# OFF

#### Polycentric space governance coming now - no action is needed

Tepper 20 [Eytan Tepper, 2020-03-23, Faculty of Law, Institute of Air and Space Law McGill University, Montréal, The Big Bang of Space Governance: Towards Decentralized Regulation of Space Activities, McGill University, https://escholarship.mcgill.ca/concern/theses/9019s670j]

There is no fundamental need to adjust space law in order for polycentric space governance to emerge, as nothing in the current space law prevents the establishment and work of the separate governance centers. There is no urgent need to introduce new treaties or amend existing ones as the suggestions herein include policy goals and design principles, not hard-law rules, and they can – and should – be applied in conformity with the OST. The OST does not provide for a central authority or organization that manages outer space and therefore stakeholders-led governance and a polycentric structure would not violate the treaty but would rather be in line with it. In addition, the rules that would be set by the various governance centers would still all have to be in accordance with the legal norms set out in the OST and elsewhere. The OST remains the normative framework for the space quest.

#### Including all actors is key only they the relevant knowledge and rules in establishing governance

Tepper 20 [Eytan Tepper, 2020-03-23, Faculty of Law, Institute of Air and Space Law McGill University, Montréal, The Big Bang of Space Governance: Towards Decentralized Regulation of Space Activities, McGill University, https://escholarship.mcgill.ca/concern/theses/9019s670j]

In practice, polycentric space governance means that instead of space governance developing top-down, by instruments introduced by UN-COPUOS, it will develop bottom-up, by numerous, issue-specific forums (e.g., on militarization), led by stakeholders (the active actors /users thereof) and experts (as part of epistemic communities), that would create rules for that issue. Embracing polycentric governance, as this thesis calls for, means facilitating and encouraging the evolution of separate governance centers on each sub- issue-area: one for weaponization and militarization, one for space debris, one for utilization of space natural resources and yet another one for space traffic control. Central to polycentric governance is users’ self-governance, i.e. that the users themselves establish, modify and possibly enforce the rules. The evidence shows that users establish rules that better suit the conditions and needs and tend to follow those rules more so than rules imposed from above. In the context of space governance, it means that the actors involved in a certain issue will lead in the creation of the relevant rules. Indeed, the experience with space governance shows that while the attempt to adopt a universally accepted code of conduct failed, an inter-agency forum of stakeholders adopted guidelines on space debris mitigation, which success should be monitored over time. UNOOSA should represent the global public interests and the interests of prospective and affected actors. Private actors may also take part in the governance of sub-issue-areas in which they are active. By dividing space governance to sub-issue-areas and having a forum predominately with users/ stakeholders, who have a vested interest in establishing some rules and have relevant knowledge of the issue-area, and with experts, there are greater chances to establish a governance system that is continuously evolving and meeting the changing needs.

#### Absent the private sector we'll backslide

Bushley 14 [Bryan R. Bushley., 9-9-2014, "Ecology and Society: REDD+ policy making in Nepal: toward state-centric, polycentric, or market-oriented governance?," No Publication, https://www.ecologyandsociety.org/vol19/iss3/art34/]

With its uneven, multi-sector institutional landscape characterized by strong influence and ties among government organizations, powerful INGOs, and influential CSOs (i.e., a development triangle) and scant involvement by the private sector, forest governance in Nepal resembles neither a purely state-centric nor a market-oriented model. Yet with (perceived) influence, information sharing, and collaboration concentrated among relatively few actors and sectors, and civil society involvement limited to a few powerful CSOs, it does not reflect broad-based polycentric (or network) governance either. Rather, the pendulum of forest governance seems to be wavering between state-centric and polycentric, with limited influence from the market. With a government-dominated policy process, an INGO/donor-driven agenda, narrow and token involvement from civil society, and the exclusion of many important constituencies and stakeholders, the practice of REDD+ policy making in Nepal threatens to push the pendulum back toward a more techno-bureaucratic, centralized mode of forest governance. This regressive force and its consequences can be attributed to several factors.

It is widely held that the effectiveness of governance of social-ecological systems in general, and of far-reaching policy mechanisms such as REDD+ in particular, depends on broad participation and deliberation among a wide range of actors from multiple sectors (Stringer et al. 2006, Pokharel and Baral 2009). In Nepal, however, the development triangle hinders participation by important actors from the private, academic, and civil society sectors, which are either marginalized or completely excluded from the process. Rather than an inclusive network of horizontal relations, there is considerable disparity in the influence, importance, and connectedness of actors across key relations representing vital dimensions of policy making, with sparse interaction among and within some actor groups. This unevenness does not reflect the normative ideal of polycentric or network governance. It undermines the capacity for many actors to participate in and benefit from REDD+ and hinders the development and implementation of effective policies.

#### Polycentricity solves better - it's self-correcting and is key to address specific issues instead of a broad government approach

Tepper 20 [Eytan Tepper, 2020-03-23, Faculty of Law, Institute of Air and Space Law McGill University, Montréal, The Big Bang of Space Governance: Towards Decentralized Regulation of Space Activities, McGill University, https://escholarship.mcgill.ca/concern/theses/9019s670j]

The conventional wisdom was that multiplicity of political units makes governance “a pathological phenomenon” and that “too many governments [is] not enough government”.242 However, as the Bloomington School demonstrated, the merits of polycentric governance outweigh the shortcomings. The study of the problem of metropolitan government demonstrated that:

the existence of multiple agencies interacting and overlapping, far from being a pathological situation, ‘may be in fact a natural and healthy one.’ This overlapping and duplication is the result of the fact that different services require a different scale for efficient provision and that principles of division of labor, cooperation, and exchange function in the public sector, too As Vincent and Elinor Ostrom noted, duplication of functions is assumed to be wasteful and inefficient, yet market economy is efficient precisely because of the existence of multiple suppliers of a single product or service i.e., competition. Similar forces operate in a public economy and the duplication is efficient also in public governance.244 Furthermore, polycentric systems have a built-in mechanism of self-correction, as they provide more opportunity for actors to intervene and correct, which contributes to the success of such systems.245 Writing on polycentric governance in climate change E. Ostrom asserted that polycentrism is a long-term reality, but also an effective way of addressing problems that would otherwise encounter a gridlock.246

The above description of polycentric governance resembles that of international regimes – governance that is not based on rules imposed from above but rather on rules and mechanisms devised by the collective action of several actors or governance centers. Absent a central global authority, governance at the global level is made by the actors and is therefore also decentralized. What characterizes polycentric governance is decentralization, and at this point it correlates to international regimes and global governance. Moreover, global governance already fits the definition of a polycentric system as there are multiple decision-making centers, notably the UN and its agencies and powerful actors like the OECD, G7 and major powers.

#### We don't need to win the private sector is key just that each additional actor massively decreases the probability of failure

Carisle and Gruby 17 [Keith Carlisle,Rebecca L. Gruby, 08-08-2017, " Polycentric Systems of Governance: A Theoretical Model for the Commons", Policy Studies Journal, https://onlinelibrary.wiley.com/doi/full/10.1111/psj.12212]

The final theoretical advantage we address is the claim that polycentric governance systems mitigate the risk of institutional failure and resource losses on account of their redundancy (e.g., Gelcich, 2014; Nelson, Howden, & Smith, 2008; E. Ostrom, 1999). This claim encompasses two related forms of redundancy: (i) the duplication of functions by decision-making centers within a given domain or issue area, and (ii) the existence of a diversity of institutions for managing a natural resource system across spatial and/or issue areas (see Low et al., 2003). This advantage is commonly proposed without a great deal of exposition. However, E. Ostrom (2012) provides the following hypothetical that illustrates the intuitive appeal of the claim:

Let us imagine a series of inshore fisheries located along the coast of a region and posit that every policy innovation has a probability of failure of 1/10. If the region were regulated by a single governing agency, one out of ten policy changes would be failures for the entire region. If designing rules were delegated to three genuinely independent authorities, each of these authorities would still face a failure rate of one out of ten. The probability that a failure would simultaneously occur along the entire coast, however, would be reduced from 1/10 to 1/103 or 1/1000. On a coast with many relatively separable inshore fisheries that are governed by local authorities, the likelihood of a coastal-wide failure is reduced still more. (p. 129)

As this example illustrates, the existence of redundant or back-up teams of decision makers experimenting with different rule combinations may significantly reduce the risk of policy failure for an entire region, thereby increasing the stability or resilience of a natural resource system (Galaz et al., 2008). Dietz et al. (2003) note in this regard that catastrophic resource collapses have resulted when central governments exerted sole authority over resources.

#### Solves Conflict

Carlisle and Gruby 17[Keith Carlisle,Rebecca L. Gruby, 08-08-2017, " Polycentric Systems of Governance: A Theoretical Model for the Commons", Policy Studies Journal, https://onlinelibrary.wiley.com/doi/full/10.1111/psj.12212]

Rather than creating strict hierarchical systems, E. Ostrom (2008) proposes “[d]esigning multiple tiers of arenas that can engage in rapid discovery of conflicts and effective conflict resolution” (p. 18). It is unclear how one might operationalize such a multi-tiered system, but the important point may be that conflict resolution systems should possess a diversity of forums and offer a variety of approaches (e.g., conciliation, mediation, and arbitration) so that disputants have a choice in selecting a forum and mechanism most appropriate to the nature of the dispute and to their material circumstances. As Dietz et al. (2003) note, conflict resolution mechanisms “range from ballots and polls, where engagement is passive and participants interact minimally, to adversarial processes that allow parties to redress grievances through formal legal procedures, to various experiments with intense interaction and deliberation aimed at negotiating decisions or allowing parties in potential conflict to provide structured input to them through participatory processes” (p. 1909). The existence of a variety of formal and informal conflict resolution mechanisms may be particularly important in polycentric governance systems on account of their diversity of governance actors with varying degrees of political standing and material resources.

#### Solves debris, weaponization, and resource issues better

Tepper 20 [Eytan Tepper, 2020-03-23, Faculty of Law, Institute of Air and Space Law McGill University, Montréal, The Big Bang of Space Governance: Towards Decentralized Regulation of Space Activities, McGill University, https://escholarship.mcgill.ca/concern/theses/9019s670j]

In practice, polycentric space governance means that instead of space governance developing top-down, by instruments introduced by UN-COPUOS, it will develop bottom-up, by numerous, issue-specific forums (e.g., on militarization), led by stakeholders (the active actors /users thereof) and experts (as part of epistemic communities), that would create rules for that issue. Embracing polycentric governance, as this thesis calls for, means facilitating and encouraging the evolution of separate governance centers on each sub- issue-area: one for weaponization and militarization, one for space debris, one for utilization of space natural resources and yet another one for space traffic control. Central to polycentric governance is users’ self-governance, i.e. that the users themselves establish, modify and possibly enforce the rules. The evidence shows that users establish rules that better suit the conditions and needs and tend to follow those rules more so than rules imposed from above. In the context of space governance, it means that the actors involved in a certain issue will lead in the creation of the relevant rules. Indeed, the experience with space governance shows that while the attempt to adopt a universally accepted code of conduct failed, an inter-agency forum of stakeholders adopted guidelines on space debris mitigation, which success should be monitored over time. UNOOSA should represent the global public interests and the interests of prospective and affected actors. Private actors may also take part in the governance of sub-issue-areas in which they are active. By dividing space governance to sub-issue-areas and having a forum predominately with users/ stakeholders, who have a vested interest in establishing some rules and have relevant knowledge of the issue-area, and with experts, there are greater chances to establish a governance system that is continuously evolving and meeting the changing needs.

# CASE

## ADV 1

#### No ozone impact

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

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

#### Technological innovation successfully dematerializes growth.

McAfee 19, \*Andrew Paul McAfee, a principal research scientist at MIT, is cofounder and codirector of the MIT Initiative on the Digital Economy at the MIT Sloan School of Management; (2019, “More from Less: The Surprising Story of How We Learned to Prosper Using Fewer Resources and What Happens Next”, https://b-ok.cc/book/5327561/8acdbe)

There is no shortage of examples of dematerialization. I chose the ones in this chapter because they illustrate a set of fundamental principles at the intersection of business, economics, innovation, and our impact on our planet. They are:

We do want more all the time, but not more resources. Alfred Marshall was right, but William Jevons was wrong. Our wants and desires keep growing, evidently without end, and therefore so do our economies. But our use of the earth’s resources does not. We do want more beverage options, but we don’t want to keep using more aluminum in drink cans. We want to communicate and compute and listen to music, but we don’t want an arsenal of gadgets; we’re happy with a single smartphone. As our population increases, we want more food, but we don’t have any desire to consume more fertilizer or use more land for crops.

Jevons was correct at the time he wrote that total British demand for coal was increasing even though steam engines were becoming much more efficient. He was right, in other words, that the price elasticity of demand for coal-supplied power was greater than one in the 1860s. But he was wrong to conclude that this would be permanent. Elasticities of demand can change over time for several reasons, the most fundamental of which is technological change. Coal provides a clear example of this. When fracking made natural gas much cheaper, total demand for coal in the United States went down even though its price decreased.

With the help of innovation and new technologies, economic growth in America and other rich countries—growth in all of the wants and needs that we spend money on—has become decoupled from resource consumption. This is a recent development and a profound one.

Materials cost money that companies locked in competition would rather not spend. The root of Jevons’s mistake is simple and boring: resources cost money. He realized this, of course. What he didn’t sufficiently realize was how strong the incentive is for a company in a contested market to reduce its spending on resources (or anything else) and so eke out a bit more profit. After all, a penny saved is a penny earned.

Monopolists can just pass costs on to their customers, but companies with a lot of competitors can’t. So American farmers who battle with each other (and increasingly with tough rivals in other countries) are eager to cut their spending on land, water, and fertilizer. Beer and soda companies want to minimize their aluminum purchases. Producers of magnets and high-tech gear run away from REE as soon as prices start to spike. In the United States, the 1980 Staggers Act removed government subsidies for freight-hauling railroads, forcing them into competition and cost cutting and making them all the more eager to not have expensive railcars sit idle. Again and again, we see that competition spurs dematerialization.

There are multiple paths to dematerialization. As profit-hungry companies seek to use fewer resources, they can go down four main paths. First, they can simply find ways to use less of a given material. This is what happened as beverage companies and the companies that supply them with cans teamed up to use less aluminum. It’s also the story with American farmers, who keep getting bigger harvests while using less land, water, and fertilizer. Magnet makers found ways to use fewer rare earth metals when it looked as if China might cut off their supply.

Second, it often becomes possible to substitute one resource for another. Total US coal consumption started to decrease after 2007 because fracking made natural gas more attractive to electricity generators. If nuclear power becomes more popular in the United States (a topic we’ll take up in chapter 15), we could use both less coal and less gas and generate our electricity from a small amount of material indeed. A kilogram of uranium-235 fuel contains approximately 2–3 million times as much energy as the same mass of coal or oil. According to one estimate, the total amount of energy that humans consume each year could be supplied by just seven thousand tons of uranium fuel.

Third, companies can use fewer molecules overall by making better use of the materials they already own. Improving CNW’s railcar utilization from 5 percent to 10 percent would mean that the company could cut its stock of these thirty-ton behemoths in half. Companies that own expensive physical assets tend to be fanatics about getting as much use as possible out of them, for clear and compelling financial reasons. For example, the world’s commercial airlines have improved their load factors—essentially the percentage of seats occupied on flights—from 56 percent in 1971 to more than 81 percent in 2018.

Finally, some materials get replaced by nothing at all. When a telephone, camcorder, and tape recorder are separate devices, three total microphones are needed. When they all collapse into a smartphone, only one microphone is necessary. That smartphone also uses no audiotapes, videotapes, compact discs, or camera film. The iPhone and its descendants are among the world champions of dematerialization. They use vastly less metal, plastic, glass, and silicon than did the devices they have replaced and don’t need media such as paper, discs, tape, or film.

If we use more renewable energy, we’ll be replacing coal, gas, oil, and uranium with photons from the sun (solar power) and the movement of air (wind power) and water (hydroelectric power) on the earth. All three of these types of power are also among dematerialization’s champions, since they use up essentially no resources once they’re up and running.

I call these four paths to dematerialization slim, swap, optimize, and evaporate. They’re not mutually exclusive. Companies can and do pursue all four at the same time, and all four are going on all the time in ways both obvious and subtle.

Innovation is hard to foresee. Neither the fracking revolution nor the world-changing impact of the iPhone’s introduction were well understood in advance. Both continued to be underestimated even after they occurred. The iPhone was introduced in June of 2007, with no shortage of fanfare from Apple and Steve Jobs. Yet several months later the cover of Forbes was still asking if anyone could catch Nokia.

Innovation is not steady and predictable like the orbit of the Moon or the accumulation of interest on a certificate of deposit. It’s instead inherently jumpy, uneven, and random. It’s also combinatorial, as Erik Brynjolfsson and I discussed in our book The Second Machine Age. Most new technologies and other innovations, we argued, are combinations or recombinations of preexisting elements.

The iPhone was “just” a cellular telephone plus a bunch of sensors plus a touch screen plus an operating system and population of programs, or apps. All these elements had been around for a while before 2007. It took the vision of Steve Jobs to see what they could become when combined. Fracking was the combination of multiple abilities: to “see” where hydrocarbons were to be found in rock formations deep underground; to pump down pressurized liquid to fracture the rock; to pump up the oil and gas once they were released by the fracturing; and so on. Again, none of these was new. Their effective combination was what changed the world’s energy situation.

Erik and I described the set of innovations and technologies available at any time as building blocks that ingenious people could combine and recombine into useful new configurations. These new configurations then serve as more blocks that later innovators can use. Combinatorial innovation is exciting because it’s unpredictable. It’s not easy to foresee when or where powerful new combinations are going to appear, or who’s going to come up with them. But as the number of both building blocks and innovators increases, we should have confidence that more breakthroughs such as fracking and smartphones are ahead. Innovation is highly decentralized and largely uncoordinated, occurring as the result of interactions among complex and interlocking social, technological, and economic systems. So it’s going to keep surprising us.

As the Second Machine Age progresses, dematerialization accelerates. Erik and I coined the phrase Second Machine Age to draw a contrast with the Industrial Era, which as we’ve seen transformed the planet by allowing us to overcome the limitations of muscle power. Our current time of great progress with all things related to computing is allowing us to overcome the limitations of our mental power and is transformative in a different way: it’s allowing us to reverse the Industrial Era’s bad habit of taking more and more from the earth every year.

#### Disease doesn’t cause extinction

Adalja 16 [Amesh Adalja is an infectious-disease physician at the University of Pittsburgh. Why Hasn't Disease Wiped out the Human Race? June 17, 2016. https://www.theatlantic.com/health/archive/2016/06/infectious-diseases-extinction/487514/]

But when people ask me if I’m worried about infectious diseases, they’re often not asking about the threat to human lives; they’re asking about the threat to human life. With each outbreak of a headline-grabbing emerging infectious disease comes a fear of extinction itself. The fear envisions a large proportion of humans succumbing to infection, leaving no survivors or so few that the species can’t be sustained.

I’m not afraid of this apocalyptic scenario, but I do understand the impulse. Worry about the end is a quintessentially human trait. Thankfully, so is our resilience.

For most of mankind’s history, infectious diseases were the existential threat to humanity—and for good reason. They were quite successful at killing people: The 6th century’s Plague of Justinian knocked out an estimated 17 percent of the world’s population; the 14th century Black Death decimated a third of Europe; the 1918 influenza pandemic killed 5 percent of the world; malaria is estimated to have killed half of all humans who have ever lived.

Any yet, of course, humanity continued to flourish. Our species’ recent explosion in lifespan is almost exclusively the result of the control of infectious diseases through sanitation, vaccination, and antimicrobial therapies. Only in the modern era, in which many infectious diseases have been tamed in the industrial world, do people have the luxury of death from cancer, heart disease, or stroke in the 8th decade of life. Childhoods are free from watching siblings and friends die from outbreaks of typhoid, scarlet fever, smallpox, measles, and the like.

So what would it take for a disease to wipe out humanity now?

In Michael Crichton’s The Andromeda Strain, the canonical book in the disease-outbreak genre, an alien microbe threatens the human race with extinction, and humanity’s best minds are marshaled to combat the enemy organism. Fortunately, outside of fiction, there’s no reason to expect alien pathogens to wage war on the human race any time soon, and my analysis suggests that any real-life domestic microbe reaching an extinction level of threat probably is just as unlikely.

Any apocalyptic pathogen would need to possess a very special combination of two attributes. First, it would have to be so unfamiliar that no existing therapy or vaccine could be applied to it. Second, it would need to have a high and surreptitious transmissibility before symptoms occur. The first is essential because any microbe from a known class of pathogens would, by definition, have family members that could serve as models for containment and countermeasures. The second would allow the hypothetical disease to spread without being detected by even the most astute clinicians.

The three infectious diseases most likely to be considered extinction-level threats in the world today—influenza, HIV, and Ebola—don’t meet these two requirements. Influenza, for instance, despite its well-established ability to kill on a large scale, its contagiousness, and its unrivaled ability to shift and drift away from our vaccines, is still what I would call a “known unknown.” While there are many mysteries about how new flu strains emerge, from at least the time of Hippocrates, humans have been attuned to its risk. And in the modern era, a full-fledged industry of influenza preparedness exists, with effective vaccine strategies and antiviral therapies.

HIV, which has killed 39 million people over several decades, is similarly limited due to several factors. Most importantly, HIV’s dependency on blood and body fluid for transmission (similar to Ebola) requires intimate human-to-human contact, which limits contagion. Highly potent antiviral therapy allows most people to live normally with the disease, and a substantial group of the population has genetic mutations that render them impervious to infection in the first place. Lastly, simple prevention strategies such as needle exchange for injection drug users and barrier contraceptives—when available—can curtail transmission risk.

Ebola, for many of the same reasons as HIV as well as several others, also falls short of the mark. This is especially due to the fact that it spreads almost exclusively through people with easily recognizable symptoms, plus the taming of its once unfathomable 90 percent mortality rate by simple supportive care.

Beyond those three, every other known disease falls short of what seems required to wipe out humans—which is, of course, why we’re still here. And it’s not that diseases are ineffective. On the contrary, diseases’ failure to knock us out is a testament to just how resilient humans are. Part of our evolutionary heritage is our immune system, one of the most complex on the planet, even without the benefit of vaccines or the helping hand of antimicrobial drugs. This system, when viewed at a species level, can adapt to almost any enemy imaginable. Coupled to genetic variations amongst humans—which open up the possibility for a range of advantages, from imperviousness to infection to a tendency for mild symptoms—this adaptability ensures that almost any infectious disease onslaught will leave a large proportion of the population alive to rebuild, in contrast to the fictional Hollywood versions.

#### Warming doesn’t trigger extinction

IBD 18 [Investors Business Daily, Citing Study from Peer reviewed journal by Lewis and Curry, “Here's One Global Warming Study Nobody Wants You To See”, 4/25/18, https://www.investors.com/politics/editorials/global-warming-computer-models-co2-emissions/]

Settled Science: A new study published in a peer-reviewed journal finds that climate models exaggerate the global warming from CO2 emissions by as much as 45%. If these findings hold true, it's huge news. No wonder the mainstream press is ignoring it.

In the study, authors Nic Lewis and Judith Curry looked at actual temperature records and compared them with climate change computer models. What they found is that the planet has shown itself to be far less sensitive to increases in CO2 than the climate models say. As a result, they say, the planet will warm less than the models predict, even if we continue pumping CO2 into the atmosphere.

As Lewis explains: "Our results imply that, for any future emissions scenario, future warming is likely to be substantially lower than the central computer model-simulated level projected by the (United Nations Intergovernmental Panel on Climate Change), and highly unlikely to exceed that level.

How much lower? Lewis and Curry say that their findings show temperature increases will be 30%-45% lower than the climate models say. If they are right, then there's little to worry about, even if we don't drastically reduce CO2 emissions.

The planet will warm from human activity, but not nearly enough to cause the sort of end-of-the-world calamities we keep hearing about. In fact, the resulting warming would be below the target set at the Paris agreement.

This would be tremendously good news.

The fact that the Lewis and Curry study appears in the peer-reviewed American Meteorological Society's Journal of Climate lends credibility to their findings. This is the same journal, after all, that recently published widely covered studies saying the Sahara has been growing and the climate boundary in central U.S. has shifted 140 miles to the east because of global warming.

The Lewis and Curry findings come after another study, published in the prestigious journal Nature, that found the long-held view that a doubling of CO2 would boost global temperatures as much as 4.5 degrees Celsius was wrong**.** The most temperatures would likely climb is 3.4 degrees.

It also follows a study published in Science, which found that rocks contain vast amounts of nitrogen that plants could use to grow and absorb more CO2, potentially offsetting at least some of the effects of CO2 emissions and reducing future temperature increases.

#### Climate models are wrong- we can adapt

Lau 18 [Matthew Lau, contributing writer to Canadians for Affordable Energy, citing peer reviewed studies from journal nature climate change and Journal of Climate, “Climate change data is wildly overestimated”, 8/14, https://torontosun.com/opinion/columnists/guest-column-climate-change-data-is-wildly-over-estimated]

A study last year by Thorsten Mauritsen and Robert Pincus in the journal Nature Climate Change and another one this year by Nicholas Lewis and Judith Curry in the Journal of Climate, produced median estimates suggesting that a doubling in atmospheric carbon dioxide would increase global temperatures by only about half of what Intergovernmental Panel on Climate Change (IPCC) models predict.

Recently, two Heritage Foundation scholars and Canadian economist Ross McKitrick re-estimated the social cost of carbon dioxide emissions using earlier empirical estimates from Lewis and Curry, instead of relying on simulated estimates of the sensitivity of temperature to carbon dioxide concentration in the atmosphere. In one model, the social cost of carbon fell 40-50% and in another the costs dropped a staggering 80%.

In addition to future warming and its associated costs likely being over-predicted by climate models, historical warming might also be less than what most temperature records suggest. That is because some techniques for producing temperature records systematically display more warming than actually occurred.

According to Patrick J. Michaels and Ryan Maue, scientists with the Cato Institute, one of the most reliable temperature data sets is from the Japan Meteorological Office. This record also shows the least amount of warming. “The fact of the matter is,” the Cato researchers write, “that what should be the most physically realistic measure of global average surface temperature is also our coolest.”

Not only is the amount of warming often exaggerated, but climate cost estimates are often inflated by assuming that humans will not adapt to the warmer climate. This assumption makes no sense when we consider how long the warming is supposed to take and how creative our society is when it comes to solving complex problems.

Adding all this up suggests that climate change probably won’t be anywhere near as disastrous as many people imagine. This has profound policy implications – it means that the drastic and expensive tax and regulatory actions taken by governments in the name of saving the climate are increasingly difficult to justify.

## ADV 2

#### If conventional war with Russia started or was imminent, the US would use nukes first

Tong Zhao et al 18, fellow @ Carnegie, PhD in Science, Technology, and International Affairs @ Georgia Institute of Technology, MA in International Relations @ Tsinghua University, “Reducing the Risks of Nuclear Entanglement”, https://carnegieendowment.org/2018/09/12/reducing-risks-of-nuclear-entanglement-pub-77236

Chinese or Russian non-nuclear strikes against the United States could also spark escalation—a risk that has been overlooked since the Cold War—for reasons other than crisis instability. The risk would be most acute if China or Russia launched non-nuclear attacks against dual-use U.S. C3I assets (including early-warning and communication satellites, as well as ground-based radars and transmitters). Even if conducted exclusively for the purpose of winning (or at least not losing) a conventional war, such non-nuclear attacks could be misinterpreted by Washington as preparations for nuclear use. As a result, Washington might come to believe (wrongly) that it was about to become the victim of a nuclear attack—an effect termed misinterpreted warning. For example, China or Russia might attack U.S. early-warning satellites to enable their regional non-nuclear ballistic missiles (or, perhaps, non-nuclear ICBMs or boost-glide weapons in the future) to penetrate U.S. missile defenses. However, such an attack might be misinterpreted by the United States as an attempt to disable missile defenses designed to protect the homeland against limited nuclear strikes. Even if the United States did not believe that nuclear use by an adversary was imminent, it might still worry that non-nuclear strikes against its dual-use C3I assets could compromise its ability to limit the damage it would suffer if the war turned nuclear at some later point. Such damage-limitation operations, which are an acknowledged part of U.S. nuclear strategy, would probably involve nuclear or non-nuclear attacks on the adversary’s nuclear forces backed up by missile defenses. To have any chance of success, these operations would require very sophisticated C3I capabilities (to target mobile missiles, for example). Attacks on—or even perceived threats to—these C3I assets (many of which are dual use) could lead to concerns in Washington that, unless it took action now, effective damage limitation might be impossible—that is, the damage-limitation window might already have closed—if the war turned nuclear. The United States might respond to either of these concerns in ways that could further escalate the crisis. Washington would probably take steps to protect surviving C3I capabilities. It might, for example, attack anti-satellite weapons that were seen as particularly threatening. Such strikes could prove especially escalatory if they were conducted deeper inside the adversary’s borders than the United States had previously struck. Alternatively, or additionally, Washington might issue explicit or implicit nuclear threats against nuclear use or further attacks on C3I assets. In fact, the 2018 U.S. Nuclear Posture Review even goes so far as to threaten to use nuclear weapons in response to attacks on C3I assets. Risk mitigation will likely prove challenging. China may not want to disentangle its nuclear and non-nuclear forces because doing so might weaken its ability to deter U.S. attacks against the latter and because such disentanglement might prove challenging organizationally for the People’s Liberation Army Rocket Force (which operates China’s land-based nuclear forces). For Russia, the financial costs associated with disentanglement are likely to be a significant barrier. Moreover, inadvertent escalation is not generally regarded as a serious risk in China or Russia. Unfortunately, the belief that inadvertent escalation is unlikely actually makes it more probable because it leaves political and military leaders less inclined, in peacetime, to take steps that could mitigate the risks and more inclined, in wartime, to interpret ambiguous events in the worst possible light. Although there is more acceptance of the possibility of inadvertent escalation in the United States, there is little evidence that the U.S. government and military have fully factored the risks of entanglement into procurement policies and war planning. There is also little evidence that the administration of President Donald Trump is willing to invest significant political capital in reducing the risk of inadvertent escalation.

#### That initial strike will completely destroy their nuclear arsenal – solves the impact

Hans Kristensen et al 17, Associate Senior Fellow with the SIPRI Disarmament, Arms Control and Non-proliferation Programme, director of the Nuclear Information Project with the Federation of American Scientists, co-author to the world nuclear forces overview in the SIPRI Yearbook (Oxford University Press) and a frequent adviser to the news media on nuclear weapons policy and operations, "How US nuclear force modernization is undermining strategic stability: The burst-height compensating super-fuze", Bulletin of the Atomic Scientists, https://thebulletin.org/2017/03/how-us-nuclear-force-modernization-is-undermining-strategic-stability-the-burst-height-compensating-super-fuze/

The US nuclear forces modernization program has been portrayed to the public as an effort to ensure the reliability and safety of warheads in the US nuclear arsenal, rather than to enhance their military capabilities. In reality, however, that program has implemented revolutionary new technologies that will vastly increase the targeting capability of the US ballistic missile arsenal. This increase in capability is astonishing—boosting the overall killing power of existing US ballistic missile forces by a factor of roughly three—and it creates exactly what one would expect to see, if a nuclear-armed state were planning to have the capacity to fight and win a nuclear war by disarming enemies with a surprise first strike. Because of improvements in the killing power of US submarine-launched ballistic missiles, those submarines now patrol with more than three times the number of warheads needed to destroy the entire fleet of Russian land-based missiles in their silos. US submarine-based missiles can carry multiple warheads, so hundreds of others, now in storage, could be added to the submarine-based missile force, making it all the more lethal. The revolutionary increase in the lethality of submarine-borne US nuclear forces comes from a “super-fuze” device that since 2009 has been incorporated into the Navy’s W76-1/Mk4A warhead as part of a decade-long life-extension program. We estimate that all warheads deployed on US ballistic missile submarines now have this fuzing capability. Because the innovations in the super-fuze appear, to the non-technical eye, to be minor, policymakers outside of the US government (and probably inside the government as well) have completely missed its revolutionary impact on military capabilities and its important implications for global security. Before the invention of this new fuzing mechanism, even the most accurate ballistic missile warheads might not detonate close enough to targets hardened against nuclear attack to destroy them. But the new super-fuze is designed to destroy fixed targets by detonating above and around a target in a much more effective way. Warheads that would otherwise overfly a target and land too far away will now, because of the new fuzing system, detonate above the target. FIGURE 1. The deployment of the new MC4700 arming, fuzing, and firing system on the W76-1/Mk4A significantly increases the number of hard target kill-capable warheads on US ballistic missile submarines. The result of this fuzing scheme is a significant increase in the probability that a warhead will explode close enough to destroy the target even though the accuracy of the missile-warhead system has itself not improved. As a consequence, the US submarine force today is much more capable than it was previously against hardened targets such as Russian ICBM silos. A decade ago, only about 20 percent of US submarine warheads had hard-target kill capability; today they all do. (See Figure 1.) This vast increase in US nuclear targeting capability, which has largely been concealed from the general public, has serious implications for strategic stability and perceptions of US nuclear strategy and intentions. Russian planners will almost surely see the advance in fuzing capability as empowering an increasingly feasible US preemptive nuclear strike capability—a capability that would require Russia to undertake countermeasures that would further increase the already dangerously high readiness of Russian nuclear forces. Tense nuclear postures based on worst-case planning assumptions already pose the possibility of a nuclear response to false warning of attack. The new kill capability created by super-fuzing increases the tension and the risk that US or Russian nuclear forces will be used in response to early warning of an attack—even when an attack has not occurred. The increased capability of the US submarine force will likely be seen as even more threatening because Russia does not have a functioning space-based infrared early warning system but relies primarily on ground-based early warning radars to detect a US missile attack. Since these radars cannot see over the horizon, Russia has less than half as much early-warning time as the United States. (The United States has about 30 minutes, Russia 15 minutes or less.) The inability of Russia to globally monitor missile launches from space means that Russian military and political leaders would have no “situational awareness” to help them assess whether an early-warning radar indication of a surprise attack is real or the result of a technical error. The combination of this lack of Russian situational awareness, dangerously short warning times, high-readiness alert postures, and the increasing US strike capacity has created a deeply destabilizing and dangerous strategic nuclear situation. When viewed in the alarming context of deteriorating political relations between Russia and the West, and the threats and counter-threats that are now becoming the norm for both sides in this evolving standoff, it may well be that the danger of an accident leading to nuclear war is as high now as it was in periods of peak crisis during the Cold War. How the new accuracy-enhancing fuze works. The significant increase in the ability of the W76-1/Mk4A warhead to destroy hardened targets—including Russian silo-based ICBMs—derives from a simple physical fact: Explosions that occur near and above the ground over a target can be lethal to it. This above-target area is known as a “lethal volume”; the detonation of a warhead of appropriate yield in this volume will result in the destruction of the target. The recognition that the killing power of the W76 warhead could be vastly increased by equipping it with a new fuze was discussed in a 1994 alternate warhead study conducted by the Defense and Energy departments. The study calculated the number of warheads that would be needed for the W76 to attack the Russian target base, if START II were implemented. At the time, W76/Mk4 warheads had a fixed height-of-burst fuze (meaning the fuze could not adjust its detonation at an optimal location if it were falling short or long of a target). With those fixed-height fuzes, submarine-launched nuclear missiles were mainly aimed at softer targets such as military bases. But the study found that an enhanced Mk4A reentry-body with a new fuze that provided for an adjustable height-of-burst as it arrives would have significant capabilities against harder targets, compared to warheads with the earlier fuzes. The study assumed that a smaller number of Mk4 nuclear warheads with higher killing power per warhead could cover the Russian target base and be more effective than multiple attacks on targets with less destructive warheads. In other words, an enhanced fuze would allow the United States to reduce the number of warheads on its ballistic missile submarines, but increase the targeting effectiveness of the fleet. Figure 2 illustrates the kill distribution of US submarine-launched nuclear missiles equipped with the earlier, fixed height-of-burst fuzes. The dome-shaped volume outlined in gray shows the lethal volume within which a 100-kiloton nuclear explosion will generate 10,000 pounds per square inch or more of blast pressure on the ground. In other words, if a target on the ground cannot survive a blast of 10,000 pounds per square inch or more, it will be destroyed if a 100-kt nuclear weapon detonates anywhere within that dome-shaped volume. To show the physical relationship of the lethal volume for a particular ground target of interest—in this case a Russian SS-18 ICBM silo—Figure 2 was drawn to scale. Also shown to scale is the approximate spread of warhead trajectories that correspond to a missile that is accurate to 100 meters, a miss distance roughly the same as what is achieved by the Trident II sea-launched ballistic missile. Miss distances are typically characterized in terms of a quantity called the “circular error probable,” or CEP, which is defined as the radius of a circle around the aim point within which half of the warheads aimed at a target are expected to impact. In the case of a Trident II 100-kt W76-1 ballistic missile warhead, the lethal distance on the ground and the CEP are roughly equal. As a result, roughly half of the warheads equipped with the old, fixed-height fuze system could be expected to fall close enough to detonate on the ground within the lethal range. The new super-fuze for W76-1/Mk4A has a flexible height-of-burst capability that enables it to detonate at any height within the lethal volume over a target. Figure 3 shows how the new fuze vastly increases the chances that the target will be destroyed, even though the arriving warheads have essentially the same ballistic accuracy. The super-fuze is designed to measure its altitude well before it arrives near the target and while it is still outside the atmosphere. This measurement would typically be taken at an altitude of 60 to 80 kilometers, where the effects of atmospheric drag are very small. At this point, the intended trajectory is known to very high precision before the warhead begins to substantially slow from atmospheric drag. If the warhead altitude measured by the super-fuze at that time were exactly equal to the altitude expected for the intended trajectory, the warhead would be exactly on target. But if the altitude were higher than expected, the warhead could be expected to hit beyond the intended aim point. Likewise, if the altitude is lower than that expected, the warhead would likely hit short of the intended aim point. Testing has established the statistical shape and orientation of the expected spread of warhead locations as they fly towards the target. In the case of Trident II, the spread of trajectories around the intended trajectory is so small that the best way to increase the chances of detonating inside the lethal volume is to intentionally shift the aim point slightly beyond the location of the target. (Note that the intended trajectory in Figure 3 is shifted slightly down range.) By shifting the aim point down range by a distance roughly equal to a CEP, warheads that would otherwise fall short or long of the target using the conventional Mk4 fuze instead will detonate—at different heights dictated by the super fuze—within the lethal volume above a target. This shift in the down-range aim point will result in a very high percentage of warheads that overfly the target detonating in the lethal volume. The end result is that with the new Mk4A super-fuze, a substantially higher percentage of launched warheads detonate inside the lethal volume, resulting in a considerable increase in the likelihood that the target is destroyed. The ultimate effect of the super fuze’s flexible burst-height capability is a significantly increased target kill probability of the new W76-1/Mk4A warhead compared with the conventional warhead of the same type. Figure 4 shows the probability that warheads will detonate close enough to destroy the ground-target for both the conventional fuze and the super-fuze. As can be seen from figure 4, the probability of kill using a submarine-launched warhead with the new super-fuze (W76-1/Mk4A) is about 0.86. This 86 percent probability is very close to what could be achieved using three warheads with conventional fuzes to attack the same target. To put it differently: In the case of the 100-kt Trident II warhead, the super fuze triples the killing power of the nuclear force it has been applied to. Many Russian targets are not hardened to 10,000 pounds per square inch blast overpressure. Figure 5 shows the same probability of kill curves for the case of a target that is only hard to 2,000 pounds per square inch or more of blast overpressure, which is the actual case for almost all targets hardened to nuclear attack—ICBMs and supporting command posts, hardened structures at strategic airbases, submarines at pierside or in protected tunnels, hardened command posts at road mobile missile bases and elsewhere, etc. In this case, the super-fuze achieves a probability of kill of about 0.99—or very near certainty. This case also is equivalent to achieving a probability of kill associated with using three warheads with a 0.83 probability to achieve a 0.99 probability of kill. The probability of kills revealed by figures 4 and 5 have enormous security ramifications. The US military assumes that Russian SS-18 and TOPOL missile silos are hardened to withstand a pressure of 10,000 pounds per square inch or more. Since with the new super-fuze, the probability of kill against these silos is near 0.9, the entire force of 100-kt W76-1/Mk4A Trident II warheads now “qualifies” for use against the hardest of Russian silos. This, in turn, means that essentially all of the higher-yield nuclear weapons (such as the W88/Mk5) that were formerly assigned to these Russian hard targets can now be focused on other, more demanding missions, including attacks against deeply-buried underground command facilities. In effect, the significant increase in the killing power of the W76 warhead allows the United States to use its submarine-based weapons more decisively in a wider range of missions than was the case before the introduction of this fuze. The history of the US super-fuze program. The super-fuze is officially known as the arming, fuzing and firing (AF&F) system. It consists of a fuze, an arming subsystem (which includes the radar), a firing subsystem, and a thermal battery that powers the system. The AF&F is located in the tip of the cone-shaped reentry body above the nuclear explosive package itself. The AF&F developed for the new W76-1/Mk4A is known as MC4700 and forms part of the W76 life-extension program intended to extend the service life of the W76—the most numerous warhead in the US stockpile—out to the time period 2040-2050. The new super-fuze uses a technology first deployed on the high-yield W88/Mk5 Trident II warhead. The Navy’s Strategic Systems Program contracted with the Lockheed Missile and Space Corporation in the early 1980s to develop a new fuze that included “a radar-updated, path-length compensating fuze … that could adjust for trajectory errors and significantly improve the ability to destroy a target. This was an early and sophisticated use of artificial intelligence in a weapon.” It was the radar-updated, path-length compensating fuze—combined with the increased accuracy of the Trident II missile—that gave an SLBM the ability to hold a hardened target at risk. Efforts to incorporate the W88/Mk5 fuze capability into the W76/Mk4 was part of the Energy Department’s Warhead Protection Program in the mid-1990s to permit “Mk5 fuzing functionality (including radar-updated path length fuzing, and radar proximity fuzing) as an option to replacement of the much smaller Mk4 AF&F,” according to the partially declassified 1996 Stockpile Stewardship and Management Plan (emphasis added). Apart from the inherent drive to improve military capabilities whenever possible, the motivation for increasing the target kill capability of the submarine-borne W76 was that the Air Force’s hard-target killer, the MX Peacekeeper ICBM, was scheduled to be retired under the START II treaty. The Navy only had 400 W88 hard-target kill warheads, so a decision was made to add the capability to the W76. In an article in April 1997, Strategic Systems Program director Rear Adm. George P. Nanos publicly explained that “just by changing the fuze in the Mk4 reentry body, you get a significant improvement. The Mk4, with a modified fuze and Trident II accuracy, can meet the original D5 [submarine-borne missile] hard target requirement,” [Nanos stated](https://fas.org/wp-content/uploads/sites/4/W76nanos.pdf). Later that same year, the Energy Department’s Stockpile Stewardship and Management Plan formally described the objective of the fuze modernization program “to enable W76 to take advantage of [the] higher accuracy of [the] D5 missile.” By 1998, the fuze modernization effort became a formal project, with five SLBM flight tests planned for 2001-2008. Full-scale production of the super-fuze equipped W76-1/Mk4A began in September 2008, with the first warhead delivered to the Navy in February 2009. By the end of 2016, roughly 1,200 of an estimated 1,600 planned W76-1/Mk4As had been produced, of which about 506 are currently deployed on ballistic missile submarines. The implications. The newly created capability to destroy Russian silo-based nuclear forces with 100-kt W76-1/Mk4A warheads—the most numerous in the US stockpile—vastly expands the nuclear warfighting capabilities of US nuclear forces. Since only part of the W76 force would be needed to eliminate Russia’s silo-based ICBMs, the United States will be left with an enormous number of higher-yield warheads that would then be available to be reprogrammed for other missions. Approximately 890 warheads are deployed on US ballistic missile submarines (506 W76-1/Mk4A and 384 W88/Mk5). Assuming that the 506 deployed W76-1s equipped with the super-fuze were used against Russian silo-based ICBMs, essentially all 136 Russian silo-based ICBMs could be potentially eliminated by attacking each silo with two W76-1 warheads—a total of 272 warheads. This would consume only 54 percent of the deployed W76-1 warheads, leaving roughly 234 of the 500 warheads free to be targeted on yet other installations. And hundreds of additional submarine warheads are in storage for increasing the missile warhead loading if so ordered. The Trident II missiles that are deployed today carry an average of four to five W76-1 warheads each. However, each missile could carry eight such warheads if the US were to suddenly decide to carry a maximum load of W76 warheads on its deployed Trident II ballistic missiles. And the missile was tested with up to 12 warheads. Essentially all the 384 W88 “heavy” Trident II warheads, with yields of 455 kt, would also be available for use against deeply-buried targets. In addition, about 400 Minuteman III warheads, with yields of about 300 kt, could be used to target hardened Russian targets. In all, the entire Russian silo-based forces could potentially be destroyed while leaving the US with 79 percent of its ballistic missile warheads unused. Even after Russia’s silo-based missiles were attacked, the US nuclear firepower remaining would be staggering—and certainly of concern to Russia or any other country worried about a US first strike. Because of the new kill capabilities of US submarine-launched ballistic missiles (SLBMs), the United States would be able to target huge portions of its nuclear force against non-hardened targets, the destruction of which would be crucial to a “successful” first strike. One such mission would likely involve the destruction of road-mobile ICBMs that had left their garrisons to hide in Russia’s vast forests in anticipation of attack. The garrisons and their support facilities would probably be destroyed quickly, and some of the dispersed road-mobile launchers would also be quickly destroyed as they were in the process of dispersing. To destroy or expose the remaining launchers, United States planners would have the nuclear forces needed to undertake truly scorched-earth tactics: Just 125 US Minuteman III warheads could set fire to some 8,000 square miles of forest area where the road-mobile missiles are most likely to be deployed. This would be the equivalent of a circular area with a diameter of 100 miles. Such an attack would be potentially aimed at destroying all road-mobile launchers either as they disperse or after they have taken up position some short distance from roads that give them access to forested areas. Many of the nearly 300 remaining deployed W76 warheads could be used to attack all command posts associated with Russian ICBMs. A very small number of Russia’s major leadership command posts are deeply buried, to protect them from direct destruction by nuclear attack. The US military would likely reserve the highest-yield warheads for those targets. Figure 7 below shows an example of a structure that is roughly the size of the US Capitol building that is postulated to have rooms and tunnels as deep as 800 feet or more. Shelters that have rooms and tunnels at even greater depths could be sealed by using multiple nuclear warheads to crater every location where an entrance or exit might conceivably have been built.

#### And, missile defense will absorb any missiles that survive our initial strike

Lieber and Press 6 – Keir, Professor @ Georgetown, Daryl, Professor @ Dartmouth, “The End of MAD? The Nuclear Dimension of U.S. Primacy”, https://www.mitpressjournals.org/doi/pdf/10.1162/isec.2006.30.4.7

MISSILE DEFENSE. U.S. offensive nuclear capabilities will grow as the United States deploys a national missile defense (NMD) system. In 2001 the United States withdrew from the Antiballistic Missile Treaty and began to build a missile shield. The first contingent of NMD interceptors was deployed in 2004, but this step is only the starting point for a large, multilayered missile defense system. To this end, the United States has doubled investment in missile defense and accelerated research and development on a range of land-, air-, sea-, and space-based missile defense systems.52 Opponents of national missile defense raise two important critiques regarding its feasibility. First, they note that even a few hundred incoming warheads would overwhelm any plausible defense. Second, a missile defense system based on intercepting warheads outside the Earth’s atmosphere is impractical because it is extremely difficult to differentiate decoys from warheads in space.53 Although both criticisms are cogent, even a limited missile shield could be a powerful complement to the offensive capabilities of U.S. nuclear forces. Russia has approximately 3,500 strategic nuclear warheads today, but if the United States struck before Russian forces were alerted, Russia would be lucky if a half-dozen warheads survived. A functioning missile defense system could conceivably destroy six warheads. Furthermore, the problem of differentiating warheads from decoys becomes less important if only a handful of surviving enemy warheads and decoys are left to intercept. Facing a small number of incoming warheads and decoys, U.S. interceptors could simply target them all.

#### Successful preemptive strike forces a surrender – solves further escalation

Sarah Johnson 17, "U.S. Nuclear First Strike Policy; Be Afraid", Bill Track 50, https://www.billtrack50.com/blog/in-the-news/u-s-nuclear-first-strike-policy-be-afraid/

The second situation is a [preemptive strike](http://www.dictionary.com/browse/preemptive-strike) — a first-strike attack with nuclear weapons carried out to destroy an enemy’s capacity to respond. Preemptive strikes can be based on the assumption that the enemy is planning an imminent attack, but don’t have to be. The methodology behind a preemptive nuclear strike is to attack the enemy’s strategic nuclear weapon facilities (missile silos, submarine bases, bomber airfields), command and control sites and storage depots first. By hitting these targets first the enemy will be so wounded with so little of their resources left that they will be forced to surrender with minimal damage to the attacking party.

#### Otherwise, Russia will broadly scale up military AI – extinction

Mike Rogers 17, former US Representative from Michigan, chairman of the House Permanent Select Committee on Intelligence, "Artificial intelligence — the arms race we may not be able to control", TheHill, https://thehill.com/opinion/technology/351725-artificial-intelligence-is-the-new-arms-race-we-may-not-be-able-to-control

“Whoever becomes the leader in this sphere will become ruler of the world,” [said](https://www.theverge.com/2017/9/4/16251226/russia-ai-putin-rule-the-world) Vladimir Putin. The sphere the President of Russia is referring to is artificial intelligence (AI) and his comments should give you a moment of pause. Addressing students at the beginning of our Labor Day weekend, Putin remarked “Artificial intelligence is the future, not only for Russia, but for all humankind,” adding, “It comes with colossal opportunities, but also threats that are difficult to predict.” For once, I find myself in agreement with the President of Russia, but just this once. Artificial Intelligence offers incredible promise and peril. Nowhere is this clearer than in the realm of national security. Today un-crewed systems are a fact of modern warfare. Nearly every country is adopting systems where personnel are far removed from the conflict and wage war by remote control. AI [stands](https://www.nytimes.com/2016/10/26/us/pentagon-artificial-intelligence-terminator.html) to sever that ground connection. Imagine a fully autonomous Predator or Reaper drone. Managed by an AI system, the drone could identify targets, determine their legitimacy, and conduct a strike all without human intervention. Indeed, the Ministry of Defence of the United Kingdom issued a press [statement](https://www.theverge.com/2017/9/12/16286580/uk-government-killer-robots-drones-weapons) in September that the country “does not possess fully autonomous weapon systems and has no intention of developing them,” and that its weapons systems “will always be under control as an absolute guarantee of human oversight and authority and accountability.” Let’s think smaller. Imagine a tiny insect-sized drone loaded with explosive. Guided by a [pre-programmed AI](https://www.amazon.com/Life-3-0-Being-Artificial-Intelligence/dp/1101946598), it could hunt down a specific target — a politician, a general, or an opposition figure — determine when to strike, how to strike, and if to strike based on its own learning. Howard Hughes Medical Center [recently](https://qz.com/1000011/scientists-attached-an-electronic-backpack-to-a-genetically-modified-dragonfly-and-turned-it-into-a-drone/) attached a backpack to a genetically modified dragonfly and flew it remotely. These examples are, however, where humans are involved and largely control the left and right limits of AI. Yet, there are examples of AI purposely and independently going beyond programed parameters. Rogue algorithms led to a [flash crash](http://gizmodo.com/rogue-algorithm-blamed-for-historic-crash-of-the-britis-1787523587) of the British Pound. In 2016, in-game AIs created super AIs weapons and [hunted down](http://www.kotaku.co.uk/2016/06/03/elites-ai-created-super-weapons-and-started-hunting-players-skynet-is-here) human players, and AIs have [created](https://www.forbes.com/sites/tonybradley/2017/07/31/facebook-ai-creates-its-own-language-in-creepy-preview-of-our-potential-future/#1cf69787292c) their own languages that were indecipherable to humans. AIs proved more effective than their human counterparts in producing and catching users in spear phishing programs. Not only did the AIs create more content, they successfully [captured](https://www.blackhat.com/docs/us-16/materials/us-16-Seymour-Tully-Weaponizing-Data-Science-For-Social-Engineering-Automated-E2E-Spear-Phishing-On-Twitter.pdf) more users with their deception. While seemingly simple and low stakes in nature, extrapolate these scenarios into more significant and risky areas and the consequences become much greater. Cybersecurity is no different. Today we are focused on the hackers, trolls, and cyber criminals (officially sanctioned and otherwise) who seek to penetrate our networks, steal our intellectual property, and leave behind malicious code for activation in the event of a conflict. Replace the individual with an AI and imagine how fast hacking takes place; networks against networks, at machine speed all without a human in the loop. Sound far-fetched? It’s not. In 2016, the Defense Advanced Research Projects Agency held an AI on AI capture the flag contest called the [Cyber Grand Challenge](https://www.youtube.com/watch?v=qSgYu3w3DMM) at the DEF CON event. AI networks against AI networks. In August of this year the founders of 116 AI and robotics companies signed a letter petitioning the United Nations [to ban](https://www.theverge.com/2017/8/21/16177828/killer-robots-ban-elon-musk-un-petition) lethal autonomous systems. Signatories to this letter included Google DeepMind’s co-founder Mustafa Suleyman and Elon Musk who, in response to Putin’s quote [tweeted](https://twitter.com/elonmusk/status/904638455761612800), “Competition for AI superiority at national level most likely cause of WW3 imo (sic)”. AI is not some far off future challenge. It is a challenge today and one with which we must grapple. I am in favor of fielding any system that enhances our national security, but we must have an open and honest conversation about the implications of AI, the consequences of which we do not, and may not, fully understand. This is not a new type of bullet or missile. This is a potentially fully autonomous system that even with human oversight and guidance will make its own decisions on the battlefield and in cyberspace. How can we ensure that the system does not escape our control? How can we prevent such systems from falling into the hands of terrorists or insurgents? Who controls the source code? How and can we build in so-called impenetrable kill switches? AI and AI-like systems are slowly being introduced into our arsenal. Our adversaries, China, Russia, and others are also introducing AI systems into their arsenals as well. Implementation is happening faster than our ability to fully comprehend the consequences. Putin’s new call spells out a new arms race. Rushing to AI weapon systems without guiding principles is a dangerous. It risks an escalation that we do not fully understand and may not be able to control. The cost of limiting AI intelligence being weaponized [could vastly exceed](https://www.belfercenter.org/sites/default/files/files/publication/AI%20NatSec%20-%20final.pdf) all of our nuclear proliferation efforts to date. More troubling, the consequences of failure are equally existential.

## ADV 3

#### No retal or escalation from satellite attacks

Eric J. Zarybnisky 18, MA in National Security Studies from the Naval War College, PhD in Operations Research from the MIT Sloan School of Management, Lt Col, USAF, “Celestial Deterrence: Deterring Aggression in the Global Commons of Space”, 3/28/2018, https://apps.dtic.mil/dtic/tr/fulltext/u2/1062004.pdf

PREVENTING AGGRESSION IN SPACE

While deterrence and the Cold War are strongly linked in the public’s mind through the nuclear standoff between the United States and the Soviet Union, the fundamentals of deterrence date back millennia and deterrence remains relevant. Thucydides alludes to the concept of deterrence in his telling of the Peloponnesian War when he describes rivals seeking advantages, such as recruiting allies, to dissuade an adversary from starting or expanding a conflict.6F6 Aggression in space was successfully avoided during the Cold War because both sides viewed an attack on military satellites as highly escalatory, and such an action would likely result in general nuclear war.7F7 In today’s more nuanced world, attacking satellites, including military satellites, does not necessarily result in nuclear war. For instance, foreign countries have used high-powered lasers against American intelligence-gathering satellites8F8 and the United States has been reluctant to respond, let alone retaliate with nuclear weapons. This shift in policy is a result of the broader use of gray zone operations, to which countries struggle to respond while limiting escalation. Beginning with the fundamentals of deterrence illuminates how it applies to prevention of aggression in space.