### 1

#### Statesought to call a global constitutional convention and establish a constitution reflecting intergenerational concern with exclusive authority to nationalize space X

#### And bind participating bodies to its result

#### That solves the aff – it addresses shared anxieties while building political consensus

Gardiner 14 1 [Stephen M. Gardiner, Professor of Philosophy and Ben Rabinowitz Endowed Professor of Human Dimensions of the Environment at the University of Washington, Seattle, “A Call for a Global Constitutional Convention Focused on Future Generations,” 2014, *Ethics & International Affairs*, Vol. 28, Issue 3, pp. 299-315, https://doi.org/10.1017/S0892679414000379, EA]

A Constitutional Convention

In my view, the above line of reasoning leads naturally to a more specific proposal: that we—concerned individuals, interested community groups, national governments, and transnational organizations—should initiate a call for a global constitutional convention focused on future generations. This proposal has two components. The first component is procedural. The proposal takes the form of a “call to action.” It is explicitly an attempt to engage a range of actors, based on a claim that they have or should take on a set of responsibilities, and a view about how to go about discharging those responsibilities. The second component is substantive. The main focus for action is a push for the creation of a constitutional convention at the global level, whose role is to pave the way for an overall constitutional system that appropriately embodies intergenerational concern.

The substantive idea rests on several key ideas. Still, for the purposes of a basic proposal, I suggest that these be understood in a relatively open way that, as far as is practicable, does not prejudge the outcome of the convention, and especially its main recommendations. First, the convention itself should be understood as “a representative body called together for some occasional or temporary purpose” and “constituted by statute to represent the people in their primary relations.”14 Second, a constitutional system should be thought of in a minimalist sense as “a set of norms (rules, principles or values) creating, structuring, and possibly defining the limits of government power or authority.”15 Third, the “instigating” role of the convention should be to discuss, develop, make recommendations toward, and set in motion a process for the establishment of a constitution. Fourth, its primary subject matter should be the need to adequately reflect and embody intergenerational concern, where this would include at least the protection of future generations, the promotion of their interests (where “interests” is to be broadly conceived so as to include rights, claims, welfare, and so on), and the discharging of duties with respect to them. It may also (and in my view should) include some way of reflecting concern for past generations, including responsiveness to at least certain of their interests and views. However, I will leave that issue aside in what follows.

The proposal to initiate a call for a global constitutional convention has at least two attractive features. First, it is based in a deep political reality, and does not underplay the challenge. It acknowledges the problem as it is, both specific and general, and calls attention to the heart of that problem, including to the failures of the current system, the need for an alternative, and the background issue of responsibility. Moreover, though the proposal is dramatic and rhetorically eye-catching, it is so in a way that is appropriately responsive to the seriousness of the issue at hand, the persistent political inertia surrounding more modest initiatives, and the fact that (grave though concerns about it are) climate change is only one instance of the tyranny of the contemporary (and the wider perfect moral storm), and we should expect others to arise over the coming decades and centuries.

The second attractive feature of the proposal is that, though ambitious, it is not alienating. While it does not succumb to despair in the face of the challenge, neither does it needlessly polarize and divide from the outset (for example, by leaping to specific recommendations about how to fill the institutional gap). Instead, it acknowledges that there are fundamental difficulties and anxieties, but uses them to start the right kind of debate, rather than to foreclose it. As a result, the proposal is a promising candidate to serve as the subject of a wide and overlapping political consensus, at least among those who share intergenerational concern.

Selective Mirroring

To quell some initial anxieties, it is perhaps worth clarifying the open-ended and non-alienating character of the proposal. One temptation would be to view the call for a global constitutional convention as a fairly naked plea for world government, a prospect that would be deeply alienating—indeed anathema—to many. However, that is not my intention. Though it is possible that a global constitutional convention would lead in this direction, it is by no means certain.

At a minimum, no such body could plausibly recommend any form of “world government” without simultaneously advancing detailed suggestions about how to avoid the standard threats such an institution might pose. Moreover, it seems perfectly conceivable, even likely under current ways of thinking, that a global constitutional convention would pursue what we might call a selective mirroring strategy. Specifically, a convention would seek to develop a broader system of institutions and practices that reflected the desirable features of a powerful and highly centralized global authority but neutralized the standing threats posed by it (for example, it might employ familiar strategies such as the separation of powers). In all likelihood, one feature of a selective mirroring approach would be the significant preservation of existing institutions to serve as a bulwark against the excesses of any newly created ones. Whether and how such a strategy might be made effective against the perfect moral storm, and whether something closer to a “world government” would do better, would be a central issue for discussion by the convention.

#### It spills over to foster broader intergenerational representation, but independence is key

Gardiner 14 2 [Stephen M. Gardiner, Professor of Philosophy and Ben Rabinowitz Endowed Professor of Human Dimensions of the Environment at the University of Washington, Seattle, “A Call for a Global Constitutional Convention Focused on Future Generations,” 2014, *Ethics & International Affairs*, Vol. 28, Issue 3, pp. 299-315, https://doi.org/10.1017/S0892679414000379, EA]

One set of guidelines concerns how the global constitutional convention relates to other institutions. The first guideline concerns relative independence:

(1) Autonomy: Any global constitutional convention should have considerable autonomy from other institutions, and especially from those dominated by factors that generate or facilitate the tyranny of the contemporary (and the perfect moral storm, more generally).

Thus, for example, attempts should be made to insulate the global constitutional convention from too much influence from short-term and narrowly economic forces.

The second guideline concerns limits to that independence:

(2) Mutual Accountability: Any global constitutional convention should be to some extent accountable to other major institutions, and they should be accountable to it.

Thus, for example, though the global constitutional convention should not be able to decide unilaterally that national institutions should be radically supplanted, nevertheless such institutions should not have a simple veto on the recommendations of the convention, including those that would result in sharp limits to their powers.

A third guideline concerns adequacy:

(3) Functional Adequacy: The global constitutional convention should be constructed in such a way that it is highly likely to produce recommendations that are functionally adequate to the task.

Thus, for example, the tasks of the global constitutional convention should not be assigned to any currently existing body whose design and authority is clearly unsuitable. In my view, this guideline rules out proposals such as the Royal Society’s suggestion that governance of geoengineering should be taken up by the United Nations’ Commission on Sustainable Development,20 or the Secretary-General’s recommendation of a new United Nations’ High Commissioner for Future Generations.21 Though such proposals may have merit for some purposes (for example, as pragmatic, incremental suggestions to highlight the importance of intergenerational issues), they are too modest, in my opinion, to reflect the gravity of the threats posed by climate change in particular, and the perfect moral storm more generally.

Aims

A second set of guidelines concerns the aims of the global constitutional convention. Here, the perfect moral storm analysis would suggest:

(4) Comprehensiveness: The convention should be under a mandate to consider a very broad range of global, intergenerational issues, to focus on such issues at a foundational level, and to recommend institutional reform accordingly.

(5) Standing Authority: Though the convention may recommend the establishment of some temporary and issue-specific bodies, its focus should be on the establishment of institutions with standing authority over the long term.

These guidelines are significant in that they stand against existing issue-specific approaches to global and intergenerational problems, and encourage not only a less ad hoc but also a more proactive approach. In particular, the global constitutional convention might be expected to recommend institutions that would be charged with identifying, monitoring, and taking charge of intergenerational issues as such. For example, such institutions should address not only specific policy issues (such as climate change, large asteroid detection, and long-term nuclear waste) but also the need to identify similar threats before they arise.

#### Proactive measures mitigate a laundry list of emerging catastrophic risks – extinction

Beckstead et al. 14 [Nick Beckstead, Nick Bostrom, Niel Bowerman, Owen Cotton-Barratt, William MacAskill, Seán Ó hÉigeartaigh, Toby Ord, \* Future of Humanity Institute, University of Oxford, \*\* Director, Future of Humanity Institute, University of Oxford, \*\*\* Global Priorities Project, Centre for Effective Altruism; Department of Physics, University of Oxford, \*\*\*\* Global Priorities Project, Centre for Effective Altruism; Future of Humanity Institute, University of Oxford, \*\*\*\*\* Uehiro Centre for Practical Ethics, University of Oxford, \*\*\*\*\*\* Cambridge Centre for the Study of Existential Risk; Future of Humanity Institute, University of Oxford, \*\*\*\*\*\*\* Programme on the Impacts of Future Technology, Oxford Martin School, University of Oxford, “Policy Brief: Unprecedented Technological Risks,” 2014, *The Global Priorities Project, The Future of Humanity Institute, The Oxford Martin Programme on the Impacts of Future Technology, and The Centre for the Study of Existential Risk*, https://www.fhi.ox.ac.uk/wp-content/uploads/Unprecedented-Technological-Risks.pdf, Accessed: 03/13/21, EA]

In the near future, major technological developments will give rise to new unprecedented risks. In particular, like nuclear technology, developments in synthetic biology, geoengineering, distributed manufacturing and artificial intelligence create risks of catastrophe on a global scale. These new technologies will have very large benefits to humankind. But, without proper regulation, they risk the creation of new weapons of mass destruction, the start of a new arms race, or catastrophe through accidental misuse. Some experts have suggested that these technologies are even more worrying than nuclear weapons, because they are more difficult to control. Whereas nuclear weapons require the rare and controllable resources of uranium-235 or plutonium-239, once these new technologies are developed, they will be very difficult to regulate and easily accessible to small countries or even terrorist groups.

Moreover, these risks are currently underregulated, for a number of reasons. Protection against such risks is a global public good and thus undersupplied by the market. Implementation often requires cooperation among many governments, which adds political complexity. Due to the unprecedented nature of the risks, there is little or no previous experience from which to draw lessons and form policy. And the beneficiaries of preventative policy include people who have no sway over current political processes — our children and grandchildren.

Given the unpredictable nature of technological progress, development of these technologies may be unexpectedly rapid. A political reaction to these technologies only when they are already on the brink of development may therefore be too late. We need to implement prudent and proactive policy measures in the near future, even if no such breakthroughs currently appear imminent.

#### Maintaining sustainable use of outer space is key to future generations

**Islam 18** [Mohammad Saiful Islam, Mohammad works for the Institute of Advanced Judicial Studies and the Beijing Institute of Technology. 4-27-2018, "The Sustainable Use of Outer Space: Complications and Legal Challenges to the Peaceful Uses and Benefit of Humankind," Beijing Law Review, <https://www.scirp.org/journal/paperinformation.aspx?paperid=85201> accessed 12/12/21] Adam

4.2. Ensure the Rights of Future Generations in Outer Space

Sustainable development is the establishing principle for achieving present human needs without damaging the demands of future generations maintaining integrity and constancy of the natural systems. The modern idea of sustainable development is derived from the Brundtland Report in 1987. Generally considered in modern application and exploration of outer space, fundamental elements are the area must be dedicated to peaceful purposes; and the area must be preserved for future generations [(Heim, 1990)](https://www.scirp.org/journal/paperinformation.aspx?paperid=85201#ref17). It is an indispensable and inordinate challenge to confirm uphold the healthy environment and make sure development without destroying the rights of future generations in space. Article IX of The Outer Space Treaty provided, in the exploration and use of outer space, States should pursue studies and conduct exploration of outer space so as to avoid harmful contamination and also adverse changes in the environment of the Earth [(Outer Space Treaty, 1967)](https://www.scirp.org/journal/paperinformation.aspx?paperid=85201#ref35). The issues of what constitutes harmful contamination in Earth’s environment have yet to be interpreted. The legal definition of “adverse” and “harmful” will also modification as Earth, indigenous sciences progress, separately or in concert, with the planetary exploration space sciences [(Robinson, 2005)](https://www.scirp.org/journal/paperinformation.aspx?paperid=85201#ref38). As a result of multifaceted political, economic, scientific, technological, educational, and other global problems, there has been practicing exclusively only international cooperation for sustainable space development among the developed countries [(Noichim, 2005)](https://www.scirp.org/journal/paperinformation.aspx?paperid=85201#ref34). The space faring nations should promote a supportive environment for peaceful and sustainable use of space, decrease environmental effects on Earth and protect the terrestrial environment. We should escape a regime that will ultimately reflect the over-exploitation of resources and environmental havoc [(Fountain, 2002)](https://www.scirp.org/journal/paperinformation.aspx?paperid=85201#ref9).

### 2

When companies like SpaceX make it big, they’d be obligated to return some portion of their gains to the public infrastructure that helped them succeed

#### BBB passes now – Biden remarks give it momentum

**Frazin 1/23** – Staff Writer for The Hill (Rachel, “ Biden comments add momentum to spending bill's climate measures,” *The Hill*, 1-23-22, <https://thehill.com/policy/healthcare/590871-biden-comments-add-momentum-to-spending-bills-climate-measures>)

President Biden’s remarks at a Wednesday press conference are giving momentum to the climate portions of his spending agenda as lawmakers call for Congress to pass the parts of the Build Back Better legislation that are achievable. Biden expressed confidence that lawmakers can pass **upward of $500 billion in energy and environmental spending** — a number close to the amount the White House proposed spending on climate and clean energy in October. And after months of negotiations, weary lawmakers are now pushing to get climate action across the finish line. “The climate and clean energy provisions in Build Back Better have been largely worked through and financed, so let’s start there and add any of the other important provisions to support working families that can meet the 50-vote threshold,” Sen. Ed Markey (D-Mass.) said in a statement. Markey is far from alone. Sen. Tina Smith (D-Minn.), who has been a vocal proponent of the legislation’s climate change measures, expressed a similar sentiment in an interview with The Hill. “We need to figure out what we have agreement on and we need to do that,” Smith said. “Based on where we have been and comments that Sen. Manchin has made about the climate provisions that we have been negotiating up until the end of last year, it seems like **those sections of the old Build Back Better bill should be in pretty good shape,**” she added. Manchin is the West Virginia Democrat who stopped the Build Back Better bill in its tracks when he announced his opposition in December. Democrats need all of their 50 caucus members to back the legislation for it to get to Biden’s desk. Manchin has **expressed support for the environmental provisions**, but moving ahead would mean cuts to other programs, including an expanded child tax credit, to win his vote. But Smith said it’s important to be practical and get as much as possible out of the negotiations. “I’m a progressive in the caucus but I’m also practical, and I think this is the practical, commonsense way of moving forward to accomplish the best that we can,” she said. Democrats in Congress have historically failed to move major climate change legislation forward and have suffered from high-profile failures like the Obama-era Waxman-Markey bill. Democrats have limited options for getting this type of spending across, give the budgetary rules that allow them to avoid a filibuster that would allow the GOP to block their measure. It’s unlikely that 10 Republicans would join Democrats on many of their climate provisions. The New York Times recently asked all 50 Republicans if they would support the climate provisions as a standalone and **none of them said that they would.** Senate Finance Committee Chairman Ron Wyden (D-Ore.) told reporters Thursday that he saw Biden’s latest remarks as **establishing a way forward** for some provisions like climate. “What the president did last night, and he and I talked about this a number of times, is he created a path for a handful of provisions where we've got a lot of strong support, and it starts with climate. It starts with health care,” he said. Biden, during his Wednesday press conference said, “I think we can break the package up,” “Get as much as we can now and fight for the rest later,” he added. The president also said that he believes Democrats can pass more than $500 billion in energy and environment spending, a figure close to the White House’s proposed $555 billion of climate and clean energy spending from October. Manchin earlier this month said that climate is an area “we probably can come to an agreement much easier than anything else” and **specifically touted clean energy tax credits.**

#### Large President-led national space policies incite immense partisan backlash that spills over to kill the entire political agenda

Dreier 16 [Casey Dreier, Chief Advocate & Senior Space Policy Adviser for The Planetary Society, April 13, 2016. “Does Presidential Intervention Undermine Consensus for NASA?” https://www.planetary.org/blogs/casey-dreier/2016/0413-does-a-strong-president-help-or-hurt-consensus-on-NASA.html]

To see how this happens, I recommend reading the book “[Beyond Ideology](http://smile.amazon.com/Beyond-Ideology-Politics-Principles-Partisanship/dp/0226470768/ref=smi_www_rco2_go_smi_g2243582042?_encoding=UTF8&*Version*=1&*entries*=0&ie=UTF8)” by Frances Lee. The author’s larger premise is that issues having no intrinsic relation to stated party ideology have become increasingly polarized in recent years. This is a function of the two party nature of our political system. If your party coalition wins, the other one loses. It’s [It is] zero-sum. Your party can win in one of two ways: you can make a better pitch to voters by demonstrating the superiority of your agenda; or you can undermine and stymie the agenda of the opposition party, making them unpopular with voters, and pick up the seats that they lose. Since you’re the only other political party, you gain in either scenario. I’m not sure if you’ve noticed, but the “undermine and stymie” approach has been popular for quite some time now in the U.S. Congress. Given this situation, the President and their policies naturally become the symbolic target of the opposition party. Anything promoted by the President effectively induces opposition by association. Lee demonstrates the magnitude of this induced polarization on various types of issues. For highly polarized issues like the role of government in the economy, or social issues, the impact is minimal—the opposition has already been clearly defined and generally falls into clearly defined ideologies of the Republican and Democratic parties. But for issues that do not fit readily into a predefined political ideology—like space—the induced polarization by the President can be significant. In fact, Lee showed that space, science, and technology issues incur the greatest increase in partisanship based on their inclusion in the Presidential agenda. One need only look to at the responses by political operatives of the opposing party to the strong human spaceflight proposals by [Barack Obama in 2010](http://www.shelby.senate.gov/public/index.cfm/mobile/newsreleases?ID=25F3AD2E-802A-23AD-4960-F512B9E205D2), [George W. Bush in 2004](http://www.nbcnews.com/id/3950099/ns/technology_and_science-space/t/bush-sets-new-course-moon-beyond/#.Vw3UMRMrKHo), and [George H.W. Bush in 1989](http://www.nytimes.com/1989/07/21/us/president-calls-for-mars-mission-and-a-moon-base.html) to see this reflected in recent history. This isn’t to say that Presidents can’t have a significant impact on the space program. Clearly they can. But the broad consensus needed for stability after their departure from office may be undermined by the very priority they gave it during their tenure. It what amounts to a mixed blessing for NASA, the U.S. space program does have an unusually strong bipartisan group of politicians who support the program due to NASA centers in a variety of states throughout the union. Berger notes this throughout his article, and it does, in a way, act as force that is resistant to change for good and bad. This mitigates somewhat the pure polarization seen on other science and technology issues. But for a Journey to Mars—a major effort that would, at best, require stability and significant funding over many Presidential administrations—that may not be enough. Perhaps the solution is for the next President to maintain a light touch on space. Maybe they should speak softly through the budget process, and avoid the Kennedyesque speeches and declarations to Congress that induce the types of partisanship we so dearly need to avoid.

#### Republicans want private space exploration

Jeff Foust 16 [PhD Planetary Sciences, Senior Staff Writer @ SpaceNews], "Republican platform endorses commercial space partnerships," SpaceNews, 7-19-2016 <https://spacenews.com/republican-platform-endorses-commercial-space-partnerships/> C.VC

WASHINGTON — The new platform of the Republican Party includes language supporting the use of public-private partnerships to develop space capabilities, an approach that has been used by administrations of both major political parties.

The platform, formally approved by delegates at the Republican party convention July 18 in Cleveland, also features language supporting “unfettered access” to space and increasing the number of scientific missions.

The 54-page document includes two paragraphs about space in a section about technology policy nearly one page long. One paragraph focuses on the use of public-private partnerships.

“The public-private partnerships between NASA, the Department of Defense, and commercial companies have given us technological progress that has reduced the cost of accessing space and extended America’s space leadership in the commercial, civil, and national security spheres,” it states. “The entrepreneurship and innovation culture of the free market is revitalizing the nation’s space capabilities, saving taxpayer money, and advancing technology critical to maintain America’s edge in space and in other fields.”

The platform doesn’t give specific examples of those partnerships, but NASA has made significant use of them under both the current and previous presidential administrations. NASA started the Commercial Orbital Transportation Services (COTS) program in 2005 to develop spacecraft to transport cargo to the International Space Station. COTS was run as a public-private partnership through the use of funded Space Act Agreements, with companies expected to supplement the NASA funds with their own to support vehicle development.

COTS led to the development of SpaceX’s Falcon 9 rocket and Dragon spacecraft, and Orbital Sciences Corp.’s Antares rocket and Cygnus spacecraft. Both companies won Commercial Resupply Services contracts from NASA to transport cargo to and from the ISS in December 2008, a month before the end of the presidency of George W. Bush.

Under the Obama Administration, NASA adopted a similar approach for commercial crew systems, awarding a series of funded Space Act Agreements to several companies to support vehicle and other technology capabilities. NASA ultimately gave contracts in September 2014 to Boeing and SpaceX for their CST-100 Starliner and Crew Dragon spacecraft.

The following paragraph of the platform offered more general policy guidance for civil and national security space. “To protect our national security interests and foster innovation and competitiveness, we must sustain our preeminence in space by launching more scientific missions, guaranteeing unfettered access, and ensuring that our space-related industries remain a source of scientific leadership and education,” it states.

#### BBB climate provisions k2 methane emissions and leak detection

**Casten 1/21** - a member of the House of Representatives, representing the Sixth District of Illinois (Sean, “To Fully Mitigate Climate Change, We Need to Curb Methane Emissions,” *Scientific American*, 1-21-22, <https://www.scientificamerican.com/article/to-fully-mitigate-climate-change-we-need-to-curb-methane-emissions/>)

To Fully Mitigate Climate Change, We Need to Curb Methane Emissions It’s been more than two months since the House of Representatives passed the Build Back Better Act—a bill that would make desperately needed and decades-overdue strides toward the U.S. meeting its moral responsibility to combat the climate crisis. But instead of moving into a new year on the hope that would come with the Senate passing and President Biden signing this historic legislation into law, I’m terrified—and furious—that **we’re tripping at the finish line.** Ahead of COP26, the United Nations climate change conference in November, President Joe Biden committed the U.S. to reducing our greenhouse gas emissions by half by 2030. Having run for Congress on a climate platform after spending two decades combating climate change in the private sector, I know that reducing our greenhouse gas emissions is what’s right for our environment—and for our wallets. If we want to have a shot at meeting that goal, we must find a way to implement the provisions in the House version of the Build Back Better Act that science tells us will reduce emissions quickly, cheaply and most dramatically. One of the most critical and expedient moves we can make is to reduce methane emissions. Methane is a rapidly accelerating part of the climate problem. It is the primary component of natural gas, and it warms the planet more than 80 times as quickly as a comparable volume of atmospheric CO2 over a comparable amount of time. On the one hand, while burning natural gas produces about half the CO2 emissions as burning coal, methane leaking into the atmosphere **more than eliminates those environmental benefits.** Moreover, methane pollution, which is a primary component of ground-level ozone and emitted alongside toxic chemicals such as benzene, has been linked to heart disease, birth defects, asthma and other adverse health impacts. These affect frontline and fenceline communities, the majority of whom are people of color, the hardest. Eliminating those leaks is perhaps the biggest “bang for the buck” action we can take, and the Build Back Better legislation has built within it a program that pairs grants to natural gas companies to help monitor and reduce methane pollution at oil and gas operations with fines on companies who instead break the rules. The program ties into the Global Methane Pledge that President Biden created at COP26. More than 100 countries signed on to a 30 percent reduction of methane levels by 2030. Reducing methane pollution could also reduce adverse health for those in the immediate vicinity of polluters. To meet this goal, we can use existing technology to monitor for and prevent leaks at oil and gas drilling, production, and transmission sites, and prohibit routine venting and flaring of methane gas. This one set of actions would get us most of the way to that goal and is exactly why the Build Back Better Act is so critical. President Biden understands we have a golden opportunity at a critical moment. His administration has already taken a number of important executive actions to eliminate methane emissions at the source: on the same day he and climate envoy John Kerry announced the Global Methane Pledge, the Environmental Protection Agency and the Departments of the Interior and Transportation rolled out new or strengthened rules to tackle methane emissions from oil and gas operations, landfills, pipelines and agriculture. But we can’t get there on executive action alone. While eliminating methane emissions is essential to our fight against climate change building the leak monitoring system that Build Back Better currently calls for would create tens of thousands of jobs in the manufacturing and service sectors and spur hundreds of billions in economic growth.

**Methane emissions lock in irreversible warming**

**Howarth 14** [Robert Howarth, PhD, Director, Agriculture, Energy & Environment Program, Chair, International SCOPE Biofuels Program, David R. Atkinson Professor of Ecology and Environmental Biology – Cornell, “A bridge to nowhere: methane emissions and the greenhouse gas footprint of natural gas,” Energy Science & Engineering, Volume 2, Issue 2, June, 2014]

The GWP of Methane While methane is far more **effective** as a greenhouse gas than carbon dioxide, methane has an atmospheric lifetime of only 12 years or so, while carbon dioxide has an effective influence on atmospheric chemistry for a century or longer [34]. The time frame over which we compare the two gases is therefore **critical**, with methane becoming relatively less important than carbon dioxide as the timescale increases. Of the major papers on methane and the GHG for conventional natural gas published before our analysis for shale gas, one modeled the relative radiative forcing by methane compared to carbon dioxide continuously over a 100-year time period following emission [2], and two used the global warming approach (GWP) which compares how much larger the integrated global warming from a given mass of methane is over a specified period of time compared to the same mass of carbon dioxide. Of the two that used the GWP approach, one showed both 20-year and 100-year GWP analyses [3] while another used only a 100-year GWP time frame [4]. Both used GWP values from the Intergovernmental Panel on Climate Change (IPCC) synthesis report from 1996 [35], the **most reliable estimates** at the time their papers were published. In subsequent reports from the IPCC in 2007 [36] and 2013 [34] and in a paper in Science by workers at the NASA Goddard Space Institute [37], these GWP values have been **substantially increased**, in part, to account for the **indirect effects** of methane on other **radiatively active substances** in the atmosphere such as ozone (Table 2). In Howarth et al. [8], we used the GWP approach and closely followed the work of Lelieveld and colleagues [3] in presenting both integrated 20 and 100 year periods, and in giving equal credence and interpretation to both timescales. We upgraded the approach by using the most recently published values for GWP at that time [37]. These more recent GWP values **increased** the relative warming of methane compared to carbon dioxide by 1.9-fold for the 20-year time period (GWP of 105 vs. 56) and by 1.6-fold for the 100-year time period (GWP of 33 vs. 21; Table 2). Our conclusion was that for the 20-year time period, **shale gas had a larger GHG than coal or oil** even at our low-end estimates for methane emission (Fig. 1); conventional gas also had a larger GHG than coal or oil at our mean or high-end methane emission estimates, but not at the very low-end range for methane emission (the best-case, low-emission scenario). At the 100-year timescale, the influence of methane was much diminished, yet at our high-end methane emissions, the GHG of both shale gas and conventional gas still exceeded that of coal and oil (Fig. 1). Of nine new reports on methane and natural gas published in 9 months after our April 2011 paper [8], six only considered the 100-year time frame for GWP, two used both a 20- and 100-year time frame, and one used a continuous modeling of radiative forcing over the 0–100 time period (Table 2). Of the six papers that only examined the 100-year time frame, all used the **lower GWP value of** 25 from the 2007 IPCC report rather than the higher value of 33 published by Shindell and colleagues in 2009 that we had used; this higher value better accounts for the indirect effects of methane on global warming. Many of these six papers implied that the IPCC dictated a focus on the 100-year time period, **which is simply not the case**: the IPCC report from 2007 [36] presented both 20- and 100-year GWP values for methane. And two of these six papers criticized our inclusion of the 20-year time period as inappropriate [14, 17]. I strongly disagree with this criticism. In the time since April 2011 I have come increasingly to believe that it is essential to consider the role of methane on timescales that are **much shorter than 100 years**, in part, due to **new science on methane** and global warming presented since then [34, 41, 42], briefly summarized below. The **most recent synthesis** report from the IPCC in 2013 on the physical science basis of global warming highlights the **role of methane** in global warming at **multiple timescales**, using GWP values for 10 years in addition to 20 and 100 years (GWP of 108, 86, and 34, respectively) in their analysis [34]. The report states that “there is no scientific argument for selecting 100 years compared with other choices,” and that “the choice of time horizon …. depends on the relative weight assigned to the effects at different times” [34]. The IPCC further concludes that at the 10-year timescale, the current global release of methane from all anthropogenic sources **exceeds** (slightly) **all anthropogenic carbon dioxide emissions** as agents of global warming; that is, **methane emissions are more important** (slightly) **than carbon dioxide** emissions for driving the **current rate** of global warming. At the 20-year timescale, total global emissions of methane are equivalent to over 80% of global carbon dioxide emissions. And at the 100-year timescale, current global methane emissions are equivalent to slightly less than 30% of carbon dioxide emissions [34] (Fig. 3). This difference in the time sensitivity of the climate system to methane and carbon dioxide **is critical**, and **not widely appreciated** by the policy community and even some climate scientists. While some note how the long-term momentum of the climate system is driven by carbon dioxide [15], the climate system is **far more immediately responsive** to changes in methane (and other short-lived radiatively active materials in the atmosphere, such as black carbon) [41]. The model published in 2012 by Shindell and colleagues [41] and adopted by the United Nations [42] predicts that unless emissions of methane and black carbon are reduced **immediately**, the Earth's average surface temperature will warm by 1.5°C by about 2030 and by 2.0°C by 2045 to 2050 **whether or not carbon dioxide emissions are reduced**. Reducing methane and black carbon emissions, even if carbon dioxide is not controlled, **would significantly slow the rate of global warming and postpone reaching the 1.5°C and 2.0°C marks by 15–20 years**. Controlling carbon dioxide as well as methane and black carbon emissions further slows the rate of global warming after 2045, through at least 2070 [41, 42] (Fig. 4). Why should we care about this warming over the next few decades? At temperatures of 1.5–2.0°C above the 1890–1910 baseline, the risk of a fundamental change in the Earth's climate system becomes **much greater** [41-43], possibly leading to **runaway feedbacks** and **even more global warming**. Such a result **would dwarf any possible benefit from reductions in carbon dioxide emissions** over the next few decades (e.g., switching from coal to natural gas, which does reduce carbon dioxide but also increases methane emissions). One of many mechanisms for such catastrophic change is the melting of methane clathrates in the oceans or melting of permafrost in the Arctic. Hansen and his colleagues [43, 44] have suggested that warming of the Earth by 1.8°C may trigger a large and rapid increase in the release of such methane. While there is a wide range in both the magnitude and timing of projected carbon release from thawing permafrost and melting clathrates in the literature [45], warming consistently leads to greater release. This release can in turn cause a feedback of accelerated global warming [46]. To state the converse of the argument: the influence of today's emissions on global warming 200 or 300 years into the future will largely reflect carbon dioxide, and not methane, unless the emissions of methane lead to tipping points and a fundamental change in the climate system. **And that could happen as early as within the next two to three decades.** An **increasing body of science** is developing **rapidly that emphasizes** the need to consider methane's influence over the decadal timescale, and the need to reduce methane emissions. Unfortunately, some recent guidance for life cycle assessments specify only the 100-year time frame [47, 48], and the EPA in 2014 still uses the GWP values from the IPCC 1996 assessment and only considers the 100-year time period when assessing methane emissions [49]. In doing so, they underestimate the global warming significance of methane by 1.6-fold compared to more recent values for the 100-year time frame and by four to fivefold compared to the 10- to 20-year time frames [34, 37].

#### Extinction

Sprat 19 [David Spratt is a Research Director for Breakthrough National Centre for Climate Restoration, Melbourne, and co-author of Climate Code Red: The case for emergency action, and Ian T. Dunlop is a member of the Club of Rome, formerly an international oil, gas and coal industry executive, chairman of the Australian Coal Association, chief executive of the Australian Institute of Company Directors, and chair of the Australian Greenhouse Office Experts Group on Emissions Trading, “Existential climate-related security risk: A scenario approach,” BT Policy Paper, September 5, May 2019-2020, <https://docs.wixstatic.com/ugd/148cb0_90dc2a2637f348edae45943a88da04d4.pdf>]

By 2050, there is broad scientific acceptance that system **tipping-points** for the West Antarctic Ice Sheet and a sea-ice-free Arctic summer were passed well before 1.5°Cof warming, for the Greenland Ice Sheet well before 2°C, and for widespread **permafrost loss and large-scale Amazon drought** and dieback by 2.5°C. The “hothouse Earth” scenario has been realised, and Earth is headed for another degree or more of warming, especially since human greenhouse emissions are still significant.20 While sea levels have risen 0.5 metres by 2050, the increase may be 2–3 metres by 2100, and it is understood from historical analogues that seas may eventually rise by more than 25 metres. Thirty-five percent of the global land area, and 55 percent of the **global population**, are **subject to** more than 20 days a year of **lethal heat conditions**, beyond the threshold of human survivability. The destabilisation of the Jet Stream has very significantly affected the intensity and geographical distribution of the Asian and West African monsoons and, together with the further slowing of the Gulf Stream, is impinging on life support systems in Europe. North America suffers from **devastating weather extremes** including wildfires, heatwaves, drought and inundation. The summer monsoons in China have failed, and water flows into the great rivers of Asia are severely reduced by the loss of more than one-third of the Himalayan ice sheet. **Glacial loss reaches 70 percent** in the Andes, and rainfall in Mexico and central America falls by half. Semi-permanent El Nino conditions prevail. Aridification emerges over more than 30 percent of the world’s land surface. **Desertification is severe** in southern Africa, the southern Mediterranean, west Asia, the Middle East, inland Australia and across the south-western United States. Impacts: **A number of ecosystems collapse**, including coral reef systems, the Amazon rainforest and in the Arctic. Some poorer nations and regions, which lack capacity to provide artificially-cooled environments for their populations, become unviable. **Deadly heat conditions persist** for more than 100 days per year in West Africa, tropical South America, the Middle East and South-East Asia, which together with land degradation21 and rising sea levels contributes to perhaps **a billion people being displaced.** Water availability decreases sharply in the most affected regions at lower latitudes (dry tropics and subtropics), affecting about two billion people worldwide. **Agriculture becomes nonviable** in the dry subtropics. Most regions in the world see a significant drop in food production and increasing numbers of extreme weather events, **including heat waves, floods and storms**. Food production is inadequate to feed the global population and **food prices skyrocket**, as a consequence of a one-fifth decline in crop yields, a decline in the nutrition content of food crops, a catastrophic decline in insect populations, desertification, monsoon failure and chronic water shortages, and conditions too hot for human habitation in significant food-growing regions. The lower reaches of the agriculturally-important river deltas such as the Mekong, Ganges and Nile are inundated, and significant sectors of some of the world’s most populous cities — including Chennai, Mumbai, Jakarta, Guangzhou, Tianjin, Hong Kong, Ho Chi Minh City, Shanghai, Lagos, Bangkok and Manila — are abandoned. Some small islands become uninhabitable. Ten percent of Bangladesh is inundated, displacing 15 million people. According to the Global Challenges Foundation’s Global Catastrophic Risks 2018 report, even for 2°C of warming, more than a billion people may need to be relocated due to sea-level rise, and In high-end scenarios “**the scale of destruction is beyond our capacity to model**, with a high likelihood of human civilisation coming to an end”.22 National security consequences: For pragmatic reasons associated with providing only a sketch of this scenario, we take the conclusion of the ​Age of Consequences ‘Severe’ 3°C scenario developed by a group of senior US national-security figures in 2007 as appropriate for our scenario too: Massive nonlinear events in the global environment give rise to ​massive nonlinear societal events​. In this scenario, nations around the world **will be ​overwhelmed** by the scale of change and pernicious challenges, **such as pandemic disease**. The **internal cohesion** of nations **will be under great stress**, including in the United States, both as a result of a dramatic rise in migration and changes in agricultural patterns and water availability. The **flooding** of coastal communities **around the world**, especially in the Netherlands, the United States, South Asia, and China, has the potential to challenge regional and even national identities.​ **Armed conflict between nations over resources**, such as the Nile and its tributaries, **is likely and nuclear war is possible**. The social consequences range from increased religious fervor to ​outright chaos​. In this scenario, climate change provokes ​a permanent shift in the relationship of humankind to nature​’.23 (emphasis added)

### Case

#### Newest research proves even worst-case nuclear winter is survivable – assumes secondary effects, fallout, arsenal sizes,

**Rodriguez 20** [Luisa Rodriguez is research fellow at the Forethought Foundation for Global Priorities Research. Previously, she researched nuclear war at Rethink Priorities and as a visiting researcher at the Future of Humanity Institute, "What is the likelihood that civilizational collapse would directly lead to human extinction (within decades)? - EA Forum", 24th Dec 2020, <https://forum.effectivealtruism.org/posts/GsjmufaebreiaivF7/what-is-the-likelihood-that-civilizational-collapse-would#Concrete_example__A_large_nuclear_war_that_causes_a_nuclear_winter//imp>]

Case 2: 90% population loss, infrastructure damage, and extreme climate change (e.g. nuclear war that caused nuclear winter) In a scenario in which a catastrophe causes the deaths of 90% of the population (800 million survivors), major infrastructure damage, and climate change — for example, a severe, global nuclear war that caused a nuclear winter — I believe the question of whether humans would be able to meet their basic needs becomes more difficult.[14] The questions I consider for this scenario are: What is the likelihood that survivors are able to continue to survive using traditional forms of agriculture, given a catastrophe that causes severe infrastructure damage and climate change? What is the likelihood that radiation causes extinction? What is the likelihood that humanity would survive in the event of conflict immediately following the catastrophe? What is the likelihood that survivors are able to continue to survive using traditional forms of agriculture? Time spent on this section: 2–3 hours Types of sources: Academic literature, non-academic reports, and expert interviews Expert judgment: Several experts, including ALLFED director David Denkenberger, have affirmed this conclusion — they do not expect humanity to dip below the minimum viable population even in relatively extreme sun-blocking scenarios. Literature review: The nature of all of the catastrophes we know of that would cause extreme global cooling (e.g. nuclear winter, asteroid impacts) **would have unevenly distributed impacts** — causing extreme global cooling in some parts of the world, but more moderate cooling in others. For example, in the case of a nuclear war between the US and Russia, nuclear winter models suggest that the most **severe climate effects would be limited** to the Northern Hemisphere, where temperatures would fall by 10–30 degrees C. But in the Southern Hemisphere, and especially at the equator, those effects would be much less severe: between 5–10 degrees Celsius. With heterogeneous impacts like this, it’s likely that agriculture would still be possible in some regions — especially in New Zealand and Australia, and possibly in South America and Central Africa.[15] To be clear, I’m describing a very grim scenario, in which basically everyone in the Northern Hemisphere — and in many parts of the Southern Hemisphere — would be unable to grow food using standard agricultural techniques. Given this, I expect there would be mass starvation and violent competition and conflict until a new equilibrium was reached, one where the remaining survivors didn’t exceed the Earth’s carrying capacity. While I expect this would be a truly terrible period of widespread suffering, I believe this equilibrium would be reached long before the population got anywhere near the minimum viable population. My best guess is the population would fall to hundreds of thousands to tens of millions, but not much lower. While I haven’t looked into this much, I feel fairly convinced that hundreds of thousands or **millions** of people **could survive** using traditional approaches to agriculture in parts of the world with more moderate climate effects (and basic mitigation strategies, like switching to crop types that are more resilient to temperature and precipitation fluctuations). And as with Case 1, at least some of the survivors in a Case 2 scenario would probably be able to survive the immediate aftermath of a catastrophe that caused civilizational collapse by exploiting food and other supplies in stores and larger stockpiles. This would give survivors some buffer time to learn additional skills required to survive once those supplies run out (e.g. fishing) or develop the techniques necessary to produce food using methods that don’t rely on climate factors like warm temperatures and regular precipitation. BOTEC: The longer the buffer time, the more likely humanity would be to subsequently survive. But there are a number of different considerations (relative to Case 1) that affect the calculus of just how long such a grace period would be in the context of a catastrophic event like a nuclear war that killed 90% of people and caused a nuclear winter. So I’ve done a similar exercise to the one above where I try to account for some of those differences. Note: As above, the following BOTEC relies on particularly poor sources, makes a bunch of dubious assumptions (discussed more below), and I’m not confident I’ve thought of all of the most important supplies. It should be considered very rough. TABLE5 See table note here.[16] Bottom line: I think it’s extremely likely that these supplies would last somewhere between around a year and a decade or more. I expect it would be closer to the lower end, given that competition and violence could lead to the depletion of supplies more quickly than if the population were reduced to a smaller number by the catastrophe directly. All this in mind, I think it is very likely that the survivors would be able to learn enough during the grace period to be able to feed and shelter themselves ~indefinitely. What is the likelihood that radiation causes extinction? Time spent on this section: 2–3 hours Types of sources: Academic papers, Wikipedia, and interviews with experts Literature review: In the aftermath of a nuclear war, radioactive fallout from the nuclear detonations would have long-lasting health impacts. In **the most extreme** nuclear war **scenario**s considered by academics (a nuclear war between the US and Russia and their allies, using 10,000 megatons (MT) of nuclear bombs), approximately 30% of the geographic area in the Northern Hemisphere would have enough fallout to be lethal to any adult in the area (Ehrlich et al., 1983). The current US and Russian nuclear arsenals don’t currently have that kind of megatonnage (they currently have closer to 2,500 MT). If we naively assume that radiation scales linearly, we might expect a modern day US-Russia nuclear war to contaminate up to 7.5% of the land area of the Northern Hemisphere. This may not sound like much, but consider that 95% of the world’s population lives on just 10% of its land area — meaning that 7.5% of land area could be home to millions or even billions of people. What’s more, tens to hundreds of millions more might be exposed to enough radiation to be more susceptible to cancer for the rest of their lives. On top of this, there are currently around 440 civilian nuclear power reactors scattered around the world, and likely tens or hundreds more military reactors. These have fail-safes and automatic shut down measures that are designed to ensure that all of the nuclear material in these reactors would be safely contained in the event of a global catastrophe that meant people stopped attending to them. Concretely, these fail safes make sure that water continues to be circulated around the nuclear fuel to ensure it doesn’t get so hot it causes a meltdown — i.e., an event where the nuclear core partially or completely melts, which might allow the nuclear fuel to breach its multiple layers of containment and leak out into the environment. If fuel did reach the environment, the radioactive fallout could spread across continents, creating exposure levels ranging from immediately fatal (in areas ranging from tens to thousands of square kilometers) to non-lethal but causing potential higher rates of cancer and infertility. But some of these fail-safes could plausibly fail during a catastrophe that caused infrastructure damage (or afterward, if any components of the fail system degraded). For example, some nuclear reactors rely on backup generators to power the pumps that keep water circulating in the core of the reactor. If those backup generators eventually all broke down, the reactor might melt down. I currently don’t have a good sense of how likely these failures would be. Newer nuclear reactors rely on more robust safety systems, with parts that wouldn’t break down as easily. And all nuclear reactor safety systems are designed to account for infrastructure damage caused by earthquakes and other physical shocks. But in a large-scale nuclear war, it seems very plausible that at least some nuclear reactors would melt down. My best guess is that this wouldn’t happen at a large scale, but even if it did, some areas would likely be far enough away from reactors to be spared the radioactive contamination. For example, Australia has just one nuclear reactor. Even if that reactor were to melt down, much of Australia would likely remain uncontaminated (Australia is just under 3 million square miles, and the Chernobyl meltdown is estimated to have contaminated under 60,000 square miles; and only a much smaller fraction of that area was sufficiently contaminated as to be lethal to humans). Bottom line: While radioactive fallout from nuclear detonations and power plant meltdowns would increase the death toll in the years following the collapse, I expect it **wouldn’t be** widespread enough to be immediately **fatal to everyone**, nor would it cause fertility rates or life expectancy to decrease enough to threaten extinction. And at the very least, **some** areas **are sufficiently far away as to be** relatively **safe** from radioactive fallout. What is the likelihood that humanity would survive in the event of conflict immediately following the catastrophe? Time spent on this section: 1–2 hours Types of sources: Academic literature, expert interviews, and speculation Historical base rate: In Case 2, it seems slightly more plausible to me that violence would lead to human extinction than in Case 1, but still fairly unlikely. I don’t think human extinction could be caused by a conflict fought with conventional weapons; **there would** just **be** **too many survivors (~800 million)** to be killed in conventional warfare (compare this to WWI and WWII, during which ~20 million and ~75 million people were killed, respectively). Weapons of mass destruction: My best guess is that the only way violence in the wake of a Case 2 civilizational collapse could directly lead to human extinction is if one group of **survivors** had access to and deployed weapons of mass destruction. This seems unlikely to me, first because it seems hard to imagine a group of survivors incapable of recovering critical infrastructure — and barely capable of meeting even their basic needs — would be able to successfully deploy weapons of mass destruction (though I’m not very confident about this). Second, it’s hard to imagine a scenario where the use of weapons of mass destruction kills millions of survivors, spread all over the world, without modern technologies like transportation. For example, with potentially many survivor groups, it seems hard to imagine how nuclear detonations would kill ~everyone despite the fact that the groups would likely be spread out all over the world, potentially in small bands that can’t each be individually targeted. Similarly, it’s hard to imagine how a pathogen could spread ~everywhere when survivors would likely have greatly reduced mobility (the latter isn’t obviously impossible, but it at least seems exceedingly difficult to me). There’s one counterargument I find somewhat persuasive, which is that it seems possible that all of the survivors might be confined to a relatively small area (for example, if only a small fraction of the Earth’s land area is habitable), making them more vulnerable to a single, large attack. If this were the case, it’s easier for me to imagine that the use of weapons of mass destruction could kill all of the remaining survivors. This would presumably mean the aggressors would be killing themselves, which makes it seem even less likely to me. But we’ve seen humans come dangerously close to threatening their own survival before, often because human aggressors aren’t always good at predicting how cascading effects could threaten their survival as well. A random example to make this concrete: If all of the survivors of a nuclear war were confined to Australia, which might be less impacted by a nuclear winter, one group might choose to use nuclear weapons against another group, not realizing that the radioactive fallout or further climate change could make Australia uninhabitable, even for them. Bottom line: I expect the survivors in Case 2 would not deploy weapons of mass destruction against their competitors, as it would likely pose a pretty big risk to the aggressor as well as the target. But I’m uncertain about this — humans have come close to making similarly self-destructive choices before. Thankfully, even if one group did use weapons of mass destruction against their competitors, I still think it’s very unlikely that their use would cause human extinction. This is because except in a few very specific and very strange scenarios, I expect the survivors would be too geographically distributed and disconnected to be wiped out by a single act of aggression. I therefore expect the result would be a much higher death toll, but not extinction. Concrete example: A large nuclear war that causes a nuclear winter So what, concretely, do I think would happen in the event of a catastrophe like a nuclear war that led to the death of 90% of the population, and caused severe infrastructure damage and significant global cooling? I expect that, in addition to the billions of people killed in the initial catastrophe, hundreds of millions or more would likely die in the famines and violent competition that followed. But my best guess is that hundreds of thousands to hundreds of millions of the survivors of the initial catastrophe would survive this violent period. I think it’s extremely likely these survivors would be able to support themselves using leftover food stocks and supplies, before eventually working out how to feed themselves through traditional agriculture and fishing and/or modified agriculture (using methods that don’t rely on climate factors like warm temperatures and regular precipitation). **All of the catastrophes** we know of **that would lead to extreme cooling** would only do so **for** 1–**10 years, and agriculture would become possible again once the climate began to return to normal**. At that point, it seems even more likely that the surviving humans would be able to meet their own basic needs by returning to traditional forms of agriculture. My key uncertainties are around whether I’m putting too much weight on the idea that humans would figure out how to subsist without traditional agriculture just because it’s technically possible, and whether conflict could lead to extinction through channels I haven’t foreseen. Another toy calculation suggests that these **uncertainties** probably **aren’t troubling enough to change my bottom line**. Note: I again assume each group’s fate is independent of the fates of other groups. I actually think this is a pretty reasonable assumption in this case. I expect that the **survivors** of a catastrophe like a severe nuclear war **would end up somewhat spread out** (at least across the Southern Hemisphere), as doing so would create less competition for resources within a smaller area (I discuss this more later). The farther apart the surviving groups are, the less likely they are to be affected by the same shocks (natural disasters, disease outbreaks, conflict). Additionally, in the event of a catastrophe like a nuclear war, transportation, communication, and other technologies that facilitate contact between geographically distributed groups would be enormously limited. This would further limit the extent to which each group’s fate ended up relating to another’s. There would be other sources of variation between groups that made their fates less correlated: Some groups might be made up mostly of farmers, while others will be made up of lawyers, some groups will tend toward cooperation, while others toward conflict, plus pure randomness (e.g. some groups might have a high proportion of survivors with genetic immunity to a particular disease). But there are also factors that point in the other direction — factors that suggest the surviving groups would be at least somewhat correlated. For example, nuclear winter climate conditions, while nonuniform, would nonetheless impact all surviving groups. Similarly, more severe natural disasters might affect large regions, meaning that at least all of the survivor groups at the regional level might end up experiencing very similar challenges to survival simultaneously. Likewise, there might be things about "human nature" that would be shared amongst all survivors. For example, it’s possible that all of the survivors, having witnessed the initial catastrophe, would have similar psychological experiences — like shock, stress, and social distrust, among others — that would make it more difficult to survive and cooperate. As above, the higher the true correlation between survivor groups, the more my toy calculations will cause me to underestimate the probability that all of the survivor groups would be wiped out. TABLE6 With 800 million survivors, the degree of pessimism you have to have about their ability to survive to end up believing that no groups would survive indefinitely is actually kind of extreme. The exact beliefs you’d have to have would depend on whether survivors were concentrated into a few big groups, or distributed in many smaller ones. Specifically: Even if you thought any given group of 100, 1,000, or 10,000 survivors had a 99% chance of being wiped out, it would still be virtually guaranteed that at least one group would survive. If you thought there was a 99% chance that any one of 800 groups of 100,000 people would be wiped out, there would still only be a 1 in 3,000 chance of extinction. The probability of extinction is higher (45%) if you believe that larger groups of 10 million would also have a 99% chance of being wiped out. But, again, to hold that view, you’d have to think that out of a group of 10 million people (again, bigger than the largest US city), not even a few hundred of those people would overcome the obstacles of the post-collapse environment (how to fish, how to farm despite global cooling, avoiding being killed by a hurricane or drought). I do not find this view very plausible. Similarly, the probability of extinction is very high indeed if you think that any given group of 100 million survivors has a 99% chance of being wiped out. Again, to believe extinction risk was that high, you’d have to think that there would be a 99% chance that none of the 100 million people would work out how to survive (for reference, only 14 countries have a population of 100 million or higher). Given all of this, my subjective judgment is that **it’s very unlikely that this scenario would more or less directly lead to human extinction.**

#### Rigorous climate simulations prove that hydrophilic black carbon results in a rainout effect that quickly reverses nuclear cooling

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

\*BC = Black Carbon

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

#### War now spurs disarm – otherwise, nuclear war is inevitable

Daniel **Deudney 18**. Associate Professor of Political Science at Johns Hopkins University. 03/15/2018. “The Great Debate.” The Oxford Handbook of International Security. www.oxfordhandbooks.com, doi:10.1093/oxfordhb/9780198777854.013.22. //reem

Although nuclear war is the oldest of these technogenic threats to civilization and human survival, and although important steps to restraint, particularly at the end of the Cold War, have been achieved, the nuclear world is increasingly changing in major ways, and in almost entirely dangerous directions. The third “bombs away” phase of the great debate on the nuclear-political question is more consequentially divided than in the first two phases. Even more ominously, most of the momentum lies with the forces that are pulling states toward nuclear-use, and with the radical actors bent on inflicting catastrophic damage on the leading states in the international system, particularly the United States. In contrast, the arms control project, although intellectually vibrant, is largely in retreat on the world political stage. The arms control settlement of the Cold War is unraveling, and the world public is more divided and distracted than ever. With the recent election of President Donald Trump, the United States, which has played such a dominant role in nuclear politics since its scientists invented these fiendish engines, now has an impulsive and uninformed leader, boding ill for nuclear restraint and effective crisis management. Given current trends, it is prudent to assume that sooner or later, and probably sooner, nuclear weapons will again be the used in war. But this bad news may contain a “silver lining” of good news. Unlike a general nuclear war that might have occurred during the Cold War, such a nuclear event now would probably not mark the end of civilization (or of humanity), due to the great reductions in nuclear forces achieved at the end of the Cold War. Furthermore, politics on “the day after” could have immense potential for positive change. The survivors would not be likely to envy the dead, but would surely have a greatly renewed resolution for “never again.” Such an event, completely unpredictable in its particulars, would unambiguously put the nuclear-political question back at the top of the world political agenda. It would unmistakeably remind leading states of their vulnerability It might also trigger more robust efforts to achieve the global regulation of nuclear capability. Like the bombings of Hiroshima and Nagasaki that did so much to catalyze the elevated concern for nuclear security in the early Cold War, and like the experience “at the brink” in the Cuban Missile Crisis of 1962, the now bubbling nuclear caldron holds the possibility of inaugurating a major period of institutional innovation and adjustment toward a fully “bombs away” future.

#### That’s good – war later is worse

**Turchin & Denkenberger 18** [Alexey Turchin & David Denkenberger. Turchin is a researcher at the Science for Life Extension Foundation; Denkenberger is with the Global Catastrophic Risk Institute (GCRI) @ Tennessee State University, Alliance to Feed the Earth in Disasters (ALLFED). 09/2018. “Global Catastrophic and Existential Risks Communication Scale.” Futures, vol. 102, pp. 27–38.]

2. “Civilizational collapse risks” As most human societies are fairly complex, a true civilizational collapse would require a drastic reduction in human population, and the break-down of connections between surviving populations. Survivors would have to rebuild civilization from scratch, likely losing much technological abilities and knowledge in the process. Hanson (2008) estimated that the minimal human population able to survive is around 100 people. Like X risks, there is little agreement on what is required for civilizational collapse. Clearly, different types and levels of the civilizational collapse are possible (Diamond, 2005) (Meadows, Randers, & Meadows, 2004). For instance, one definition of the collapse of civilization involves, collapse of long distance trade, widespread conflict, and loss of government (Coates, 2009). How such collapses relate to existential risk needs more research. 3. “Human extinction risks” are risks that all humans die, and no future generations (in the extended sense mentioned above) will ever exist. 4. “All life on Earth ends risks” involve the extinction of all life on earth. As this includes H. sapiens, such risks are at the very least on a par with human extinction, but are likely worse as the loss of biodiversity is higher, and (without life arising a second time) no other civilizations, human or otherwise, would be possible on Earth. 5. “Astronomical scale risks” include the demise of all civilizations in the affectable universe. This of course includes human extinction, and all life on Earth, and so again are at the very least on a par, and very likely much worse outcomes, than those two. 6. “S-risks” include collective infinite suffering (Daniel, 2017). These differ from extinction risks insofar as extinction leads to a lack of existence, whereas this concerns ongoing existence in undesirable circumstances. These also vary in scale and intensity, but are generally out of scope of this work. Even with a focus squarely on X Risk, global catastrophic risks and civilizational collapse are critically important. This is because there is at least some likelihood that global catastrophic risks increase the probability of human extinction risks—and the more extreme end of civilizational collapses surely would. Before shifting to a discussion of probability appropriate to X risk, we’ll discuss some reasons to link these kinds of risk. First, global risks may have a fat tail—that is a low probability of high consequences—and the existence of such fat tails strongly depend on the intrinsic uncertainty of global systems (Ćirković, 2012) (Baum, 2015), (Wiener, 2016) (Sandberg & Landry, 2015). This is especially true for risks associated with future world wars, which may include not only nuclear weapons, but weapons incorporating synthetic biology and nanotechnology, different AI technologies, as well as Doomsday blackmail weapons (Kahn, 1959). Another case are the risks associated with climate change, where runaway global warming is a likely fat tail (Obata & Shibata, 2012a), (Goldblatt & Watson, 2012). Second, global catastrophes could be part of double catastrophe (Baum, Maher, & Haqq-Misra, 2013) or start a chain of catastrophes (Tonn & and MacGregor, 2009), and in this issue (Karieva, 2018). Even if a single catastrophic risk is insufficient to wipe us out, an unhappy coincidence of such events could be sufficient, or under the wrong conditions could trigger a collapse leading to human extinction. Further, global catastrophe could weaken our ability to prepare for other risks. Luke Oman has estimated the risks of human extinction because of nuclear winter: “The probability I would estimate for the global human population of zero resulting from the 150 Tg of black carbon scenario in our 2007 paper would be in the range of 1 in 10,000 to 1 in 100,000” (Robock, Oman, & Stenchikov, 2007), (Shulman, 2012). Tonn also analyzed chains of events, which could result in human extinction and any global catastrophe may be a start of such chain (Tonn and MacGregor, 2009). Because this, we suggest that any global catastrophe should be regarded as a possible cause of human extinction risks with no less than 0.01 probability. Similarly, scenarios involving civilization collapses also plausibly increase the risk of human extinction. If civilization collapses, recovery may be slowed or stopped for a multitude of reasons. For instance, easily accessible mineral and fossil fuel resources might be no longer available, the future climate may be extreme or unstable, we may not regain sufficient social trust after the catastrophe’s horrors, the catastrophe may affect our genetics, a new endemic disease could prevent high population density, and so on. And of course, the smaller populations associated with civilization collapse are more vulnerable to being wiped out by natural events. We estimate that civilization collapse has a 0.1 probability of becoming an existential catastrophe. In section 4, this discussion will form the basis of our analysis of an X risk’s “severity”, which is the main target of our scale. Before getting there, however, we should first discuss the difficulties of measuring X risks, and related worries regarding probabilities. 3. Difficulties of using probability estimates as the communication tool Plain probability estimates are often used as an instrument to communicate X risks. An example is a claim like “Nuclear war could cause human extinction with probability P”. However, in our view, probability measures are inadequate, both for measuring X risks, and for communicating those risks. This is because of conceptual difficulties (3.1), difficulty in providing meaningful measurements (3.2), the possibility of interaction effects (3.3) and the measurement’s inadequacy for prioritization (3.4) purposes. After presenting these worries, we argue that the magnitude of probabilities is a better option, which we use in our tool (3.5). 3.1 Difficulties in defining X risk probabilities Frequentism applies to X risks only with difficulty. One-off events don’t have a frequency, and multiple events are required for frequentist probabilities to apply. Further, on a frequentist reading, claims concerning X risks cannot be falsified. Again, this is because in order to infer from occurrences to probability, multiple instances are required. Although these conceptual and epistemic difficulties may be analyzed and partly overcome in technical scientific and philosophical literature, they would overcomplicate a communication tool. Also, discussion of X risks sometimes involves weird probabilistic effects. Consider, for example, what (Ćirković, Sandberg, & Bostrom, 2010) call the ‘anthropic shadow’. Because human extinction events entail a lack of humans to observe the event after the fact, we will systematically underestimate the occurrence of such events in an extreme case of survivorship bias (the Doomsday Argument (Tegmark & Bostrom, 2005) is similar). All of this makes the probabilities attached to X risks extremely difficult to interpret, bad news for an intended communication tool, and stimulates obscure anthropic reasoning. In addition, the subtle features involved in applying frequentism to one-off events, would otherwise tamper with our decision making process. 3.2 Data & X Risk There are little hard data concerning global risks from which probabilities could be extracted. The risk of an asteroid impact is fairly well understood, both due to the historical record, and because scientists can observe particular asteroids and calculate their trajectories. Studies of nuclear winter (Denkenberger & Pearce, 2016), volcanic eruptions, and climate change also provide some risk probability estimates, but are less rigorously supported. In all other cases, especially technological risks, there are many (often contradicting) expert opinions, but little hard data. Those probability calculations which have been carried out are based on speculative assumptions, which carry their own uncertainty. In the best case, generally, only the order of magnitude of the catastrophe’s probability can be estimated. Uncertainty in GCRs is so high, that predictions with high precision are likely to be meaningless. For example, surveys could produce such meaningless over-precision. A survey on human extinction probability gave an estimate of 19 percent in the 21st century (Sandberg & Bostrom, 2008). Such measurements are problematic for communication, because probability estimates of global risks often do not include corresponding confidence intervals (Garrick, 2008). For some catastrophic risks, uncertainty is much larger than for others, because of objective difficulties in their measurement, as well as subjective disagreements between various approaches (especially in the case of climate change, resource depletion, population growth and other politicized areas). As we’ll discuss below, one response is to present probabilities as magnitudes. 3.3 Probability density, timing and risks’ interactions Two more issues with using discrete frequentist probabilities for communicating X risks are related to probability density and the interactions between risks. For the purpose of responding to the challenges of X risk, the total probability of an event is less useful than the probability density: we want to know not only the probability but the time in which it is measured. This is crucial if policy makers are to prioritize avoidance efforts. Also, probability estimates of the risks are typically treated separate: interdependence is thus ignored. The total probability of human extinction caused by risk A could strongly depend on the extinction probability caused by risks B and C and also of their timing. (See also double catastrophes discussed by Baum, Maher, & HaqqMisra, 2013 and the integrated risk assessment project (Baum, 2017). Further, probability distributions of different risks can have different forms. Some risks are linear, others are barrier-like, other logistical. Thus, not all risks can be presented by a single numerical estimate. Exponentially growing risks may be the best way to describe new technologies, such as AI and synthetic biology. Such risks cannot be presented by a single annual probability. Finally, the probability estimation of a risk depends on whether human extinction is ultimately inevitable. We assume that if humanity becomes an interstellar civilization existing for millions of years, it will escape any near-term extinction risks; the heat death of the universe may be ultimate end, but some think even that is escapable (Dvorsky, 2015). If near-term extinction is inevitable, it is possible to estimate which risks are more probable to cause human extinction (like actuaries do in estimating different causes of death, based in part on the assumption that human death is inevitable). If near-term human extinction is not inevitable, then there is a probability of survival, which is (1- P(all risks)). Such conditioning requires a general model of the future. If extinction is inevitable, the probability of a given risk is just a probability of one way to extinction compared to other ways. 3.4 Preventability, prioritizing and relation to the smaller risks Using bare probability as a communication tool also ignores many important aspects of risks which are substantial for decision makers. First, a probability estimate does not provide sufficient guidance on how to prioritize prevention efforts. A probability estimate does not say anything about the risk’s relation to other risks, e.g. its urgency. Also, if a risk will take place at a remote time in the future (like the Sun becoming a red giant), there is no reason to spend money on its prevention. Second, a probability estimate does not provide much information about the relation of human extinction risks, and corresponding smaller global catastrophic risks. For example, a nuclear war probability estimate does not disambiguate between chances that it will be a human extinction event, a global catastrophic event, or a regional catastrophe. Third, probability measures do not take preventability into account. Hopefully, measures will be taken to try and reduce X risks, and the risks themselves have individual preventability. Generally speaking, it ought to be made clear when probabilities are conditional on whether prevention is attempted or not, and also on the probability of its success. Probability density, and its relation with cumulative probability could also be tricky, especially as the probability density of most risks is changing in time. 3.5 Use of probability orders of magnitude as a communication tool We recommend using magnitudes of probabilities in communicating about X risk. One way of overcoming many of the difficulties of using probabilities as communication tool described above is to estimate probabilities with fidelity of one or even two orders of magnitude, and do it over large fixed interval of time, that is the next 100 years (as it the furthest time where meaningful prognoses exist). This order of magnitude estimation will smooth many of the uncertainties described above. Further, prevention actions are typically insensitive in to the exact value of probability. For example, if a given asteroid impact probability is 5% or 25%, needed prevention action will be nearly the same. For X risks, we suggest using probability intervals of 2 orders of magnitude. Using such intervals will often provide meaningful differences in probability estimates for individual risks. (However, expert estimates sometimes range from “inevitable” to “impossible”, as in AI risks). Large intervals will also accommodate the possibility of one risk overshadowing another, and other uncertainties which arise from the difficulties of defining and measuring X-risks. This solution is itself inspired by The Torino scale of asteroid danger, which we discuss in more detail below. The Torino scale has five probability intervals, each with a two order of magnitude difference from the next. Further, such intervals can be used to present uncertainty in probability estimation. This uncertainty is often very large for even approximately well-defined asteroid risks. For example, Garrick (Garrick, 2008) estimated that asteroid impacts on the contiguous US with at least 10 000 victims to have expected frequency between once 1: 1900 and 1: 520 000 years with 90 percent confidence. In other words, it used more than 2 orders of magnitude uncertainty. Of course, there is a lot more to be said about the relationship between X risks and probability—however here we restrict ourselves to those issues most crucial for our purpose, that is, designing a communication tool for X risks. 4. Constructing the scale of human extinction risks 4.1. Existing scales for different catastrophic risks In section 2 we established the connection between global catastrophic risks, civilizational collapse risks, human extinction and X risks; we explored the difficulty of the use of probabilities as a communication tool for X risks in section 3; now we can construct the scale to communicate the level of risk of all global catastrophic and X risks. Our scale is inspired by the Torino scale of asteroid danger which was suggested by professor Richard Binzel (Binzel, 1997). As it only measures the energy of impact, it is not restricted to asteroids but applies to many celestial bodies (comets, for instance). It was first created to communicate the level of risk to the public, because professionals and decision makers have access to all underlying data for the hazardous object. The Torino scale combines a 5 level color code and 11 level numbered codes. One of the Torino scale’s features is that it connects the size and the probability using diagonal lines, i.e., an event with a bigger size and smaller probability warrants the same level of attention as smaller but more probable events. However, this approach has some difficulties, as was described by (Cox, 2008). There are several other scales of specific global risks based on similar principles: 1. Volcanic explosivity index, VEI, 0-8, (USGS, 2017) 2. DEFCON (DEFense readiness CONdition, used by the US military to describe five levels of readiness), from 5 to 1. 3. “Rio scale” of the Search for Extra-Terrestrial Intelligence (SETI) – complex scale with three subscales (Almar, 2011). 4. Palermo scale of asteroid risks compares the likelihood of the detected potential impactor with the average risk posed by objects of the same size measured both by energy and frequency (NASA, 2017). 5. San-Marino scale of risks of Messaging to Extra-Terrestrial Intelligence (METI) (Almar, 2007). The only more general scale for several global risks is the Doomsday Clock by the Bulletin of the Atomic Scientists, which shows global risks as minutes before midnight. It is oriented towards risks of a nuclear war and climate change and communicates only emotional impact (The Bulletin of the Atomic Scientists, 2017). 4.2. The goals of the scale How good a scale is depends in part on what it is intended to do: who will use it and how will they use it. There are three main groups of people the scale addresses: Public. Simplicity matters: a simple scale is required, similar to the hurricane Saffir-Simpson scale (Schott et al., 2012). This hurricane ACCEPTED MANUSCRIPT 13 measuring scale has 5 levels which present rather obscure wind readings as corresponding to the expected damage to houses and thus can help the public make decisions about preparedness and evacuation. In the case of X risks, personal preparedness is not very important, but the public make decisions about which prevention projects to directly support (via donations or crowdfunding) or voting for policymakers who support said projects. Simplicity is necessary to communicate the relative importance of different dangers to a wide variety of nonexperts. Policymakers. We intend our scale to help initiate communication of the relative importance of the risks to policymakers. This is particularly important as it appears that policymakers tend to overestimate smaller risks (like asteroid impact risks) and underestimate larger risks (like AI risks) (Bostrom, 2013). Our scale helps to make such comparison possible as it does not depend on the exact nature of the risks. The scale could be applicable to several groups of risks thus allowing comparisons between them, as well as providing a perspective across the whole situation. Expert community. Even a scale of the simplicity we suggest may benefit the expert community. It can act as a basis for comparing different risks by different experts. Given the interdisciplinarity inherent in studying X risk, this common ground is crucial. The scale could facilitate discussion about catastrophes’ probabilities, preventability, prevention costs, interactions, and error margins, as experts from different fields present arguments about the importance of the risks on which they work. Thus it will help to build a common framework for the risk discussions. 4.3. Color codes and classification of the needed actions Tonn and Steifel suggested a six-level classification of actions to prevent X risks (Tonn & Steifel, 2017). They start from “do nothing” and end with “extreme war footing, economy organized around reducing human extinction risk”. We suggest a scale which is coordinated with Tonn and Steifel’s classification of actions (Table 1), that is our colors correspond to the needed level of action. Also, our colors correspond to typical nonquantifiable ways of the risks description: theoretical, small, medium, serious, high and immediate. We also add iconic examples, which are risks where the probability distribution is known with a higher level of certainty, and thus could be used to communicate the risk’s importance by comparison. Such ACCEPTED MANUSCRIPT 14 examples may aid in learning the scale, or be used instead of the scale. For instance, someone could say: “this risk is the same level as asteroid risk”. The iconic risks are marked bold in the scale. Iconic examples are also illustrated with the best-known example of that type of event. For example, the best known supervolcanic eruption was the Toba eruption 74,000 years ago (Robock et al., 2009). The Chicxulub impact 66 million years ago is infamous for being connected with the latest major extinction, associated with the non-avian Dinosaur extinction. The scale presents the total risk of one type of event, without breaking categories down into subrisks. For example, it estimates the total risks of all known and unknown asteroids, but not the risk of any particular asteroid, which is a departure from the Torino scale. Although the scale is presented using probability intervals, it could be used instead of probabilities if they are completely unknown, but other factors, such as those affecting scope and severity, are known. For example, we might want to communicate that AI catastrophe is a very significant risk, but its exact probability estimation is complicated by large uncertainties. Thus we could agree to represent the risk as red despite difficulties of its numerical estimation. Note that the probability interval (when it is known) for “red” is shorter and is only 1 order of magnitude, as it is needed to represent most serious risks and here we need better resolution ability. As it is a communication scale, the scientists using it could come to agreement that a particular risk should be estimated higher or lower in this scale. We don’t want to place too many restrictions on how different aspects of a risk’s severity (like preventability or connection with other risks) should affect risks coding, as it should be established in the practical use of the scale. However, we will note two rules: 1. The purple color is reserved to present extreme urgency of the risk 2. The scale is extrapolated from the smaller than extinction risks and larger than extinction risks in Table 2. (This is based on idea that smaller risks have considerable but unknown probability to become human extinction risks, and also on the fact that policy makers may implement similar measures for smaller and larger risks). 4.4. Extrapolated version of scale which accounts for the risk size In Table 2 we extend the scale to include smaller risks like civilization collapse and global catastrophic risks as well as on “larger” ACCEPTED MANUSCRIPT 15 risks like life extinction and universe destruction, in accordance with our discussion in section 2. This is necessary because: 1) Smaller risks could become larger extinction risks by starting chains of catastrophic events. 2) The public and policymakers will react similarly to human extinction level catastrophe and to a global catastrophe where there will be some survival: both present similar dangers to personal survival, and in both similar prevention actions are needed. [[TABLE 2 OMITTED]] 4.5. Accessing risks with shorter timeframes than 100 years In Table 2 above we assessed the risks for the next 100 years. However, without prevention efforts, some risks could approach a probability of 1 in less time: climate change, for instance. We suggest that the urgency of intervening in such cases may be expressed by increasing their color coding. Moreover, the critical issue is less the timing of risks, but the timing of the prevention measures. Again, although extreme global warming would likely only occur at the end of the 21st century, it is also true that cutting emissions now would ameliorate the situation. We suggest, then, three ranks which incorporate these shorter time-frame risks. Note that the timings relate to implementation of interventions not the timings of the catastrophes. 1) Now. This is when a catastrophe has started, or may start in any moment: The Cuban Missile Crisis is an historical example. We reserve purple to represent it. 2) “Near mode”. Near mode is roughly the next 5 years. Typically current political problems (as in current relations with North Korea) are understood in near mode. Such problems are appropriately explored in terms of planning and trend expectations. Hanson showed that people are very realistic in “Near mode”, but become speculative and less moral in “Far mode” thinking (Hanson, 2010). Near mode may require one color code increase. 3) “Next 2-3 decades”. Many futurists predict a Technological Singularity between 2030-2050: that is around 10-30 years from now (Vinge, 1993), (Kurzweil, 2006). As this mode coincides with an adult’s working life, it may also be called “in personal life time”. In this mode people may expect to personally suffer from a catastrophe, or be personally responsible for incorrect predictions. MIRI recently increased its estimation of the probability that AGI will appear around 2035 (MIRI, 2017), pushing AGI into “next 2-3 decades” mode. There is a consideration against increasing the color code too much for near-term risks, as that may lead to myopia regarding longterm risks of human extinction. There will always be smaller but more urgent risks, and although these ought to be dealt with, some resources ought to be put towards understanding and mitigating the longer term. ACCEPTED MANUSCRIPT 19 Having said this, in high impact emergency situations, short term overwhelming efforts may help to prevent impending global catastrophe. Examples include the Cuban missile crisis and fighting the recent Ebola pandemic in Western Africa. Such short-term efforts do not necessarily constrain our long-term efforts towards preventing other risks. Thus, short term global catastrophic and larger risks may get a purple rating. 4.6. Detailed explanation of risk assessment principles in the color coded scale In Table 3, we estimate the main global risks, according to the scale suggested in section 4.4. Table 3. Detailed explanation of the X risks scale Color code Examples of risks White Sun becomes red giant. Although this risk is practically guaranteed, it is very remote indeed. Natural false vacuum decay. Bostrom and Tegmark estimated such events as happening in less than one in 1 billion years, (that is 10-7 in a century) (Tegmark & Bostrom, 2005). Moreover, nothing can be done to prevent it. Green Gamma-ray bursts. Earth threatening gamma-ray bursts are extremely rare, and in most cases they will result only in a crop failure due to UV increases. However, a close gamma-ray burst may produce a deadly muon shower which may kill everything up to 3 km in depth (A. Dar, Laor, & N.J, 1997). However, such events could happen less than once in a billion years (10-7 in a century) (Cirković & Vukotića, 2016). Such an event will probably kill all multicellular life on Earth. Dar estimates risks of major extinction events from gamma ray bursts as 1 in 100 mln years (A. Dar, 2001). Asteroid impacts. No dangerous asteroids have been thus far identified, and the background level of global catastrophic impacts is around 1 in a million years (10- 4 in a century). Extinction-level impact probability is 10-6 per century. There are several prevention options involving deflecting comets/asteroids. Also, food security could be purchased cheaply (Denkenberger, 2015). However, some uncertainty exists. Some periods involve intense comet bombardment, and if we are in such a time investment in telescopes should be larger (Rampino & Caldeira, 2015). High energy accelerator experiments creating false vacuum decay/black hole/strangelet. Vacuum decay seems to have extremely low probability, far below 10-8 currently. One obvious reason for expecting such events to have very low probability is that similar events happen quite often, and haven’t destroyed everything as yet (Kent, 2004). However, we give this event a higher estimation for two reasons. First, as accelerators become more capable such events might become more likely. Second, the risks are at an astronomical scale: it could affect other civilizations in the universe. Other types of accelerator catastrophes, like mini-black hole or strangelet creation, would only kill Earth life. However, these are more likely, with one estimate being <2E-8 risk from a single facility (the Relativistic Heavy Ion Collider) (Arnon Dar, De Rújula, & Heinz, 1999), which should be coded white. There many unknowns about dangerous experiments (Sandberg & Landry, 2015). Overall, these risks should be monitored, so green is advisable. Yellow Supervolcanic eruption. Given historical patterns, the likelihood of living in a century containing a super volcanic eruption is approximately 10-3 (Denkenberger, 2014). However, the chance of human extinction resulting is ACCEPTED MANUSCRIPT 21 significantly lower than this. If such an eruption produces global crop failure, it could end current civilization. Conventional wisdom is that there is nothing that could be done to prevent a super volcano from erupting, but some possible preventive measures have been suggested (Denkenberger, this issue). We estimate supervolcanic risks to be higher than asteroid impacts because of the historical record, as they likely nearly finished us off 74 000 ago (Robock et al., 2009). Natural pandemic. A natural pandemic is fairly likely to kill 1% (to an order of magnitude) of the global population during this century, as the Spanish flu did. However, such a pandemic is very unlikely to cause total extinction because lethality is under 100% and some populations are isolated. Between all natural pandemics, emerging pandemic flus have a shorter timespan and need much more attention. Bird flu has a mortality above 0.5 (WHO, 2017) and could produce widespread chaos and possible civilizational collapse if human-to-human transmission starts. Therefore, we estimate 10% probability this century of 10% mortality. Global warming triggering global catastrophe. According to the IPCC anthropogenic global warming may affect billions of people by the end of the 21st century (Parry, 2007), causing heat waves, crop failures and mass migration. Those events, and downstream consequences such as conflicts, could conceivably kill 1 billion people. However, this would only occur for tail risk scenarios which have order of magnitude 1% probability. Having said this, several experts think that methane release from permafrost and similar positive feedback loops may result in runaway global warming with much larger consequences (Obata & Shibata, 2012). Orange Full-scale nuclear war. There is roughly 0.02-7% chance per year of accidental full-scale nuclear war between the US and Russia (Barrett, Baum, & Hostetler, 2013). With fairly high probabilities of nuclear winter and civilization collapse given nuclear war, this is order of magnitude 10% this century. We should also take into consideration that despite reductions in nuclear weapons, a new nuclear arms race is possible in the 21st century. Such a race may include more devastating weapons or cheaper manufacturing methods. Nuclear war could include the creation of large cobalt bombs as doomsday weapons or attacks on nuclear power plants. It could also start a chain of events which result in civilization collapse. Nanotechnology risks. Although molecular manufacturing can be achieved without self-replicating machines (Drexler & Phoenix, 2004), technological fascination with biological systems makes it likely that self-replicating machines will be created. Moreover, catastrophic uses of nanotechnology needn’t be due to accident, but also due to the actions of purposeful malignant agents. Therefore, we estimate the chance of runaway self-replicating machines causing “gray goo” and thus human extinction to be one per cent in this century. There could also be extinction risks from weapons produced by safe exponential molecular manufacturing. See also (Turchin, 2016). Artificial pandemic and other risks from synthetic biology. An artificial multipandemic is a situation in which multiple (even hundreds) of individual viruses created through synthetic biology are released simultaneously either by a terrorist state or as a result of the independent activity of biohackers (Turchin, Green, & Dekenbergern, 2017). Because the capacity to create such a multipandemic could arrive as early as within the next ten to thirty years (as all the needed technologies already exist), it could overshadow future risks, like nanotech and AI, so we give it a higher estimate. There are also other possible risks, connected with synthetic biology, which are widely recognized as serious (Bostrom, 2002). Agricultural catastrophe. There is about a one per cent risk per year of a ten per cent global agricultural shortfall occurring due to a large volcanic eruption, a medium asteroid or comet impact, regional nuclear war, abrupt climate change, or extreme weather causing multiple breadbasket failures (Denkenberger 2016). This could lead to 10% mortality. Red AI risks. The risks connected with the possible creation of non-aligned Strong AI are discussed by (Bostrom, 2014), (Yudkowsky, 2008), (Yampolskiy & Fox, 2013) and others. It is widely recognized as the most serious X risk. AI could start an “intelligence explosion wave” through the Universe, which could prevent appearance of the other civilizations before they create their own AI. Purple Something like the Caribbean crisis in the past, but larger size. Currently, there are no known purple risks. If we could be sure that Strong AI will appear in the next 100 years and would probably be negative, it would constitute a purple risk. Another example would be the creation of a Doomsday weapon that could kill our species with global radiation poisoning (much greater ionizing radiation release than all of the current nuclear weapons) (Kahn, 1959). A further example would be a large incoming asteroid being located, or an extinction level pandemic has begun. These situations require quick and urgent effort on all levels.

#### Global wars drive calls for world government

**Chase-Dunn 12** [Christopher Chase-Dunn, Distinguished Professor of Sociology and Director of the [Institute for Research on World-Systems](http://www.irows.ucr.edu/)at the University of California-Riverside, Hiroko Inoue, Research Assistant at the Institute of Research on World-Systems, “Accelerating democratic global state formation”, <https://journals.sagepub.com/doi/full/10.1177/0010836712443168>, June 6, 2012, imp, \*\*we do not endorse this cards pathetic non-utilitarianism]

All the previous advances in global governance have taken place after a hegemon has declined and there has been a world war among rivals. H. G. Wells saw the importance of catastrophes in the emergence of a new civilization (Wagar, 1961). The idea here is that **major** organizational **changes** tend to **emerge after huge catastrophes** when the existing institutions are in disarray and need to be rebuilt and when people are sufficiently disgusted with the old failed institutions that have led to disaster.15 Of course, political actors who seek to promote the emergence of an effective and democratic global state must also do all that they can to try to prevent another war among the great powers because humanistic morality must trump whatever advantages might result from such a catastrophe. This said, many believe that it is rather likely that major calamities will occur in the coming decades regardless of the efforts of far-sighted world citizens and social movements. And it would make both tactical and strategic sense to have plans for how to move forward if indeed a perfect storm of calamities were to come about.

#### disarm movements are latent now

**Ragheb 18** [Magdi Ragheb, Prof. @ Department of Nuclear, Plasma, and Radiological Engineering, University of Illinois at Urbana-Champaign. 08-08-18. “Safeguards, Non -Proliferation, and Peaceful Nuclear Energy.” <http://mragheb.com/NPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering/Safeguards%20Non%20Proliferation%20and%20Peaceful%20Nuclear%20Energy.pdf> //reem

The “axiom of proliferation” states that as long as some states cling to the possession of nuclear weapons, others will also seek to acquire them. According to “catastrophe theory,” **serious nuclear disarmament** is apparently **waiting** for some **event** that would **stir action** toward the **eventual goal of humanity to eliminate nuclear weapons**. An analogy is advanced of a village fully aware about the need to build gates along railroad tracks that pass through it, remaining **inactive** then **spring into action** until the time that one of its residents is **hit by a passing train**.

#### States are motivated by fear – elevating the nuclear threat via use would cause global buy-in for a world state

**Sargent 19** [Brianna Sargent, “THE HOBBESIAN STATE OF NATURE AMONG NATIONS”, Undergraduate Thesis @ Ashland University Honors College, <https://etd.ohiolink.edu/apexprod/rws_etd/send_file/send?accession=auhonors1556751283322051&disposition=inline>, April 2019, imp]

Were the threat great enough, the nations would either form an international government with an assembly to represent each nation or allow one man or one government to rule over them all. This threat would have to be a threat to the very existence of each nation. This principle of **existential fear controls all nations** and why they have not exited the state of nature to be under one sovereign. As of now, there is no threat that scares nations enough to give up their own sovereignty, but if a threat of this magnitude were to be felt, then a world government would be absolutely necessary to the survival of the nations and the world.

#### International anarchy guarantees war makes threat response impossible

**Craig 8** [Campbell Craig, “The Resurgent Idea of World Government”, Ethics & International Affairs, <https://ciaotest.cc.columbia.edu/journals/cceia/v22i2/f_0007579_6441.pdf>, June 2008, imp]

Certainly, one of the most evident failures of the nation-state system in recent years has been its inability to deal successfully with problems that endanger much or most of the world’s population. As the world has become more globalized—economically integrated and culturally interconnected—individual countries have become increasingly averse to dealing with international problems that are not caused by any single state and cannot be fixed even by the focused efforts of individual governments. Political scientists refer to this quandary as the ‘‘collective action problem,’’ by which they mean the dilemma that emerges when several actors have an interest in eradicating a problem that harms all of them, but when each would prefer that someone else do the dirty work of solving it. If everyone benefits more or less equally from the problem’s solution, but only the actor that addresses it pays the costs, then all are likely to want to ‘‘free ride’’ on the other’s efforts. The result is that no one tackles the problem, and everyone suffers.

Several such collective action problems dominate much of international politics today, and scholars of course debate their importance and relevance to world government. Nevertheless, a few obvious ones stand out, notably the imminent danger of climate change, the difficulty of addressing terrorism, and the complex task of humanitarian intervention. All of these are commonly (though not universally) regarded as serious problems in need of urgent solutions, and in each case powerful states have repeatedly demonstrated that they would prefer that somebody else solve them.

The solution to the collective action problem has long been known: it requires the establishment of some kind of authoritative regime that can organize common solutions to common problems and spread out the costs fairly. This is why many scholars and activists concerned with acute global problems support some form of world government. These advocates are not so naive as to believe that such a system would put an effortless end to global warming, terrorism, or human rights atrocities, just as even the most effective national governments have not eradicated pollution or crime. The central argument in favor of a world-government approach to the problems of globalization is not that it would easily solve these problems, but that it is the only entity that can solve them

A less newsworthy issue, but one more central to many advocates of world government, is the persistent possibility of a third world war in which the use of megaton thermonuclear weaponry could destroy most of the human race. During the Cold War, nuclear conflict was averted by the specter of mutual assured destruction (MAD)—the recognition by the United States and the Soviet Union that a war between them would destroy them both. To be sure, this grim form of deterrence could well obtain in future international orders, but it is unwise to regard the Cold War as a promising model for future international politics. It is not at all certain that international politics is destined to return to a stable bipolar order, such as prevailed during the second half of the Cold War, but even if this does happen, there is no guarantee that nuclear deterrence would work as well as it did during the second half of the twentieth century. It is well to remember that the two sides came close to nuclear blows during the Cuban crisis, and this was over a relatively small issue that did not bear upon the basic security of either state. As Martin Amis has written, the problem with nuclear deterrence is that ‘‘it can’t last out the necessary timespan, which is roughly between now and the death of the sun.’’4 As long as interstate politics continue, we cannot rule out that in some future conflict a warning system will fail, a leader will panic, governments will refuse to back down, a third party will provoke a response— indeed, there are any number of scenarios under which deterrence could fail and thermonuclear war could occur

#### Only a world state solves extinction – outweighs on probability and magnitude

**Czarnecki 20** [Tony Czarnecki, Economist, founder of the Sustensis Think Tank, “Existential threats require a planet-wide approach managed by the World Government”, <https://sustensis.medium.com/existential-threats-require-a-planet-wide-approach-managed-by-the-world-government-cd496f746102>, October 29, 2020, imp]

We have heard a lot about an existential threat of Climate Change. But this is only one of about a dozen of such existential risks. Among them, the **most severe** is the threat of Artificial Intelligence and especially, its mature form — Superintelligence. **This is an existential threat of an entirely different magnitude**, which can either make our species extinct by a direct malevolent action, or by taking over the control over the future of Humanity. This risk is also different from Climate Change because it may come much earlier, within the next few decades. Secondly, we cannot stop (uninvent AI) — the proverbial genie is already out of the bottle. Incidentally, both Superintelligence (immature) and Climate Change have a tipping point at about 2030.