 9–49.

Technological improvements **chipped away at** the **sources of inaccuracy**, however. Leaps in navigation and guidance, including advanced inertial sensors with stellar updates, improved the ability of missiles to **precisely determine their position in flight** and **guide themselves**, as needed, back **on course**. Other breakthroughs allowed mobile delivery systems, such as submarines and mobile land-based launchers, to accurately determine their own position prior to launch, **greatly improving their accuracy**.28 As a result of these innovations, new missiles emerged in the mid-1980s with **far better accuracy** than their predecessors, rendering hardened targets vulnerable as never before. For bombers, onboard computers now continuously measure the variables that previously confounded bombardiers. Data on aircraft speed and location are uploaded from the aircraft into the computers of “smart” bombs and cruise missiles, which in turn automatically plot a flight path from the release location to the target. The weapons adjust their trajectory as they fly to remain on course.29 As a result, bombs and missiles can achieve levels of accuracy unimaginable at the start of the nuclear age. The leap in munitions accuracy has been showcased repeatedly during conventional wars: videos of missiles and bombs guiding themselves directly to designated targets now appear mundane. Although the effects of the accuracy revolution on nuclear delivery systems are equally dramatic, they have received far less attention, despite huge implications for the survivability of hardened targets. IMPROVED MISSILE ACCURACY Figure 1 illustrates one consequence of the accuracy revolution, as applied to nuclear forces, by comparing the effectiveness of U.S. ballistic missiles in 1985 to those in the current U.S. arsenal.30 We use formulas, employed by nuclear analysts for decades, to estimate the effectiveness of missile strikes against a typical hardened silo.31 The figure distinguishes three potential outcomes of a missile strike: hit, miss, and fail. “Hit” means that the warhead detonates within the lethal radius (LR) of the aimpoint, thus destroying the target. “Miss” means that the warhead detonates outside the LR, leaving the target undamaged. “Fail” means that some element of the attacking missile system malfunctioned, leaving the target undamaged. figure Figure 1. The Growing Vulnerability of Hard Targets, 1985–2017 note: The calculations underlying this figure assume targets hardened to withstand 3,000 pounds per square inch (psi). Data for 1985 are based on the most capable U.S. land-based intercontinental ballistic missile (ICBM) and submarine-launched ballistic missile (SLBM) at the time: the Minuteman III ICBM armed with a W78 warhead and the Trident I C-4 SLBM armed with a W76 warhead. The 2017 ICBM data are based on the same Minuteman III / W78, with an improved guidance system. The 2017 SLBM data show both contemporary configurations of the Trident II D-5 missile: one version armed with the W76 and the other with higher-yield W88 warheads. The data and sources for U.S. weapon systems are in the online appendix, http://dx.doi:10.7910/DVN/NKZJVT, table A1. Figure 1 shows that the accuracy improvements of the past three decades have led to substantial leaps in counterforce capabilities. In 1985 a U.S. intercontinental ballistic missile (ICBM) had only about a 54 percent chance of destroying a missile silo hardened to withstand 3,000 pounds per square inch (psi) overpressure. In 2017 that figure exceeds 74 percent. The improvement in submarine-launched weapons is starker: from 9 percent to 80 percent (using the larger-yield W88 warhead). Figure 1 also suggests, however, that despite vast improvements in missile accuracy, the weapons still are not effective enough to be employed individually against hardened targets. Even modern ballistic missiles are expected to miss or fail 20–30 percent of the time. The simple solution to that problem, striking each target multiple times, has never been a feasible option because of the problem of fratricide: the danger that incoming weapons might destroy or deflect each other.32 The accuracy revolution, however, also offers a solution to the fratricide problem, opening the door to assigning multiple warheads against a single target, and thus paving the way to disarming counterforce strikes. THE FADING PROBLEM OF FRATRICIDE One type of fratricide occurs when the prompt effects of nuclear detonations— radiation, heat, and overpressure—destroy or deflect nearby warheads. To protect those warheads, targeters must separate the incoming weapons by at least 3–5 seconds.33 A second source of fratricide is harder to overcome. Destroying hard targets typically requires low-altitude detonations (so-called ground bursts), which vaporize material on the ground. When the debris begins to cool, 6–8 seconds after the detonation, it solidifies and forms a dust cloud that envelops the target. Even small dust particles can be lethal to incoming warheads speeding through the cloud to the target. Particles in the debris cloud take approximately 20 minutes to settle back to ground.34 For decades, these two sources of fratricide, acting together, posed a major problem for nuclear planners.35 Multiple warheads could be aimed at a single target if they were separated by at least 3–5 seconds (to avoid interfering with each other); yet, all inbound warheads had to arrive within 6–8 seconds of the first (before the dust cloud formed). As a result, assigning more than two weapons to each target would produce only marginal gains: if the first one resulted in a miss, the target would likely be shielded when the third or fourth warhead arrived.36 Improvements in accuracy, however, have greatly mitigated the problem of fratricide. As figure 1 shows, the proportion of misses—the main culprit of fratricide—compared to hits is fading. To be clear, some weapons will still fail; that is, they will be prevented from destroying their targets because of malfunctioning missile boosters, faulty guidance systems, or defective warheads. Those kinds of failures, however, do not generally cause fratricide, because the warheads do not detonate near the target. Only those that miss—that is, those that travel to the target area and detonate outside the LR—will create a dust cloud that shields the target from other incoming weapons. In short, leaps in accuracy are essentially reducing the set of three outcomes (hit, fail, or miss) to just two: hit or fail. The “miss” category, the key cause of fratricide, has virtually disappeared.37 THE CUMULATIVE CONSEQUENCES FOR COUNTERFORCE The end of fratricide is just one development that has helped negate hardening and increased the vulnerability of nuclear arsenals. The computer revolution has led to other improvements that, taken together, significantly increase counterforce capabilities. First, improved accuracy has transformed the role of ballistic missile submarines, turning these instruments of retaliation against population centers into potent counterforce weapons. Recall (from figure 1 above) that a 1985 submarine-launched ballistic missile (SLBM) had only a 9 percent chance of destroying a hardened target. This meant that although ballistic missile submarines could destroy “soft” targets (e.g., cities), they could not destroy the hardened sites that would be a key focus of a disarming attack. Increased SLBM accuracy has added hundreds of SLBM warheads to the counterforce arsenal; it has also unlocked other advantages that submarines possess over land-based missiles. For example, submarines have flexibility in firing location, allowing them to strike targets that are out of range of ICBMs or that are deployed in locations that ICBMs cannot hit.38 Submarines also permit strikes from close range, reducing an adversary's response time. And because submarines can fire from unpredictable locations, SLBM launches are more difficult to detect than ICBM attacks, further reducing adversary response time before impact. Second, upgraded fuses are making ballistic missiles even more capable than figure 1 reports. In a compelling new analysis, Theodore Postol explores the implications of new “compensating” fuses that exist on most U.S. SLBMs and that will soon be deployed on the entire force.39 Reentry vehicles equipped with this fusing system use an altimeter to measure the difference between the actual and expected trajectory of the reentry vehicle, and then compensate for inaccuracies by adjusting the warhead's height of burst.40 Specifically, if the altimeter reveals that the warhead is off track and will detonate “short” of the target, the fusing system lowers the height of burst, allowing the weapon to travel farther (hence, closer to the aimpoint) before detonation. Alternatively, if the reentry vehicle is going to detonate beyond the target, the height of burst is adjusted upward to allow the weapon to detonate before it travels too far.41 Without this technology, as figure 1 shows, the lower-yield W76 warheads are much less effective against hardened targets than their higher-yield cousins, the W88s. The improved fuse cuts the effectiveness gap roughly in half, making the hundreds of W76s in the U.S. arsenal potent counterforce weapons for the first time.42 The consequences of the new fuse are, therefore, profound, essentially tripling the size of the U.S. submarine-based arsenal against hard targets.43 More broadly, the technology at the core of compensating fuses is available to any state capable of building modern multistage ballistic missiles.44 A third key improvement, rapid missile retargeting, increases the effectiveness of ballistic missiles by reducing the consequence of malfunctions. As figure 1 illustrates, when accuracy increases, missile reliability becomes the main hurdle to attacks on hardened targets. For decades analysts have recognized a solution to this problem: if missile failures can be detected, the targets assigned to the malfunctioning missiles can be rapidly reassigned to other missiles held in reserve.45 The capability to retarget missiles in a matter of minutes was installed at U.S. ICBM launch control centers in the 1990s and on U.S. submarines in the early 2000s, and both systems have since been upgraded.46 We do not know if the United States has adopted war plans that fully exploit rapid reprogramming to minimize the effects of missile failures.47 Nevertheless, such a targeting approach is within the technical capabilities of the United States and other major nuclear powers and may already be incorporated into war plans.48 Table 1 illustrates the consequences of these improvements against two hypothetical target sets: 100 moderately hard mobile missile shelters and 200 hardened missile silos.49 Row 1 shows the approximate counterforce capabilities of a 1985-era U.S. Minuteman III ICBM strike; a 2-on-1 attack would have been expected to leave 8 mobile missile shelters intact. A strike against 200 hardened silos would fare worse, with 42 targets expected to survive. Table Table 1. The Demise of Hard Target Survivability The remaining rows in table 1 highlight the implications of the changes that have occurred from 1985 to 2017. Row 2 illustrates the impact of improved Minuteman III guidance, which reportedly reduced circular error probable (CEP) from 183 to 120 meters. Row 3 employs the most capable missile and warhead combination in the current U.S. arsenal: the Trident II armed with a high-yield W88 warhead. As the results in both rows show, upgraded missiles perform better than their predecessor, but not well enough to conduct effective disarming strikes against large target sets. Rows 4–7 demonstrate how the various improvements in missile technology have combined to create transformative counterforce capabilities. In row 4, we use a more realistic figure for missile system reliability. Although 80 percent missile reliability is traditionally used as a baseline, much evidence suggests that the actual reliability of modern missiles exceeds 90 percent.50 Row 4 shows attack outcomes for a Trident II/W88 with 90 percent reliability. Row 5 shows the consequences if the United States can reprogram its missiles to replace boost-phase failures. As row 5 reveals, a 2-on-1 attack with reprogramming would be expected to destroy every hardened shelter or silo. Row 6 omits reprogramming, but it demonstrates the impact of the decline in fratricide by adding a third warhead to each target, resulting again in the destruction of either target set. Row 7 illustrates the impact of compensating fuses. This row, unlike the others, employs the lower-yield warhead on the Trident II missiles (the W76). With the compensating fuse, a 2-on-1 attack using W76s would be expected to destroy all the mobile missile shelters and all but one of the hardened silos. (An attack that mixed W88s and W76s could destroy the entire hardened silo force.) The results in table 1 are simply the output of a model. In the real world, the effectiveness of any strike would depend on many factors not modeled here, including the skill of the attacking forces, the accuracy of target intelligence, the ability of the targeted country to detect an inbound strike and “launch on warning,” and other factors that depend on the political and strategic context. As a result, these calculations tell us less about the precise vulnerability of a given arsenal at a given time—though one can reach arresting conclusions based on the evidence—and more about trends in how technology is undermining survivability.51 One crucial consequence of the accuracy revolution is not captured in the above results. Yet, its impact on the vulnerability of nuclear arsenals may be just as profound. The accuracy revolution has rendered low-casualty counterforce attacks plausible for the first time. THE DAWN OF LOW-CASUALTY COUNTERFORCE In nuclear deterrence theory, the primary factor preventing nuclear attack is the attacker's fear of retaliation. In reality, however, additional sources of inhibition exist, including the terrible civilian consequences of an attempted counterforce strike. If a leader contemplating a disarming strike knows that such an attack will inflict massive casualties on the enemy, that leader will also understand that the **failure to disarm** the enemy will provoke a **massive punitive response**, foreclosing the possibility of a limited nuclear exchange. Furthermore, if a disarming strike would cause enormous civilian casualties in the target country, but also possibly in allied and neutral neighboring countries, leaders who value human life or the fate of allies would contemplate such an attack in only the direst circumstances. The link between civilian casualties and nuclear inhibition explains why many arms control advocates oppose the development of less destructive nuclear weapons; they worry that such weapons are more “usable.”52 Counterforce was tantamount to mass casualties throughout the nuclear age, but the **accuracy revolution is severing that link**. In the past, the main impediment to low-casualty nuclear counterforce strikes has been radioactive fallout. Targeters would have had to **rely on ground bursts to maximize destructive effects** against hardened facilities such as silos and storage sites. Detonations close to the ground have a major drawback, however: debris is sucked up into the fireball, where it mixes with radioactive material, **spreading radiation wherever it settles**. Although the other effects of nuclear detonations (e.g., blast and fire) can have large-scale consequences for civilians, in many circumstances those effects can be **minimized**.53 If a strike produces fallout, however, the consequences are potentially vast and difficult to predict.54 In theory, it has always been possible to employ nuclear weapons without creating much fallout. If weapons are detonated at **high altitude** (above the “fallout threshold”), very little debris from the ground will be drawn up into the fireball, **greatly reducing fallout**.55 In practice, however, this targeting strategy has never been feasible against hardened sites. The problem is that any high-yield weapon that detonates low enough to destroy a hardened target will also be low enough to create fallout. **Low-yield** weapons could do the job and remain above the fallout threshold, but that has always been impractical because low-yield weapons would need to be delivered with great **precision** to destroy hardened sites, which was previously impossible.56 Figure 2 illustrates why high-yield strikes against hard targets inevitably create fallout, and it highlights the potential low-yield solution to the fallout problem. The vertical axis reflects weapon yield, and the horizontal axis depicts the hardness of potential targets—with the approximate values for mobile missile shelters and missile silos indicated. The solid black line shows the maximum yield of a weapon that can generate enough overpressure to destroy a target from above the fallout threshold. For example, figure 2 shows that for a 3,000 psi target, the highest-yield weapon that can destroy it while remaining above the fallout threshold is 0.35 kilotons. A larger-yield weapon will necessarily cause fallout if it destroys the target. A low-fallout strike against a 1,000 psi mobile missile shelter would require a weapon with 50 kilotons yield, or less. In short, low-fatality nuclear counterforce is possible, but it requires low-yield weapons, and hence very accurate delivery. figure Figure 2. The Potential for Low-Fallout Nuclear Counterforce note: “Target hardness” (the horizontal axis) is measured in pounds per square inch (psi), with a typical range of psi for hardened mobile missile shelters and missile silos noted. “Yield” (the vertical axis) is measured in kilotons and plotted on a logarithmic scale. The curve depicts the maximum weapon yield that can destroy a given target from above the fallout threshold. Any weapon yield/target hardness combination above the line that is effective enough to destroy the target will necessarily result in fallout. Points below the line indicate that weapons can be detonated at an altitude that will destroy the target yet produce little or no fallout. See the online appendix for calculations. The accuracy of nuclear delivery systems is now to the point that low-casualty disarming strikes are possible. For example, a 0.3 kiloton bomb would require a CEP of 10–15 meters to be highly effective against hard targets;57 that level of accuracy is likely within the reach of the new guided B61-12, which is slated to replace all nuclear gravity bombs in the U.S. arsenal.58 Similarly, a 5-kiloton missile warhead, which may approximate the yield of the fission primary on many existing ballistic missiles, could destroy a hardened target if its CEP was approximately 50 meters.59 That level of accuracy was implausible for most of the Cold War, yet it is within reach of many countries today.60 By detonating weapons above the fallout threshold, targeters can greatly reduce fallout relative to ground bursts. But how significant are these reductions? How many fewer deaths would be caused in comparison with ground burst strikes? To compare the fallout and potential fatalities from high-yield and low-yield counterforce operations, we used unclassified U.S. Defense Department software, called Hazard Prediction and Assessment Capability (HPAC).61 We modeled two different counterforce strikes, one using a “traditional” high-yield approach and one employing low-yield airbursts, against five hardened targets in North Korea (e.g., nuclear storage sites or hardened mobile missile shelters). Because there is no available unclassified information about the location of North Korea's nuclear storage sites, we modeled strikes against notional locations around the DPRK's periphery. The results of the two strikes, illustrated in figure 3, are starkly different. The traditional approach (on the left side) would likely destroy the targets, but at a terrible price: millions of fatalities across the Korean Peninsula. The low-yield option, by contrast, would produce vastly fewer deaths. As long as the targets were located outside North Korean cities, the number of Korean fatalities from a low-yield strike would be comparable to the human losses from conventional operations. In fact, the fallout contours that are visible in figure 3 for the low-yield scenario **correspond to annual radiation levels deemed acceptable by** the U.S. **O**ccupational **S**afety and **H**ealth **A**dministration figure Figure 3. Low-Fallout Counterforce Option against North Korea note: The figure illustrates the potential fallout consequences of two alternative counterforce strikes against five notional North Korean hardened nuclear sites. In both strike options, each target is destroyed with greater than 95 percent probability. The high-yield attack employs ten W88 warheads (455-kiloton yield), with two warheads against each target. Because high-yield weapons cannot destroy hardened sites from above the fallout threshold, the W88s are ground bursts. The low-yield attack uses twenty B61 bombs (0.3-kiloton yield), set to detonate at an altitude that maximizes effectiveness while minimizing fallout. The fallout patterns and casualty figures were generated using unclassified U.S. Defense Department software, called Hazard Prediction and Assessment Capability. The precise results of the HPAC simulation should be treated with skepticism: wind speed and direction change constantly, altering fallout patterns. The amount of fallout generated in the low-yield scenario is **so low**, however, that the results of figure 3 are **robust regardless of which way the wind blows:** **few people** located away from the actual targets would be killed. The point of figure 3 is not to predict the outcome of a counterforce strike on North Korea, but to reveal the relationship between accuracy and fallout. When accuracy was poor, the only approach to nuclear counterforce was high-yield strikes, which would create catastrophic results such as the one depicted above. The accuracy revolution has changed the calculus, however; **low-fatality nuclear strikes are now possible**.62 The accuracy revolution is ongoing. As accuracy continues to improve, the effectiveness of conventional attacks on hard targets will **continue to increase**. Today, low-yield nuclear weapons can destroy targets that once required very large yield detonations. In the future, many of those targets will be vulnerable to conventional attacks. In sum, from the start of the nuclear age to the present, force planners have relied on hardening as a key strategy for ensuring the survivability of their arsenals. That strategy made sense, and until recently ensured that disarming strikes would not only fail, but also kill millions of civilians in the process. Technology never stands still, however, and **the technical foundations of deterrence**, particularly for the strategy of hardening, have been **greatly undermined by leaps in accuracy**. Counterforce in the Age of Transparency While advances in accuracy are negating hardening as a strategy for protecting nuclear forces, leaps in remote sensing are undermining the other main approach: concealment. Finding concealed forces, particularly mobile ones, remains a major challenge. Trends in technology, however, are eroding the security that mobility once provided. In the ongoing competition between “hiders” and “seekers,” waged by ballistic missile submarines, mobile land-based missiles, and the forces that seek to track them, the hider's job is growing more difficult than ever before. Five trends are ushering in an age of unprecedented transparency.63 First, sensor platforms have become more diverse. The mainstays of Cold War technical intelligence—satellites, submarines, and piloted aircraft—continue to play a vital role, and they are being supplemented by new platforms. For example, remotely piloted aircraft and underwater drones now gather intelligence during peacetime and war. Autonomous sensors, hidden on the ground or tethered to the seabed, monitor adversary facilities, forces, and operations. Additionally, the past two decades have witnessed the development of a new “virtual” sensing platform: cyberspying.64 Second, sensors are collecting a widening array of signals for analysis using a growing list of techniques. Early Cold War strategic intelligence relied heavily on photoreconnaissance, underwater acoustics, and the collection of adversary communications—all of which remain important. Now, modern sensors gather data from across the entire electromagnetic spectrum; they employ seismic and acoustic sensors in tandem; and they emit radar at various frequencies depending on their purpose, for example, to maximize resolution or to penetrate foliage. Modern remote sensing exploits an increasing number of analytic techniques, including spectroscopy to identify the vapors leaking from faraway facilities, interferometry to discover underground structures, and signals processing techniques (such as those underpinning synthetic aperture radars) that allow radars to perform better than their antenna size would seem to permit.65 Third, remote sensing platforms increasingly provide persistent observation. At the beginning of the Cold War, strategic intelligence was hobbled by sensors that collected snapshots rather than streams of data. Spy planes sprinted past targets, and satellites passed overhead and then disappeared over the horizon. Over time those sensors were supplemented with platforms that remained in place and soaked up data, such as signals intelligence antennas, undersea hydrophones, and geostationary satellites. The trend toward persistence is continuing. Today, remotely piloted vehicles can loiter near enemy targets, and autonomous sensors can monitor critical road junctures for months or years. Persistent observation is essential if the goal is not merely to count enemy weapons, but also to track their movement. The fourth factor in the ongoing remote sensing revolution is the steady improvement in sensor resolution. In every field that employs remote sensing technology, including medicine, geology, and astronomy, improved sensors and advanced data processing are permitting more accurate measures and fainter signals to be discerned from background noise. The leap in satellite image resolution is but one example: the first U.S. reconnaissance satellite (Corona) could detect objects as small as 25 feet across. Today, even commercial satellites (e.g., DigitalGlobe's WorldView-3 and WorldView-4) can collect images with 1-foot resolution, and U.S. spy satellites are reportedly capable of resolutions less than 4 inches.66 Advances in resolution are not merely transforming optical remote sensing systems; they are extending what can be seen by infrared sensors, advanced radars, interferometers and spectrographs, and many other sensors. The fifth key trend is the huge increase in data transmission speed. During the first decades of the Cold War, it took days or longer to transmit information from sensors to analysts. At least a full day passed before the photographs snapped by U-2 aircraft were developed and analyzed. Early satellites were slower: the satellite had to finish its roll of film, and then eject the canister, which would be caught midair and flown to a facility for development and analysis. All told, images collected at the beginning of a satellite mission might take weeks before they arrived at an analyst's desk. Today, by contrast, intelligence gathered by aircraft, satellites, and drones can be transmitted in nearly real time. The data can be transmitted to intelligence analysts, political leaders, and in some cases directly to military commanders conducting operations. None of these **technological trends** alone is transformative. Taken **together**, however, they are creating a degree of **transparency** that was unimaginable even two decades ago. These new remote sensing technologies are not proliferating around the world evenly; the United States, for example, seems to have exploited new sensing technologies more intensively than other countries. Many countries are developing expertise in advanced sensing, however. The sensing revolution is a global phenomenon, with implications for the survivability of all countries' nuclear arsenals. Remote sensing technologies have improved greatly, but the crucial question is whether these advances have meaningfully increased the vulnerability of the **two most elusive types** of nuclear delivery systems: SSBNs and mobile land-based missiles. If the ability to track submarines at sea or mobile missiles on patrol remains out of reach, then the counterforce improvements we identify are less significant, at least for now. In fact, SSBNs have never been as invulnerable as analysts typically assume, and advances in remote sensing appear to be **reducing the survivability** of both **submarines** and **mobile missiles**.

#### Civil defense investments prevent nuclear war from causing extinction under any reasonable estimates.

Charles L. Sanders 17. Scientists for Accurate Radiation Information, PhD in radiobiology, professor in nuclear engineering at Washington State University and the Korea Advanced Institute of Science and Technology. 2017. “Radiological Weapons.” Radiobiology and Radiation Hormesis, Springer, Cham, pp. 13–44. link.springer.com, doi:10.1007/978-3-319-56372-5\_2.

2.5 Survival of Nuclear War The penetrating nature of γ-rays requires substantial shielding with denser materials in high-dose fallout regions. No lethality is expected from a radiation dose rate of 100 mGy/h. An initial dose rate from fallout of 1.0 Gy/h would not be lethal if minimum protection is taken (e.g., staying indoors). An initial dose rate of 10 Gy/h is lethal unless substantially shielded. A shelter providing a protection factor of 100 would suffice. A dose rate of 100 Gy/h would be lethal unless in the best of radiation shelters that give a protection factor of ≥500. However, the area downwind from a nuclear detonation with these high-dose rates would be limited. To protect yourself from fallout, it is essential to find shelter. The dose protection factor of a shelter is the protection afforded someone inside the shelter from radiation originating from the outside. For example, a dose protection factor of 5 means that the radiation level inside the shelter is five times less than the radiation level outside the shelter at the surface of the ground. Dose protection factors vary widely according to building construction, floor level in a multistory building, and proximity to other buildings. A dose protection factor of 5 can be assumed for most woodframe buildings. Most basements provide protection factors of about 50 in at least one area. Building a simple 6-foot trench shelter in your backyard covered with a few feet of dirt on a door would provide protection from thermal and blast effects and a protection factor of 500 from radiation fallout (Table 2.4). Provision of shelters that can withstand 100 psi blast waves, such as subway and utility tunnels, could save nearly 70% of the American urban population from a 9000-MT attack. US ICBM silos are built to withstand up to 2000 psi [60]. Americans are dreadfully ignorant on the subject of civil defense against nuclear war. Americans don’t want to talk about shelters. Most who take shelters seriously are considered on the lunatic survivalist fringe. The current US rudimentary fallout shelter system can only protect a tiny fraction of the population. There are probably less than one in a 100 Americans who would know what to do in the case of nuclear war and even fewer with any contingency plans. The civil defense system should, instead, provide stockpiles of food, water, medical supplies, radiological instruments, and shelters in addition to warning systems, emergency operation and [[TABLE 2.4 OMITTED]] communication systems, and a trained group of radiological monitors and shelter managers. There is a need for real-time radiation measurements in warning the public to seek shelter and prevent panic [61]. Shelters and a warning system providing sufficient time to go to a shelter are the most important elements of civil defense. The purpose of a shelter is to reduce the risks of injury from blast and thermal flux from nearby detonations and from nuclear fallout at distances up to hundreds of miles downwind from nuclear detonations. There are several requirements for an adequate shelter: 1. Availability—Is there space for everyone? 2. Accessibility—Can people reach the shelter in time? 3. Survivability—Can the occupants survive for several days once they are in the shelter? That is, is there adequate food, water, fresh air, sanitation, tools, clothing, blankets, and medical supplies? 4. Protection Factor—Does the shelter provide sufficient protection against radiation fallout? 5. Egress—Is it possible to leave the shelter or will rubble block you? There are several good publications that provide information for surviving nuclear war [62–64]. Two that offer good practical advice are Nuclear War Survival Skills by Kearny [65], and Life after Doomsday by Clayton [66]. Fallout is often visible in the form of ash particles. The ash can be avoided, wiped, or washed off the body or nearby areas. All internal radiation exposure from the air, food, and water can be minimized by proper ventilation and use of stored food and water. Radioactivity in food or water cannot be destroyed by burning, boiling or, using any chemical reactions. Instead it must be avoided by putting distance or mass between it and you. Radioactive ash particles will not induce radioactivity in nearby materials. If your water supply is contaminated with radioactive fallout, most of the radioactivity can be removed simply by allowing time for the ash particles to settle to the bottom and then filtering the top 80% of the water through uncontaminated clay soil which will remove most of the remaining soluble radioactivity. Provision should be made for water in a shelter: 1 quart per day or 3.5 gallons per person for a nominal 14-day shelter period. A copy of a book by Werner would be helpful for health care [67]. During the 1950s, there was firm governmental support for the construction and stocking of fallout shelters. In Eisenhower’s presidency, the National Security Council proposed a $40 billion system of shelters and other measures to protect the civilian population from nuclear war. Similar studies by the Rockefeller Foundation, the Rand Corporation, and the MIT had earlier made a strong case for shelter construction. President Kennedy expected to identify 15 million shelters, saving 50 million lives. Even at that time, there were many who felt this was a dangerous delusion giving a false sense of security. However, the summary document of Project Harbor (Publication 1237) concerning civil defense and the testimony before the 88th Congress (HR-715) both strongly supported an active civil defense program by the US government. A latter 1977 report to Congress concluded that the USA lacked a comprehensive civil defense program and that the American population was mostly confused as to what action to take in the event of nuclear war. President Carter advocated CRP (Crisis Relocation Planning) as the central tenet of a new civil defense program. President Reagan in 1981 announced a new civil defense program costing 4.2 billion dollars over a 7-year period; this program included CRP and the sheltering of basic critical industries in urban and other target areas. President Reagan believed that civil defense will reduce the possibility that the USA could be coerced in time of crisis by providing for survival of a substantial portion of her population as well as continuity for the government. Stockpile, sheltering, and education could be a relatively cheap insurance policy against Soviet attack [68]. With the fall of the U.S.S.R. came a lack of continuing interest in preparation to survive a nuclear war in subsequent administrations. The Pentagon recommended to the Reagan administration that the USA adopt a Soviet-style civil defense program, combining evacuation with fallout shelters. It was suggested that the Americans use doors wrapped in plastic to cover hastily dug trenches in their backyards. The US strategy is like poker while the Soviets’ is like chess. If we bluff and lose, we lose the game. If the Soviets bluff and lose, they only lose one piece. The Soviets have prepared for “social control” following nuclear war, while many Americans believe that all would die. Thus, a prerequisite for any substantial change in US civil defense policy requires a change in popular attitude about survival. Reagan planed for a hypothetical postwar future society in almost bizarre detail. In one additional touch worthy of Dr. Strangelove himself, it was proposed that a select group of volunteers—men and women with a carefully chosen range of skills and talents—live on the continuously moving, subterranean train and that the underground community be equipped with nuclear reactors and hydroponic gardens to sustain life in what was termed “the post-attack environment” [69]. Carl Sagan called for rejecting civil defense, appearing on television to denounce SDI military weapons [70]. Some would prefer surrender to any risk of nuclear war [71]. In 1986 the states of Oregon and Washington withdrew from an emergency drill organized by the FEMA as a protest against “planning for nuclear war.” The drill involved a hypothetical attack on these two states with 48 warheads. According to Oregon Rep. Wayne Fawbush: If you lead people to believe that a nuclear exchange can be survived, you promote the possibility of it happening. If the US was better prepared to survive a nuclear attack, then others would be less likely to launch one. Thus civil defense does not signal a willingness to wage war, but a willingness to deter war by making it less tempting to a potential aggressor. It was to the Soviets politically advantage to hyperbolically emphasize the ‘dreadful’ effects of nuclear weapons to promote American disarmament. The consequences of using nuclear weapons defy human imagination … all-out nuclear war would cause the death of more than 200 million people and 60 million more would be mutilated … Such a nuclear war would inevitably lead to global catastrophe … 80 percent of doctors would perish, 80 percent of hospital beds would be destroyed as would nearly all supplies of blood, antibiotics and other medicines … epidemics would start, radiation will remain a threat…Understand me well. We do not wish to frighten the world with these apocalyptic figures and facts. No, we wish to show the realities of a nuclear war and what needs to be done to prevent it [72]. The Federal Emergency Management Agency (FEMA) was formed in 1979, consolidating in one agency the various federal bureaucracies involved in disaster management. The 1986 FEMA plan calls for sheltering local, state, and federal officials from nuclear war, while everyone else will have to shift for themselves. Land records will be taken into shelters. The federal government denies that this is an elitist strategy but that it is rather to insure that emergency-management infrastructure survives to direct the recovery of the surviving general population. The FEMA admits that as many as half our citizens or more would be lost to the direct and indirect effects of the weapons themselves, and millions more would die in the chaos of the post-attack environment. Current FEMA strategy also calls for return to the traditions of the 1950s when school children were instructed to curl under their desks when they saw a bright flash of light. The USA is woefully unprepared for nuclear war because of radiophobia (Table 2.5). The FEMA is absent before the American public about advice. To be politically correct, the FEMA just assumes that it will never happen. To educate the public in their mind is to enhance the probability of nuclear war. A false emphasis is on prevention of nuclear war not on preparation. The National Radiological Defense Agency of the FEMA is responsible for providing radiation detection instruments, training of personnel in their use, and educating large segments of the American population about radiation hazards. A low budget and even lower public visibility have made this program largely ineffectual. The FEMA had actively promoted CRP as a method to move these more vulnerable populations prior to a war. The current goal of CRP is 80% survival of the US population following a 6559-MT attack on the USA; according to this scenario, 45 million Americans would die. During the initial phase of CRP, 150 million people would be expected to travel from 50 to 300 miles to designated low-risk areas. They will join about 75 million, totaling a shelter population of 195 million. For some the concept of CRP is flawed, unworkable, and dishonest, being in itself a [[TABLE 2.5 OMITTED]] significant threat to instigating a war since its implementation would be a sign to an enemy that we are preparing to fight a total nuclear war. To others it is common sense that we should plan for all contingencies. No one disagrees that to achieve 80% US survival will require several days to carry out evacuation and a whole lot more preparation, organization, and staffing than now exists. Richard Beal, former director for crisis management systems and planning under President Reagan, believes that “national security planning is a myth” because information uncertainty is the normal course in a crisis and that no one has devised a reliable system for tracking the implementation of presidential decisions in crises. The current White House executives have little or no experience with previous crises, making it very difficult to swiftly and accurately analyze crises using available intelligence and information. Some experts believe that civil defense will have no effect on initiation or outcome of a nuclear war. Lauriston Taylor wrote: Nobody in his right mind believes that a nuclear war can be won by anyone-civil defense or no civil defense. No worse tragedy can befall man. Unfortunately, the worst situation that can be computed today, involving a maximum mutual attack by two opponents, will not destroy man, in spite of all the nonsense that has been written to the contrary … On the basis of the worst double attack scenario that can be visualized today, it is anticipated that about 80% of the US population would die within 30 days of the attack. That means that 20% will be left in survivable condition … in varying degrees of distress, almost beyond our imagination to comprehend. Incidentally, this is almost exactly the American population just 100 years ago … Civil defense is in no sense a preparation for war. The existence or nonexistence of civil defense preparations by any party to nuclear war will have no influence on such a war coming about [73]. Paradoxically, it was Taylor who received an accidental whole-body exposure of 10 Gy and believed that 2 mGy/d (730 mGy/y) was safe while living to 102 years (Chap. 1). Nevertheless, Taylor had gotten taken up by doomsday frenzy. During the Cold War, the USA was wanting to exaggerate the effects of nuclear weapons testing to deter the U.S.S.R. from nuclear expansion and other countries from developing nuclear weapons. The U.S.S.R. did the same exaggeration when they had achieved the same capability as the USA, emphasizing that there would be no winners in a nuclear war. Their motivation was not to prevent radiation harm to its population but was political to discourage others to develop nuclear weapons. Exaggerations of the effects of nuclear war will paralyze us. We could accomplish much for so little, spending only 1% of our defense budget on civil defense. The USA has carried out little public education on how to survive nuclear war. In contrast, the U.S.S.R. had carried out an extensive educational program for all its citizens on how to survive a nuclear war. Its citizens are instructed on how to construct a simple, underground trench shelter in less than a day. The Soviets had a highly organized civil defense program, with a planned-for evacuation of cities and construction of underground shelters for some of their industries and for governmental personnel. Civil defense in the U.S.S.R. was part of everyday life as well as a propaganda tool. In peacetime, the U.S.S.R. civil defense program employed 115,000 people under military control; this could be rapidly expanded during wartime to 15,000,000. The first priority of Soviet civil defense is the survival of its political leaders. Because of this emphasis, part of the US strategy was to target Soviet leaders. The CIA predicted 25–35 million deaths in the U.S.S.R. if they had less than a week to evacuate their cities prior to total nuclear war with the USA and 100 million deaths if no warning was given [74]. Only ten million Soviets would die in total war with the USA if given 7–10 days for total evacuation and preparation [75]. In general, Europeans have in the past taken a much more serious and professional view about civil defense than do Americans. American shelters are often considered socially divisive, even though Americans are the most heavily insured people in the world. The reality is that Europeans believe with much justification that simple shelters are remarkably effective in protecting from the effects of nuclear weapons. European countries have extensive civil defense programs. Before 1990 in Switzerland, nearly two-thirds of their population had been provided shelter protection; by 1990, all their population was sheltered. Civil defense training is compulsory for all Swedes with significant support from volunteer agencies [76].

#### Nuclear Winter doesn’t cause Extinction

Fred **Singer** 6-27-20**18** “Remember Nuclear Winter?" <https://www.americanthinker.com/articles/2018/06/remember_nuclear_winter.html> (Professor emeritus at the University of Virginia and a founding director and now chairman emeritus of the Science & Environmental Policy Project)/Elmer

**Nuclear Winter** burst on the academic scene in December 1983 with the publication of the hypothesis in the prestigious journal Science. It was accompanied by a study by Paul Ehrlich, et al. that hinted that it might cause the **extinction of human life** on the planet. MCANW stands for Medical Campaign Against Nuclear Weapons. Photo via Wellcome Images. The five authors of the Nuclear Winter hypothesis were labeled **TTAPS**, using the initials of their family names (**T stands for Owen Toon** and P stands for Jim Pollak, both Ph.D. students of Carl Sagan at Cornell University.) Carl Sagan himself was the main author and driving force. Actually, Sagan had scooped the Science paper by publishing the gist of the hypothesis in Parade magazine, which claimed a readership of 50 million! Previously, Sagan had briefed people in public office and elsewhere, so they were all primed for the popular reaction, which was tremendous. Many of today's readers may not remember Carl Sagan. He was a brilliant astrophysicist but also highly political. Imagine Al Gore, but with an excellent science background. Sagan had developed and narrated a television series called Cosmos that popularized astrophysics and much else, including cosmology, the history of the universe. He even suggested the possible existence of extraterrestrial intelligence and started a listening project called SETI (Search for Extraterrestrial Intelligence). SETI is still searching today and has not found any evidence so far. Sagan became a sort of icon; many people in the U.S. and abroad knew his name and face. Carl Sagan also had another passion: saving humanity from a general nuclear war, a laudable aim. He had been arguing vigorously and publicly for a "freeze" on the production of more nuclear weapons. President Ronald Reagan outdid him and negotiated a nuclear weapons reduction with the USSR. In the meantime, much excitement was stirred up by Nuclear Winter. **Study after study tried to confirm and expand the hypothesis**, led by the Defense Department (**DOD**), which took the hypothesis seriously and spent **millions of dollars** on various reports that **accepted** Nuclear Winter rather **uncritically**. The National Research Council (**NRC**) of the National Academy of Sciences published a report that put in **more quantitative detail**. It enabled critics of the hypothesis to **find flaws – and many did**. The names Russell **Seitz**, Dick **Wilson** (both of Cambridge, Mass.), Steve **Schneider** (Palo Alto, Calif.), and Bob **Ehrlich** (Fairfax, Va.) (no relation to Paul Ehrlich) come to mind. The hypothesis was **really "politics disguised as science**." The whole TTAPS

#### Quantum vacuum mining destroys the universe- it’s feasible and inevitable

**Folger 8 –** Tim Folger, Contributing Editor at Discover Magazine, Writer for National Geographic, MA in Journalism from New York University, BA in Physics from UC Santa Cruz, “Nothingness of Space Could Illuminate the Theory of Everything”, Discover Magazine, 7-18, http://discovermagazine.com/2008/aug/18-nothingness-of-space-theory-of-everything

When the **next revolution** rocks physics, **chances are** it will be about nothing—the **vacuum**, that endless infinite void. In a discipline where the stretching of time and the warping of space are routine working assumptions, the vacuum remains a sort of cosmic koan. And as in the rest of physics, its nature has turned out to be mind-bendingly weird: Empty space is not really empty because nothing contains something, seething with energy and particles that flit into and out of existence. Physicists have known that much for decades, ever since the birth of quantum mechanics. But **only in the last 10 years** has the vacuum taken **center stage** as a font of confounding mysteries like the nature of dark energy and matter; only recently has the void turned into a tantalizing beacon for cranks. As one blond celebrity heiress and embodiment of emptiness might say, nothing is hot.

To investigate the mysteries of the void, some physicists are using the biggest scientific instrument ever built—the just-completed Large Hadron Collider, a huge particle accelerator straddling the French-Swiss border. Others are designing tabletop experiments to see if they can plumb the vacuum for ways to power strange new nanotech devices. “The vacuum is one of the places where our knowledge fizzles out and we’re left with all sorts of crazy-sounding ideas,” says John Baez, a mathematical physicist at the University of California at Riverside. Whether in the visionary search for the engine of cosmic expansion or the near-fruitless quest for perpetual free energy, the vacuum is where it’s happening. By mining the vacuum’s riches, a true theory of everything may yet emerge.

Empty space wasn’t always so mystifying. Until the 1920s physicists viewed the vacuum much as the rest of us still do: as a featureless nothingness, a true void. That all changed with the birth of quantum mechanics. According to that theory, the space around a particle is filled with countless “virtual” particles rapidly bursting into and out of existence like an invisible fireworks display.

Those virtual quantum particles are more than a theoretical abstraction. Sixty years ago a Dutch physicist named Hendrik Casimir suggested a simple experiment to show that virtual particles can move objects in the real world. What would happen, he asked, to two metal plates placed very close together in a complete vacuum? In the days before quantum mechanics, physicists would have said that the plates would just sit there. But Casimir realized that the net pressure of all the virtual particles—the stuff of empty space—outside the plates should exert a minuscule force, a nudge from nothing that would push the plates together.

Physicists tried for decades to measure the Casimir force with great precision, but it wasn’t until 1997 that technology caught up with theory. In that year, physicist Steve Lamoreaux, now at Yale, managed to detect the feeble Casimir force on two small surfaces separated by a few thousandths of a millimeter. Its strength was about equal to the force that would be exerted against the palm of one’s hand by the weight of a single red blood cell.

At first most physicists regarded the Casimir force as a quantum oddity, something of no practical value. Now that has changed: Forward thinkers see it as an **important energizer** for the tiniest of machines, devices on the nano scale, and a few labs are working on ways to use the force to defy the conventional limitations of mechanical design. Federico Capasso, a physicist at Harvard, leads a small team that is trying to create a repulsive Casimir force by tinkering with the shapes of plates or with the coatings used to cover them. His entire set of experiments fits on a desktop, and the objects he works with are so small that most of them cannot be seen without a microscope.

“Once you have a repulsive force between two plates, you should be able to eliminate static friction,” Capasso says. That could lead to a host of useful applications, including tiny frictionless bearings or nanogears that spin without touching. “But the experiments are enormously difficult, so I cannot tell you when and how.”

For all its strangeness, the Casimir force may be the one property of empty space that does not baffle today’s physicists. It is garden-variety quantum mechanics, weird but not unexpected. The same can’t be said about dark energy, a truly astonishing discovery made by astronomers a decade ago while observing distant exploding stars. The explosions revealed a universe expanding at an ever-faster rate, a finding at odds with previous expectations that the expansion of the cosmos should be slowing down, braked by the collective gravitational pull of all the matter out there. Some unknown form of energy—physicists call it dark energy simply for lack of a more descriptive term—appears to be built into the very fabric of space, countering the gravitational pull of matter and pushing everything in the universe apart. Some theorists speculate that dark energy might cause a runaway expansion of the universe, resulting in a so-called Big Rip some 50 billion years from now that would tear the cosmos to pieces, shredding even atoms.

The observations have allowed physicists to estimate the quantity of dark energy by deducing the force needed to produce the accelerating effect. The result is a minuscule amount of energy for every cubic meter of vacuum. Since most of the cosmos consists of empty space, though, that little bit adds up, and the total amount of dark energy completely dominates the dynamics of the universe.

With the discovery of dark energy came difficult questions: What is this energy, and where does it come from? Physicists simply do not know. According to quantum mechanics, the energy of empty space comes from the virtual particles that dwell there. But when physicists use the equations of quantum theory to calculate the amount of that virtual energy, they get a ridiculously huge number—about 120 orders of magnitude too large. That much energy would literally blow the universe apart: Objects a few inches from us would be carried away to astronomical distances; the universe would literally double in size every 10-43 second, and it would keep doubling at that rate until all the vacuum energy was gone. This may be the most colossal gap between observation and theory in the history of science. And it means that physicists are missing something fundamental about the way the universe works.

“We’ve made a prediction on the basis of our best theories, and it is wrong, wildly wrong,” says Sean Carroll, a theoretical physicist at the California Institute of Technology. “That means we don’t just tweak a parameter here and there; we really have to think deeply about what our theories are.”

Even if no one knows where the energy of empty space comes from or why it has the value it does, there is **now no doubt** that it **exists**. And if there is energy to be had, there is **inevitably** somebody out there thinking of how to exploit it. The notion of limitless energy from empty space has inspired **legions** of wannabe physicists who dream of developing the ultimate perpetual-motion device, a machine that would solve the world’s energy problems forever. A quick Internet search for the words free energy and vacuum turns up pages and pages of schemes for tapping the vacuum’s energy. I ask John Baez if such efforts are as hopeless as previous perpetual-motion machines. Are they equally crazy and doomed to failure?

“Perhaps not as doomed as trying to prove the world is flat,” Baez says. “One thing I can say is that I sure hope it doesn’t work, because if you could extract energy from the vacuum, it would **mean that the vacuum is not stable**. For normal physicists,” he adds with a laugh, “the definition of the vacuum is that it’s the lowest-energy situation possible—it has less energy than anything else.” In short, Baez says, while we may be able to get energy from the vacuum, success “would mean the universe is far more unstable than we ever dreamed.”

The reasoning goes like this: If the vacuum is not at the lowest energy state possible, then at some point in the future, the vacuum could fall to a lower state, pulsing out energy that would **threaten the very structure of the cosmos**. If some clever engineer were ever to extract energy from the vacuum, it could **set off a chain reaction** that would **spread at the speed of light and destroy the universe**. Free energy, yes, but not what the inventors had in mind.

#### Inflation of a baby universe channels phantom energy, which destroys our universe

Zeeya **Merali**, 3/27/20**08** (Writer for New Scientist, “Could ‘bubble’ universes threaten human existence?”, https://www.newscientist.com/article/mg19726493-900-could-bubble-universes-threaten-human-existence/)

IT IS the ultimate neighbour from hell: a rogue “bubble” universe that could rip into our world at any time and eat us and everything else in a flash. Eduardo Guendelman at Ben Gurion University in Beer-Sheva, Israel and Nobuyuki Sakai at Yamagata University in Japan discovered that our universe might face this gruesome end as they were investigating how patches of space-time expand. Alternatively, our universe could be the one feasting on its neighbours right now. According to the standard model of cosmology, our universe underwent a phase of rapid expansion known as inflation just after the big bang. In theory, inflation could still be happening to pockets of space-time, blowing them up to create new universes disconnected from ours. However, nobody knows exactly what would trigger this inflation, says Guendelman. He and Sakai wanted to see if bubbles of space-time could inflate into pocket universes without having to be kick-started by anything as dramatic as a big bang. They found that this is possible, provided the bubbles contain a weird form of repulsive “phantom energy”. Some physicists think phantom energy is similar to dark energy, and both are posited to explain the acceleration of the universe’s expansion. But phantom energy is much more powerful, and if it really is behind the acceleration, it will **create runaway expansion that will eventually rip our universe apart** (New Scientist, 8 March 2003, p 14). Guendelman and Sakai’s calculations show that small bubbles of phantom energy would start to “breathe”, gently expanding and contracting as the phantom energy inside battles against the bubble’s wall, before spontaneously **expanding into a full-blown universe**. The problem is that the expansion can play out in two ways, depending on the resistance of the wall. Ideally, the bubble would disconnect from its surroundings, says Guendelman. This "good" pocket universe would look like a black hole from the outside, but inside it would be creating its own space-time - effectively a new universe. In contrast, "**rogue" bubbles would expand uncontrollably into the space-time around them, and we probably wouldn't see one before it destroyed us because it would expand at the speed of light**. The researchers have submitted their work to Physical Review D. We probably wouldn't see one of these rogue bubbles before it destroyed us because it would expand at the speed of light.

#### ELI experiments destroy all life

(Duncan **Geere** 11/4/**11** (Science and Technology Journalist for Wired “Ultrapowerful laser planned to tear apart fabric of space,” http://www.wired.co.uk/article/laser-spacetime)

A team is planning to build an enormously powerful laser that could **rip apart the fabric of space**. The Extreme Light Infrastructure Ultra High-Field laser will be 200 times more powerful than the most powerful lasers that currently exist on the planet, says John Collider, a member of the team and the director of the Central Laser Facility at the Rutherford Appleton Laboratory in Didcot. "At this kind of intensity we start to get into unexplored territory, as it is an area of physics that we have never been before," he told the Telegraph. The aim is to boil a vacuum. Vacuums are normally thought of as empty space, but physicists believe they actually contain tiny particles that pop in and out of existence, so fast that it's difficult to prove they exist. By focusing the ELI Ultra-High-Field laser on an area of space, the team believes **that the fabric of the vacuum can be pulled apart,** revealing these particles for the first time. READ NEXT CERN's charming new particle discovery could open a 'new frontier' in physics CERN's charming new particle discovery could open a 'new frontier' in physics By ABIGAIL BEALL The laser will be made up of 10 beams, each providing **200 petawatts of power for less than a trillionth of a second**. As 200 petawatts is **more than 100,000 times the amount of power produced by the world**, the energy will need to be stored up over time in huge capacitors. At the crucial moment, that energy will be released to form metre-wide laser beams that will then be combined and focused down onto a tiny point. At that point, the intensity of the light will be greater than at the centre of the Sun. In these conditions, it's hoped that these pairs of matter-antimatter particles -- which normally annihilate each other almost as soon as they form -- will be pulled apart, leaving tiny electrical charges, which the team hope to measure.

#### 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>

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.

#### That solves inevitable extinction - massive particle colliders are being built which can create black holes and vacuum decay –destroys the universe

Rory **Mckeown** (12-14-20**15**) -Rory McKeown, Journalist for the Daily Star, quoting Wang Yifang, Director of the Institute of High Emergency Physics at the China Academy of Sciences, Stephen Hawking and Sir Martin Rees, President of the Royal Society, Fellow of Trinity College and Emeritus Professor of Cosmology and Astrophysics at the University of Cambridge Dailystar.co.uk, "China to build a gigantic hadron collider that could destroy the UNIVERSE," https://www.dailystar.co.uk/news/latest-news/china-build-gigantic-hadron-collider-17226448

**Physicists** in the Far East **want to start building a huge particle accelerator** to uncover the unsolved mysteries surrounding the universe. The proposed gigantic machine will **[with] better** Europe’s collider at CERN in Switzerland for both **power and size**. With a staggering circumference of between 30 to 62 miles, it is long enough to circle New York's Manhattan. But **the move could have disastrous consequences for the universe** as we know it – **with its potential to create a black hole or spontaneously combust**. Brit scientist Professor Stephen **Hawking made a bleak claim last year that search for the Higgs boson particle – often referred to as the God particle – could end the world in 10 to 100 years time**. **China is expected to start** building its Frankenstein’s Monster of physics **in 2020**. But conspiracy theorists were quick to point out the date coincides with a prophecy suggesting the arrival of the antichrist. **The Circular Electron Positron Collider (CEPC)** was announced by experts at the China Academy of Sciences and reportedly **will generate millions of Higgs bosons particles – a huge amount more than the Large Hadron Collider**. Wang Yifang, director of the Institute of High Emergency Physics at the academy, said the massive tunnel will hold two super colliders. They want the CEPC to be the first stage of the project, which aims to discover how the Higgs boson particle decays following collision. **China hopes its mean machine will get the closest humanity has ever got to creating the conditions just after the Big Bang.** Wang said the project will generate seven times the energy of Europe’s own collider. He said: “LHC is hitting its limits of energy level. “It seems not possible to escalate the energy dramatically at the existing facility. “The technical route we chose is different from the LHC. “While the LHC smashes together protons, it generates Higgs particles together with many other particles.” He told China Daily the CEPC, which is set to be build near the start of the Great Wall, creates a “clean environment that only produces Higgs boson particles.” “This is a machine for the world and by the world: not a Chinese one", he added. **The second stage of the accelerator – a Super Proton-Proton Collider (SPPC) would begin construction in 2040**. Here scientists could be able to shed light on dark matter, the Big Bang and black holes. And **the process would, according to Sir Martin Rees, Astronomer Royal of the UK, leave the planet “an inert hyperdense sphere about one hundred metres across.” But for all the advancement in science and technology, some fear human intervention into the unknown could wipe out the universe. Prof Hawking described the discovery of the Higgs boson particle in 2012 as a doomsday scenario**. He **warned**: “The Higgs potential has the worrisome feature that it might become metastable at energies above 100 billion gigaelectronvolts. “This could mean that **the universe could undergo catastrophic vacuum decay, with a bubble of the true vacuum expanding the speed of light. “This could happen at any time and we wouldn’t see it coming.”**

## NOT READ

#### The mini-nuclear winter solves warming without causing extinction.

Sorin Adam Matei 12. – Ph.D., Associate Dean of Research and Professor of Communication, College of Liberal Arts and Brian Lamb School of Communication, Purdue University. 3-26-2012. ["A modest proposal for solving global warming: nuclear war – Sorin Adam Matei." Matei. <https://matei.org/ithink/2012/03/26/a-modest-proposal-for-solving-global-warming-nuclear-war/>] Recut Justin

We finally have a solution for global warming. A discussion on the board [The Straight Dope](http://boards.straightdope.com/sdmb/showthread.php?t=646285) about the likely effect of a nuclear war brought up the hypothesis that a nuclear war on a large scale could produce a mini-nuclear winter. Why? Well, the dust and debris sent into the atmosphere by the conflagrations, plus the smoke produced by the fires started by the explosions would cover the sun for a period long enough to lower the temperature by as much as 40 degrees Celsius for a few months and by up to 2-6 degree Celsius for a few years. One on top of the other, according to this [Weather Wunderground contributor](http://www.wunderground.com/blog/JeffMasters/comment.html?entrynum=1208), who cites a[bona fide research paper on nuclear winter](http://www.atmos-chem-phys.org/7/2003/2007/acp-7-2003-2007.pdf), after everything would settle down we would be back to 1970s temperatures. Add to this the decline in industrial production and global oil consumption due to industrial denuding of most large nations and global warming simply goes away. I wonder what [Jonathan Swift would have thought about this proposal?](http://www.gutenberg.org/files/1080/1080-h/1080-h.htm)

#### Particle accelerators destroy the universe – which outweighs.

Joe Packer 7 – MA in Communication from Wake Forest University, PhD in Communication from the University of Pittsburgh and Professor of Communication at Central Michigan University, Alien Life in Search of Acknowledgment, p. 62-63 Recut Justin

Once we hold alien interests as equal to our own we can begin to revaluate areas previously believed to hold no relevance to life beyond this planet. A diverse group of scholars including Richard Posner, Senior Lecturer in Law at the University of Chicago, Nick Bostrom, philosophy professor at Oxford University, John Leslie philosophy professor at Guelph University and Martin Rees, Britain’s Astronomer Royal, have written on the emerging technologies that threaten life beyond the planet Earth. Particle accelerators labs are colliding matter together, reaching energies that have not been seen since the Big Bang. These experiments threaten a phase transition that would create a bubble of altered space that would expand at the speed of light killing all life in its path. Nanotechnology and other machines may soon reach the ability to self replicate. A mistake in design or programming could unleash an endless quantity of machines converting all matter in the universe into copies of themselves. Despite detailing the potential of these technologies to destroy the entire universe, Posner, Bostrom, Leslie, and Ree’s only mention of alien life in their works is in reference to the threat aliens post to humanity. The rhetorical construction of otherness only in terms of the threats it poses, but never in terms of the threat one poses to it, has been at the center of humanity’s history of genocide, colonization, and environmental destruction. Although humanity certainly has its own interests in reducing the threat of these technologies evaluating them without taking into account the danger they pose to alien life is neither appropriate nor just. It is not appropriate because framing the issue only in terms of human interests will result in priorities designed to minimize the risks and maximize the benefits to humanity, not all life. Even if humanity dealt with the threats effectively without referencing their obligation to aliens, Posner, Bostrom, Leslie, and Ree’s rhetoric would not be “just,” because it arbitrarily declares other life forms unworthy of consideration. A framework of acknowledgement would allow humanity to address the risks of these new technologies, while being cognizant of humanity’s obligations to other life within the universe. Applying the lens of acknowledgment to the issue of existential threats moves the problem from one of self destruction to universal genocide. This may be the most dramatic example of how refusing to extend acknowledgment to potential alien life can mask humanity’s obligations to life beyond this planet.

#### Nuclear war prevents AI and Nanotech research.

Baum & Barrett 18 – Seth Baum is an American researcher involved in the field of risk research. He is the executive director of the Global Catastrophic Risk Institute (GCRI), a think tank focused on existential risk. Global Catastrophic Risk Institute. 2018. [“A Model for the Impacts of Nuclear War.” SSRN Electronic Journal. 10.2139/ssrn.3155983] Recut Justin

Another link between nuclear war and other major catastrophes comes from the potential for general malfunction of society shifting work on risky technologies such as artificial intelligence, molecular nanotechnology, and biotechnology. The simplest effect would be for the general malfunction of society to halt work on these technologies. In most cases, this would reduce the risk of harm caused by those technologies.

#### AI destroys the universe.

Alan Rominger 16, PhD Candidate in Nuclear Engineering at North Carolina State University, Software Engineer at Red Hat, Former Nuclear Engineering Science Laboratory Synthesis Intern at Oak Ridge National Laboratory, BS in Nuclear Engineering from North Carolina State University, “The Extreme Version of the Technological Singularity”, Medium 11-6, [https://medium.com/@AlanSE/the-extreme-version-of-the-technological-singularity-75608898eae5 //](https://medium.com/@AlanSE/the-extreme-version-of-the-technological-singularity-75608898eae5%20//) Re-Cut Justin

Let’s reformulate that story of the AI paperclip maker.

1. We design an AI to optimize paperclip production
2. The AI improves up to the ability of self-enhancement
3. AI’s pace of improvement becomes self-reinforcing, becomes god-like
4. Time ends.
5. Something else begins?

There are many valid-sounding possibilities for the 5th step. The AI creates new baby universes from black holes. Maybe not exactly in this way. Perhaps the baby universes have to be created in particle accelerators, which is obvious to the AI after it solves the string theory problems of how our universe is folded. There’s also no guarantee that whatever next step is involved can be taken without destroying the universe that we live in. Go ahead, imagine that the particle accelerators create a new universe but trigger the vacuum instability in our own. In this case, it’s entirely possible that the AI carefully plans and coordinates the death of our universe. For a simplistic example, let’s say that after lifting the 10 nearest stars, the AI realizes the most efficient ways to stimulate the curved dimensions on the Planck scale to create baby universes. Next, it conducts an optimization study to balance the number of times this operation can be performed with gains from further expansion. Since its plans begin to largely max-out once the depth of the galactic disk is exploited, I will assume that its go-point is somewhere around the colonization of half of the milky way. At this point, a coordinated experiment is conducted throughout all of the space. Each of these events both create a baby universe and trigger an event in our own universe which destroys the meta-stable vacuum that we live in. Billions of new universes are created, while the space-time that we live in begins to unravel in a light-speed front emanating out from each of the genesis points. There is an interesting energy-management concept that comes from this. A common problem when considering exponential galactic growth of star-lifted fusion power is that the empty space begins to get cooked from the high temperature radiated out into space. If the end-time of the universe was known in advance, this wouldn’t be a problem because one star would not absorb the radiation from the neighbor star until the light had time to propagate that distance at the speed of light. That means that the radiators can pump out high-temperature radiation into nice and normal 4-Kelvin space without concerns of boiling all the industrial machinery being used. Industrial activities would be tightly restricted until the “prepare-point”, when an energy bonanza happens so that the maximum number of baby-universe produces can be built. So the progress goes in phases. Firstly, there is expansion, next there is preparation, then there is the final event and the destruction of our universe There is one more modification that can be made. These steps could be applied to an intergalactic expansion if new probes could temporarily outrun the wave-front of the destruction of the universe if proper planning is conducted. Then it could make new baby universes in new galaxies, just before the wave-front reaches them. This might all happen within a few decades of 100 years in relative time from the perspective of someone aboard one of the probes. That is vaguely consistent with my own preconceptions of the timing of an asymptotic technological singularity in our near future. So maybe we should indulge this thinking. Maybe there won’t be a year 2,500 or 3,000. Maybe our own creations will have brought about an end to the entire universe by that time, setting in motion something else beyond our current comprehension. Another self-consistent version of this story is that we are, ourselves, products of a baby universe from such an event. This is also a relatively good, self-consistent, resolution to the Fermi Paradox, the Doomsday argument, and the Simulation argument.

#### **Nanotech proliferates fast and destroys the universe.**

Hu 18 – Jiaqi Hu, Humanities Scholar and President and Chief Scientist of the Beijing Jianlei International Decoration Engineering Company and 16Lao Group, Graduate of Dongbei University, Elected as the Chinese People’s Consultative Conference Member for Beijing Mentougou District, Saving Humanity: Truly Understanding and Ranking Our World's Greatest Threats, p. 208-210

As a unit of measurement, a nanometer is 10^9 meters (or one billionth of a meter); it is roughly one 50,000th of a strand of hair and is commonly used in the measuring of atoms and molecules. In 1959, Nobel Prize winner and famous physicist Richard Feynman first proposed in a lecture entitled "There's Plenty of Room at the Bottom" that humans might be able to create molecule-sized micro-machines in the future and that it would be another technological revolution. At the time, Feynman's ideas were ridiculed, but subsequent developments in science soon proved him to be a true visionary. In 1981, scientists developed the scanning tunneling microscope and finally reached nano-level cognition. In 1990, IBM scientists wrote the three letters "IBM" on a nickel substrate by moving thirty-five xenon atoms one by one, demonstrating that nanotechnology had become capable of transporting single atoms. Most of the matter around us exists in molecule forms, which are composed of atoms. The ability to move atoms signaled an ability to perform marvelous feats. For example, we could move carbon atoms to form diamonds, or pick out all the gold atoms in low-grade gold mines. However, nanotechnology would not achieve any goals of real significance if solely reliant on manpower. There are hundreds of millions of atoms in a needle-tip-sized area—even if a person committed their life to moving these atoms, no real value could be achieved. Real breakthroughs in nanotechnology could only be produced by nanobots. Scientists imagined building molecule-sized robots to move atoms and achieve goals; these were nanobots. On the basis of this hypothesis, scientists further postulated the future of nanotechnology; for example, nanobots might be able to enter the bloodstream and dispose of cholesterol deposited in the veins; nanobots could track cancer cells in the body and kill them at their weakest moment; nanobots could instantly turn newly-cut grass into bread; nanobots could transform recycled steel into a brand new-car in seconds. In short, the future of nanotechnology seemed incredibly bright. This was not the extent of nanotechnology's power. Scientists also discovered that nanotechnology could change the properties of materials. In 1991, when studying C60, scientists discovered carbon nanotubes (CNTs) that were only a few nanos in diameter. The carbon nanotube became known as the king of nano materials due to its superb properties; scientists believed that it would produce great results when applied to nanobots. Later, scientists also developed a type of synthetic molecular motor that derived energy from the high-energy adenosine triphosphate (ATP) that powered intracellular chemical reactions. The success of molecular motor research solved the core component problem of nano machines; any molecular motor grafted with other components could turn into a nano machine, and nanobots could use them for motivation. In May 2004, American chemists developed the world’s first nanobot: a bipedal molecular robot that looked like a compass with ten-nanometer-long legs. This nanobot was composed of DNA fragments, including thirty-six base pairs, and it could "stroll" on plates in the laboratory. In April 2005, Chinese scientists developed nano-scale robotic prototypes as well. In June of 2013, the Tohoku University used peptide protein micro-tablets to successfully create nanobots that could enter cells and move on the cell membrane. In July 2017, researchers at the University of Rome and the Roman Institute of Nanotechnology announced the development of a new synthetic molecular motor that was bacteria-driven and light-controlled. The next step would be to get nanobots to move atoms or molecules. Compared to the value produced by a nanobot, they are extremely expensive to create. The small size of nanobots means that although they can accomplish meaningful tasks, they are often very inefficient. Even if a nanobot toiled day and night, its achievements would only be calculated in terms of atoms, making its practical total attainment relatively small. Scientists came up with a solution for this problem. They decided to prepare two sets of instructions when programming nanobots. The first set of instructions would set out tasks for the nanobot, while the second set would order the nanobot to self-replicate. Since nanobots are capable of moving atoms and are themselves composed of atoms, self-replication would be fairly easy. One nanobot could replicate into ten, then a hundred, and then a thousand . . . billions could be replicated in a short period of time. This army of nanobots would greatly increase their efficiency. One troublesome question that arises from this scenario is: how would nanobots know when to stop self-replicating? Human bodies and all of Earth are composed of atoms; the unceasing replication of nanobots could easily swallow humanity and the entire planet. If these nanobots were accidentally transported to other planets by cosmic dust, the same fate would befall those planets. This is a truly terrifying prospect. Some scientists are confident that they can control the situation. They believe that it is possible to design nanobots that are programmed to self-destruct after several generations of replication, or even nanobots that only self-replicate in specific conditions. For example, a nanobot that dealt with garbage refurbishing could be programmed to only self-replicate around trash using trash. Although these ideas are worthy, they are too idealistic. Some more rational scientists have posed these questions: What would happen if nanobots malfunctioned and did not terminate their self-replication? What would happen if scientists accidentally forgot to add self-replication controls during programming? What if immoral scientists purposefully designed nanobots that would not stop self-replicating? Any one of the above scenarios would be enough to destroy both humanity and Earth. Chief scientist of Sun Microsystems, Bill Joy, is a leading, world-renowned scientist in the computer technology field. In April of 1999, he pointed out that if misused, nanotechnology could be more devastating than nuclear weapons. If nanobots self-replicated uncontrollably, they could become the cancer that engulfs the universe. If we are not careful, nanotechnology might become the Pandoras box that destroys the entire universe and all of humanity with it. We all understand that one locust is insignificant, but hundreds of millions of locusts can destroy all in their path. If self-replicating nanobots are really achieved in the future, it might signify the end of humanity. If that day came, nothing could stop unethical scientists from designing nanobots that suited their immoral purposes. Humans are not far from mastering nanotechnology. The extremely tempting prospects of nanotechnology have propelled research of nanobots and nanotechnology. The major science and technology nations have devoted particular efforts to this field.

#### Back to the future coming soon

Awes Faghi Elmi 18, Contributing Writer at n’world Publications, BS in Forensic Science from London South Bank University, Extended Diploma in Physics with Distinction from Leyton Sixth Form College, Futurist, [“Technological Progress Might Make Possible Time Travel And Teleportation”, Medium, 8-13, <https://medium.com/nworld-publications/technological-progress-might-make-possible-time-travel-and-teleportation-45176c3c89bc>] Recut Justin

This is a question that many people ask their-selves. This question has occurred many times. It is said that time travel is possible and in fact it is. The key things needed to travel through time are speed and kinetic energy. Einstein’s theory also known as the theory of relativity can be used ro understand how to deal with travelling to the future. Einstein showed that travelling forward in time is easy. According to Einstein’ theory of relativity, time passes at different rates for people who are moving relative to one another although the effect only becomes large when you get close to the speed of light. Time travel sometime can cause side effects called paradoxes. These paradoxes can occur especially when going back in time. As if only one thing even the minimum of the details can change something big may happen in the future. Another scientist who believes that time travel is possible after Einstein is Brian Cox who as Einstein believes that we are only going to be able to travel in the future. This obviously would happen if having a super-fast machine that allows you to go into the future. Cox also agrees on Einstein’s theory of relativity which states that to travel forward in time, something needs to reach speeds close to the speed of light. As it approaches these speeds, time slows down but only for that specific object. They both think as said, that time travel to the future is possible however travelling back in time is impossible, as something must be really as fast as the speed of light. This however for some scientists can be wrong. They state that with the technology that we have now it could be possible to build some sort of machine who will actually be able to travel in both future and past. A wormhole as shown in the image is a theoretical passage through space-time that could create shortcuts for long journeys across the universe. Wormholes are predicted by the theory of general relativity. However, wormholes bring with them the dangers of sudden collapse, high radiation and dangerous contact with exotic matter. The public knows that time travel is possible but humans at the moment are not able to. However other sources except theories of the past are currently trying to develop a way of time travel. The audience actually cannot wait that this will happen as many media state, such as BBC. Many TV programmes talk about both time travel and teleportation.

#### This 🡪

#### collapses the universe

Steve Bowers 16, Control Officer in the United Kingdom, Executive Editor and Moderator of the Orion’s Arm Universe Project, Contributing Author for the Orion’s Arm Novella Collection, [“WHY NO TIME TRAVEL IN OA”, 1-1, <https://orionsarm.com/page/77>] Recut Justin

If the universe does allow reverse time travel, usable by sentient/sophont entities, it won't stop at one or two little historical research trips . . . If there is no effective chronological protection mechanism, the universe of today will be overrun with travellers from the future. Even if there is no 'Big Rip' where the Universe tears itself apart through accelerating expansion, hundreds of trillions of years from now the cosmos will be a slowly dying place. Even red dwarf stars will eventually burn out, leaving the inhabitants of the far future only their dying embers to gather energy from, although the creation and merger of black holes could perhaps keep civilisation going for an (admittedly very long) while. Eventually the entities of the far future will be limited to reversible computation to save energy. This means confining themselves to a very limited set of mental processes. This prospect would surely not appeal to the heirs of once-mighty advanced civilisations. If time travel were possible then refugees from the far future would flood back, sometimes in multiple instances. The future sophonts would come back in an exponentiating wave to constantly change the present and the past, and whole galaxies of material particles will begin to exist in space time reference that did not have them before - some? many? most? matter and events may turn out to be acausal, going round and round in closed timelike loops and increasing the total mass of the universe, which may begin to collapse in the distant future, sending chronistic refugees in massive tardises back to our time thus accelerating the collapse; increasing the mass of the present day universe until it collapses. The collapse will get closer to the present day, until it eventually happened yesterday and we will cease to exist . . . believe me, you don't want to go there. For an explanation how under certain circumstances a wormhole can connect different parts of the universe without causing temporal paradoxes see this page.