## 1AC

#### I affirm, Resolved: The appropriation of outer space by private entities is unjust.

### FW

### AC – Framework - 58

#### The standard is maximizing expected well-being.

#### 1] Only pleasure and pain are intrinsically valuable – all other frameworks collapse.

Moen 16 [Ole Martin Moen, Research Fellow in Philosophy at University of Oslo “An Argument for Hedonism” Journal of Value Inquiry (Springer), 50 (2) 2016: 267–281] TDI

Let us start by observing, empirically, that a widely shared judgment about intrinsic value and disvalue is that **pleasure is intrinsically valuable and pain is intrinsically disvaluable**. On virtually any proposed list of intrinsic values and disvalues (we will look at some of them below), pleasure is included among the intrinsic values and pain among the intrinsic disvalues. This inclusion makes intuitive sense, moreover, for **there is something undeniably good about the way pleasure feels and something undeniably bad about the way pain feels**, and neither the goodness of pleasure nor the badness of pain seems to be exhausted by the further effects that these experiences might have. “Pleasure” and “pain” are here understood inclusively, as encompassing anything hedonically positive and anything hedonically negative.2 **The special value statuses of pleasure and pain are manifested in how we treat these experiences in our everyday reasoning about values.** If you tell me that you are heading for the convenience store, I might ask: “What for?” This is a reasonable question, for when you go to the convenience store you usually do so, not merely for the sake of going to the convenience store, but for the sake of achieving something further that you deem to be valuable. You might answer, for example: “To buy soda.” This answer makes sense, for soda is a nice thing and you can get it at the convenience store. I might further inquire, however: “What is buying the soda good for?” This further question can also be a reasonable one, for it need not be obvious why you want the soda. You might answer: “Well, I want it for the pleasure of drinking it.” If I then proceed by asking “But what is the pleasure of drinking the soda good for?” the discussion is likely to reach an awkward end. The reason is that the **pleasure is not good for anything further**; it is simply that for which going to the convenience store and buying the soda is good.3 As Aristotle observes: “We never ask [a man] what his end is in being pleased, because we assume that pleasure is choice worthy in itself.”4 Presumably, a similar story can be told in the case of pains, for if someone says “This is painful!” we never respond by asking: “And why is that a problem?” We take for granted that if something is painful, we have a sufficient explanation of why it is bad. If we are onto something in our everyday reasoning about values, it seems that **pleasure and pain are both places where we reach the end of the line in matters of value.**

#### 2] Extinction comes first under any framework.

Pummer 15 [Theron, Junior Research Fellow in Philosophy at St. Anne's College, University of Oxford. “Moral Agreement on Saving the World” Practical Ethics, University of Oxford. May 18, 2015] AT

There appears to be lot of disagreement in moral philosophy. Whether these many apparent disagreements are deep and irresolvable, I believe there is at least one thing it is reasonable to agree on right now, whatever general moral view we adopt: that it is very important to reduce the risk that all intelligent beings on this planet are eliminated by an enormous catastrophe, such as a nuclear war. How we might in fact try to reduce such existential risks is discussed elsewhere. My claim here is only that we – whether we’re consequentialists, deontologists, or virtue ethicists – should all agree that we should try to save the world. According to consequentialism, we should maximize the good, where this is taken to be the goodness, from an impartial perspective, of outcomes. Clearly one thing that makes an outcome good is that the people in it are doing well. There is little disagreement here. If the happiness or well-being of possible future people is just as important as that of people who already exist, and if they would have good lives, it is not hard to see how reducing existential risk is easily the most important thing in the whole world. This is for the familiar reason that there are so many people who could exist in the future – there are trillions upon trillions… upon trillions. There are so many possible future people that reducing existential risk is arguably the most important thing in the world, even if the well-being of these possible people were given only 0.001% as much weight as that of existing people. Even on a wholly person-affecting view – according to which there’s nothing (apart from effects on existing people) to be said in favor of creating happy people – the case for reducing existential risk is very strong. As noted in this seminal paper, this case is strengthened by the fact that there’s a good chance that many existing people will, with the aid of life-extension technology, live very long and very high quality lives. You might think what I have just argued applies to consequentialists only. There is a tendency to assume that, if an argument appeals to consequentialist considerations (the goodness of outcomes), it is irrelevant to non-consequentialists. But that is a huge mistake. Non-consequentialism is the view that there’s more that determines rightness than the goodness of consequences or outcomes; it is not the view that the latter don’t matter. Even John Rawls wrote, “All ethical doctrines worth our attention take consequences into account in judging rightness. One which did not would simply be irrational, crazy.” Minimally plausible versions of deontology and virtue ethics must be concerned in part with promoting the good, from an impartial point of view. They’d thus imply very strong reasons to reduce existential risk, at least when this doesn’t significantly involve doing harm to others or damaging one’s character. What’s even more surprising, perhaps, is that even if our own good (or that of those near and dear to us) has much greater weight than goodness from the impartial “point of view of the universe,” indeed even if the latter is entirely morally irrelevant, we may nonetheless have very strong reasons to reduce existential risk. Even egoism, the view that each agent should maximize her own good, might imply strong reasons to reduce existential risk. It will depend, among other things, on what one’s own good consists in. If well-being consisted in pleasure only, it is somewhat harder to argue that egoism would imply strong reasons to reduce existential risk – perhaps we could argue that one would maximize her expected hedonic well-being by funding life extension technology or by having herself cryogenically frozen at the time of her bodily death as well as giving money to reduce existential risk (so that there is a world for her to live in!). I am not sure, however, how strong the reasons to do this would be. But views which imply that, if I don’t care about other people, I have no or very little reason to help them are not even minimally plausible views (in addition to hedonistic egoism, I here have in mind views that imply that one has no reason to perform an act unless one actually desires to do that act). To be minimally plausible, egoism will need to be paired with a more sophisticated account of well-being. To see this, it is enough to consider, as Plato did, the possibility of a ring of invisibility – suppose that, while wearing it, Ayn could derive some pleasure by helping the poor, but instead could derive just a bit more by severely harming them. Hedonistic egoism would absurdly imply she should do the latter. To avoid this implication, egoists would need to build something like the meaningfulness of a life into well-being, in some robust way, where this would to a significant extent be a function of other-regarding concerns (see chapter 12 of this classic intro to ethics). But once these elements are included, we can (roughly, as above) argue that this sort of egoism will imply strong reasons to reduce existential risk. Add to all of this Samuel Scheffler’s recent intriguing arguments (quick podcast version available here) that most of what makes our lives go well would be undermined if there were no future generations of intelligent persons. On his view, my life would contain vastly less well-being if (say) a year after my death the world came to an end. So obviously if Scheffler were right I’d have very strong reason to reduce existential risk. We should also take into account moral uncertainty. What is it reasonable for one to do, when one is uncertain not (only) about the empirical facts, but also about the moral facts? I’ve just argued that there’s agreement among minimally plausible ethical views that we have strong reason to reduce existential risk – not only consequentialists, but also deontologists, virtue ethicists, and sophisticated egoists should agree. But even those (hedonistic egoists) who disagree should have a significant level of confidence that they are mistaken, and that one of the above views is correct. Even if they were 90% sure that their view is the correct one (and 10% sure that one of these other ones is correct), they would have pretty strong reason, from the standpoint of moral uncertainty, to reduce existential risk. Perhaps most disturbingly still, even if we are only 1% sure that the well-being of possible future people matters, it is at least arguable that, from the standpoint of moral uncertainty, reducing existential risk is the most important thing in the world. Again, this is largely for the reason that there are so many people who could exist in the future – there are trillions upon trillions… upon trillions. (For more on this and other related issues, see this excellent dissertation). Of course, it is uncertain whether these untold trillions would, in general, have good lives. It’s possible they’ll be miserable. It is enough for my claim that there is moral agreement in the relevant sense if, at least given certain empirical claims about what future lives would most likely be like, all minimally plausible moral views would converge on the conclusion that we should try to save the world. While there are some non-crazy views that place significantly greater moral weight on avoiding suffering than on promoting happiness, for reasons others have offered (and for independent reasons I won’t get into here unless requested to), they nonetheless seem to be fairly implausible views. And even if things did not go well for our ancestors, I am optimistic that they will overall go fantastically well for our descendants, if we allow them to. I suspect that most of us alive today – at least those of us not suffering from extreme illness or poverty – have lives that are well worth living, and that things will continue to improve. Derek Parfit, whose work has emphasized future generations as well as agreement in ethics, described our situation clearly and accurately: “We live during the hinge of history. Given the scientific and technological discoveries of the last two centuries, the world has never changed as fast. We shall soon have even greater powers to transform, not only our surroundings, but ourselves and our successors. If we act wisely in the next few centuries, humanity will survive its most dangerous and decisive period. Our descendants could, if necessary, go elsewhere, spreading through this galaxy…. Our descendants might, I believe, make the further future very good. But that good future may also depend in part on us. If our selfish recklessness ends human history, we would be acting very wrongly.” (From chapter 36 of On What Matters)

#### 3] Actor specificity: A] Governments must aggregate since every policy benefit some and harms others, which also means side constraints freeze action. B] States lack wills or intentions since policies are collective actions. C] Actor-specificity comes first since different agents have different ethical standings.

### Contention 1 is Exploration

#### Currently, entrepreneurs are pushing for privatization of space travel with increasing success

Thompson 20 [(Clive, author of Coders: The Making of a New Tribe and the Remaking of the World, a columnist for Wired magazine, and a contributing writer to The New York Times Magazine) “Monetizing the Final Frontier The strange new push for space privatization,” December 3, 2020 <https://newrepublic.com/article/160303/monetizing-final-frontier>] TDI

For longtime enthusiasts of NASA’s human spacefaring, it was a singularly auspicious moment. Ever since NASA’s space shuttles were mothballed in 2011, the agency had no American-owned way of getting people into space. It had been paying the Russian government to fly U.S. astronauts up and back, on Russia’s Soyuz spacecraft. But this flight was different. It was the first time humans had flown in a rocket and a capsule made by a private-sector company: SpaceX, the creation of the billionaire Elon Musk. The launch was also a SpaceX branding bonanza. The astronauts rode up to the rocket in a Tesla, Musk’s fabled luxury electric car; when they’d reached orbit, they broadcast a live video in which they thanked SpaceX for making the flight happen, and showed off the sleek capsule—a genuine marvel of engineering, with huge touch screen control panels that looked rather like the ones inside a Tesla itself. Over the next few years, NASA will pay Musk and SpaceX $2.6 billion to ferry astronauts to and from the space station six times. For the feds, this price tag is remarkably cheaper than the space shuttle, which cost over $1 billion per flight. In his speech after the launch, Trump lauded the cost savings that SpaceX had realized on the government’s behalf. SpaceX, he announced, “embodies the American ethos of big thinking and risk-taking.... Congratulations, Elon.” For Musk, though, the launch was more than just a technical success, and is bigger even than the $2.6 billion contract. It cements him as a leading player in what might seem the unlikeliest stage of the final frontier’s exploration—the privatization of space. Private-sector activity in space travel is accelerating dramatically—rocketing, one might say. For decades, ever since people first headed for orbit in the 1960s, spaceflight had been mostly the preserve of governments. States were the only actors with the money and technical acumen to blast things into the vacuum and get them safely down again. The private sector didn’t have NASA’s know-how, nor—more important—a business plan that could rationalize the massive outlay of capital required to operate in space. In the last few years, that calculus has changed dramatically. A generation of “New Space” entrepreneurs has begun launching rockets and satellites. Some seek to flood the planet with fast, cheap mobile-phone signals; others want to manufacture new products in zero gravity, harnessing the novel physics of such conditions to engineer substances that can’t be made in Earth’s gravity. Further afield, they’re aiming to harvest water on the moon and even mine asteroids. Backing this burst of entrepreneurial fervor are many billionaires who made their money in the early Wild West of the internet, including Amazon’s Jeff Bezos, with dreams of building space colonies, and Musk, the former PayPal titan who hopes to personally make it to Mars.Barack Obama’s administration made the first major overtures to the space privatizers, signing legislation that paved the way for today’s space boom. But the real land rush has occurred under Trump, via a flurry of executive orders designed to give private firms greater access to “low-Earth orbit.” Trump officials have even touted the idea of privatizing the $100 billion space station itself—the last signature NASA-sponsored human spacecraft project still aloft. When Trump’s transition team in 2017 pondered the handoff of low-Earth orbit to the private sector, it concluded: “This may be the biggest and most public privatization effort America has ever conducted.” Or as Texas GOP Senator Ted Cruz—at the time the chairman of the Space, Science, and Competitiveness Subcommittee—put it in 2018: “I predict the first trillionaire will be made in space.” The burst of activity and high-tech acumen thrills many space fans. But it is making many others quite nervous. Opening up space to a frenzy of private actors could, they agree, produce measurable benefits back on planet Earth—making crucial scientific research, environmental monitoring, and everyday communication cheaper. But the critics are quick to note as well that the history of privatization is spotty at best, with plenty of civically brutal knock-on effects: concentrations of monopolistic power, enfeebled democratic control, and widespread environmental degradation. We’ve seen all those problems appear on Earth as all manner of traditional social goods, from education and housing to pension plans and mass transit, have been targeted for private-sector control. Next up, it seems, is the great beyond.

#### Entrepreneurs purposely understate the barriers to colonization, yet exploit its potential for financial gain –

Phillips 20 [(Leigh, science writer and EU affairs journalist, author of Austerity Ecology & the Collapse-Porn Addicts.) “We Don’t Need Elon Musk to Explore the Solar System,” May 8, 2021, https://jacobinmag.com/2021/05/elon-musk-space-exploration-mars-colonization] TDI

He opens the paper with a recognition that, at some point, if we stay on Earth, we will confront an eventual extinction event. “The alternative is to become a spacefaring civilization and a multi-planetary species.” He alights upon Mars as the obvious first option for establishing a “self-sustaining city — a city that is not merely an outpost, but which can become a planet in its own right.” He rejects Venus due to it being, as he correctly puts it, a super-high-pressure, hot acid bath. He rejects Mercury due to it being too close to the Sun, and the Moon for lack of atmosphere and its twenty-eight-day “day” (a Martian day, or “sol,” for comparison, is an Earthling-friendly 24.5 hours). And he rejects, at least for now, the moons of Jupiter or Saturn, as they are much harder to get to. Mars has more than its own share of habitability issues, but Musk does not mention them, other than to say that, while Mars is “a little cold” (in reality, -63ºC, or -81ºF, compared to Earth’s balmy 16ºC, or 57ºF), “we can warm it up.” The Martian atmosphere is “very helpful” because it’s primarily CO2, with some nitrogen and argon, meaning that “we can grow plants on Mars just by compressing the atmosphere.” Most cheery of all, Musk says it would be “quite fun” to be on Mars, because the gravity is about 38 percent that of Earth, making it easy to lift heavy things and “bound around.” Mars, as seen from space. (WikiImages via Pixabay) It’s all so simple. “We just need to change the populations because currently we have seven billion people on Earth and none on Mars.” And so the paper is primarily devoted to explaining how to solve that sole problem: how to lower the cost of a trip to Mars from the current roughly $10 billion per person down to the median cost of a house in the United States. By making rockets reusable, refilling in orbit, producing propellant on Mars, choosing the right propellant, and improving system design and performance, Musk reckons he can get the cost of a ticket down to $200,000, perhaps as little as $100,000. And Musk’s SpaceX has done a tremendous job so far of sharply reducing the cost of escaping Earth’s gravity well, primarily via deep vertical integration of the firm. It produces a whopping 70 percent of its components in-house, as opposed to the 1,200 different suppliers in the outsourced supply chain of its main competitor, the Boeing–Lockheed Martin partnership known as the United Space Alliance. Each of these suppliers extracts their own profit margin from every contract in the chain, jacking up the cost per launch to $460 million. SpaceX, by comparison, charges NASA and its other clients just $62 million per launch, and Musk says he has slashed the marginal cost of a reused Falcon 9 booster launch to a mere $15 million. Well done, Elon. Or, rather, well done to all the engineers, logistical experts, and other workers who have done most of the labor, allowing SpaceX to revolutionize the business model of getting to space. There is not really any mention of the enormous challenges of the atmosphere’s low pressure and toxic composition, the preponderance of deadly perchlorates in the soil, or the lack of magnetosphere to protect against solar and cosmic radiation. The current atmosphere of Mars is too thin to support most life: its pressure is only about 1 percent that of Earth. Only hypopiezotolerant microbes (those that live in low-pressure environments), such as ones that are lofted by winds into Earth’s stratosphere, would be able to survive. The atmosphere is also 95 percent carbon dioxide — fine for plants (if the pressure were able to be raised) but not for animals. Musk does say that once Mars is warmed up, “we would once again have a thick atmosphere and liquid oceans.” Bioremediation using bacteria to clean up perchlorates already occurs on Earth, but we are talking about an entire planet here. There is no discussion of how any of this might happen, over what time period, and who would pay for it. Same with the construction of an artificial magnetosphere. Dealing with the perchlorates alone would likely be profoundly more challenging and expensive than the relatively straightforward process of decarbonizing Earth’s economy. A 2018 NASA study found that there is insufficient CO2 and H2O from the Martian soil, polar ice caps, and minerals in the upper crust to get anywhere close to thickening the atmosphere and using it like a blanket to warm up the planet. All these sources combined would still only boost the pressure to about 7 percent of that of Earth. Carbon-bearing minerals deep in the crust might have enough CO2 to achieve the needed pressure, but nothing is known about their extent, and recovering them with current technology would be colossally energy intensive. Another idea is to direct comets or asteroids to crash into Mars and release their greenhouse gases that way. Again, these are fantastical ideas that will be impractical for many, many generations yet to come. NASA astronauts in space. (NASA) And there is likely no way of ever overcoming Mars’s low gravity. If you added all the mass of Venus to that of Mars, smashing the planets together, even then, you would still not quite achieve Earth’s gravity. It is true that we do not know what the physiological effects of 38 percent of Earth’s gravity are, either on humans or other life. We have two data points: Earth gravity, what we call 1G, and the 0G microgravity of the International Space Station (ISS). But from studies of astronauts who have spent extended periods aboard the ISS, we know that 0G is extremely bad for human health. Muscles atrophy. Tendons and ligaments begin to fail. Facial and finger muscles, which cannot be worked out via onboard gyms or treadmills, weaken. The spine lengthens, with astronauts gaining an inch or two in height and suffering from back pain. Bones demineralize, losing density at a rate of 1 percent per month. As Christopher Wanjek, a former NASA science writer and author of 2020 book Spacefarers — which is an optimistic volume on the viability of manned space travel — notes: “To visualize how bad that bone loss is, consider the fact that the major obstacle to fully recycling urine into drinking water on the ISS is that the filters get clogged daily with calcium deposits.” Wanjek writes how the rate of vision loss is such that a crew to Mars would need to pack eyeglasses with various prescriptions for “each phase of their gradual, inevitable, and permanent vision loss.” Kidneys get confused by blood not being where it’s supposed to be and think there is an excess, so they start to remove what they believe to be excess water. The blood thickens, driving a reduced production of red blood cells, which in turn drives anemia, shortness of breath, lethargy, and greater likelihood of infection. Perhaps worst of all, brain compression resulting from microgravity negatively impacts regions responsible for fine motor movement and executive function — deteriorations that could be permanent. A range of interventions, including exercise, drugs, and compression clothing can shave the sharp edges off some of these effects, but ultimately, the solution on a spacecraft is the simulation of gravity via centrifugal force — a spinning ship. This is not something that you can do with a whole planet. It is for this reason that Venus, with its gravity not too far off that of Earth, may actually be a better terraforming candidate than Mars — one day — despite its currently inhospitable atmosphere. The Real Business of SpaceX Isn’t Mars One has to suspect that Musk knows all this. We have a hint of this when, at one point in his paper, Musk concedes that it will be difficult to fund his vision just by slashing the cost of getting to space. He admits that SpaceX expects to generate substantial cash flow from launching lots of satellites and servicing the International Space Station for NASA. Additional help for bankrolling the Mars project might come from the emergence of a market for really fast transportation of things or people around the world by rocket: cargo could be transported anywhere on Earth in forty-five minutes, and a trip from New York to Tokyo could take a mere twenty-five minutes (so long as takeoff and landing takes place where the tremendous noise, as he puts it in hip-CEO-speak, “is not a super-big deal”). As a result, one gets the impression by reading between the lines that a self-sustaining Martian city is all just an impressive marketing maneuver taking advantage of most people’s sense of adventure and wonder; of our species’ ancient need to wander and explore. The real business of SpaceX was never a Martian colony but rather servicing a mature satellite market, stealing government space contracts from the likes of Boeing, and kicking off a terrestrial rocket transport sector. The dream of Mars is, in this case, not really any different from the adman’s fiction of romance and aspiration that sells a can of Pepsi or a Jeep. The dream of Mars is, in this case, not really any different from the adman’s fiction of romance and aspiration that sells a can of Pepsi or a Jeep. None of this is to suggest that establishing an outpost on Mars for the purposes of scientific exploration should not be attempted, even in the next couple of decades. But an outpost, as Musk himself makes clear, does not approach a self-sustaining city, and still less a multi-planetary species. Because humans do need to exit Earth at some point in order to maintain the species, if we are to establish genuinely self-sustaining colonies, then terraforming will likely be necessary one day, as well as interstellar generation ships that take us to habitable exoplanets far beyond the solar system. For all of this, we will have to figure out how to take our ecology with us. We are not really the collection of individuals we thought we were, but rather are deeply embedded within our ecosystems. Indeed, each of us is a microbial ecosystem whose edges are vague. Where does the bacterial, fungal, and viral multitude that is “me” stop and my equally microbiological environment begin? This does not mean that Earth will be the only home we ever have, but it does mean that the antiseptic, forestless, riverless Starship Enterprise would leave its inhabitants very sick before too long. How much of our ecology do we need to take with us, though? We just don’t know yet. The science of ecology is very much still a young discipline. This is where fantastical science-fiction conceptions of vast ships made from hollowed out asteroids and packed with different biomes fills the gap of what we do not know. Likewise for novels like Becky Chambers’s To be Taught, if Fortunate, in which, instead of terraforming other worlds, adapting them to our needs, we genetically alter our bodies via “somaforming” to adapt ourselves to their conditions. Plainly, then, there is no rush for any of this, even as there is a moral imperative for us, one day in the distant future, to permanently exit Earth. Our colonization of other worlds is akin to the building of the grandest cathedral we have ever envisaged: a project that will take centuries, or more likely millennia, many millennia. This is nothing that a private company can deliver. There is no near-term return on investment; indeed, there is no aim of profitability at all, but rather of our species’ survival through the eons.

#### Deep space exploration is a shared goal that prevents escalation of US-Russia tensions. But privatization threatens it independent of our other internal links

CSIS 18 [(Center for Strategic and International Studies), “Why Human Space Exploration Matters,” August 21, 2018 https://www.csis.org/blogs/post-soviet-post/space-cooperation] TDI

U.S.-Russian space cooperation continues to be a stated mutual goal. In April 2018, President Putin said of space, “Thank God, this field of activity is not being influenced by problems in politics. Therefore, I hope that everything will develop, since it is in the interests of everyone…This is a sphere that unites people. I hope it will continue to be this way.” During his statement at a recent event at CSIS, NASA Administrator Jim Bridenstine said, “[space] is our best opportunity to dialogue when everything else falls apart. We’ve got American astronauts and Russian cosmonauts dependent on each other on the International Space Station, which enables us to ultimately maintain that dialogue.” The U.S. and Russia both benefit from the ISS partnership. Russia provides transportation to the ISS for U.S. astronauts, from which Russia receives an average of $81 million per seat on the Soyuz (and recognition of its status as a space power). The U.S. also benefits from Russia’s technical contributions to the ISS while Russia benefits The U.S. and Russia signed a joint statement in 2017 in support of the idea of collaborating on deep space exploration, including the construction of the Lunar Orbital Platform-Gateway, a research-focused space station orbiting the moon. Through agreements on civilian space exploration, such as the Lunar Orbital Platform-Gateway or future Mars projects, that have clear benefits to both sides, some degree of cooperation will remain in both countries’ interest. The high price tag for pursuing space exploration alone and opportunities for sharing and receiving technical expertise encourages international partnerships like the ISS. However, at least three factors, apart from the overall deterioration of U.S.-Russia relations, threaten this cooperation. First, growth of the private sector space industry may alter the economic arrangement between the U.S. and Russia, and ultimately lower the benefits of cooperation to both countries. The development of advanced technologies by private companies will give NASA new options to choose from and reduce the need to depend on (and negotiate with) Russia. If NASA and its Russian counterpart, Roskosmos, have no need to talk with one another, they probably won’t in the face of tense political relations. The U.S. intends to use Boeing and SpaceX capsules for human spaceflight beginning in 2020, and a Congressional plan in 2016 set a phase out date of Russian RD-180 rocket engines by 2022.

#### It’s make or break for the relationship—Ukraine, decline of US moral authority on international affairs puts us at the brink of the end of Russian diplomacy and even war

Weir 21 [(Fred Weir has been the Monitor's Moscow correspondent, covering Russia and the former Soviet Union, since 1998. He's traveled over much of that vast territory, reporting on stories ranging from Russia's financial crash to the war in Chechnya, creeping Islamization in central Asia, Russia's demographic crisis, the rise of Vladimir Putin and his repeated returns to the Kremlin, and the ups and downs of US-Russia relations). “Worse than the Cold War? US-Russia relations hit new low.“ Christian Science Monitor 4-20-2021 https://www.csmonitor.com/World/Europe/2021/0420/Worse-than-the-Cold-War-US-Russia-relations-hit-new-low] TDI

Russia’s relations with the West, and the United States in particular, appear to be plumbing depths of acrimony and mutual misunderstanding unseen even during the original Cold War.After years of deteriorating relations, sanctions, tit-for-tat diplomatic expulsions, and an escalating “information war,” some in Moscow are asking if there even is any point in seeking renewed dialogue with the U.S., if only out of concern that more talking might just make things worse. Events have cascaded over the past month. Russia’s treatment of imprisoned dissident Alexei Navalny, who has been sent to a prison hospital amid reports of failing health, underlines the sharp perceived differences between Russia and the West over matters of human rights. Meanwhile, a Russian military buildup near Ukraine has illustrated that the conflict in the Donbass region might explode at any time, possibly even dragging Russia and NATO into direct confrontation. With its relations with Washington at a nadir, Russia is eyeing a more pragmatic, if adversarial, relationship with the U.S. in the hopes of getting the respect it desires. President Joe Biden surprised the Kremlin by proposing a “personal summit” to discuss the growing list of U.S.-Russia disagreements in a phone conversation with Vladimir Putin last week. He later spoke of the need for “disengagement” in the escalating tensions around Ukraine, and postponed a planned visit of two U.S. warships to Russia-adjacent waters in the Black Sea. But days later he also imposed a package of tough sanctions against Russia, for its alleged SolarWinds hacking and interference in the 2020 U.S. presidential elections, infuriating Moscow and drawing threats of retaliation. Last month, after Mr. Biden agreed with a journalist’s intimation that Mr. Putin is a “killer,” the Kremlin ordered Russia’s ambassador to the U.S. to return home for intensive consultations, an almost unprecedented peacetime move. Over the weekend, Russian Foreign Minister Sergey Lavrov suggested that the acting U.S. ambassador to Moscow, John Sullivan, should likewise go back to Washington for a spell. On Tuesday, Mr. Sullivan announced he would do just that this week. And there is a growing sense in Moscow that the downward spiral of East-West ties has reached a point of no return, and that Russia should consider abandoning hopes of reconciliation with the West and seek permanent alternatives: perhaps in an intensified compact with China, and targeted relationships with countries of Europe and other regions that are willing to do business with Moscow. “Things are at rock bottom. This may not be structurally a cold war in the way the old one was, but mentally, in terms of atmosphere, it’s even worse,” says Fyodor Lukyanov, editor of Russia in Global Affairs, a Moscow-based foreign policy journal. “The fact that Biden offered a summit meeting would have sounded a hopeful note anytime in the past. Now, nobody can be sure of that. A hypothetical Putin-Biden meeting might not prove to be a path to better relations, but just the opposite. It could just become a shouting match that would bring a hardening of differences, and make relations look like even more of a dead end.” Room for discussion Foreign policy experts agree that there is a long list of practical issues that could benefit from purposeful high-level discussion. With the U.S. preparing to finally exit Afghanistan, some coordination with regional countries, including Russia and its Central Asian allies, might make the transition easier for everyone. One of Mr. Biden’s first acts in office was to extend the New START arms control agreement, which the Trump administration had been threatening to abandon, but the former paradigm of strategic stability remains in tatters and requires urgent attention, experts say. “If you are looking for opportunities to make the world a safer place through reason and compromise, there are quite a few,” says Andrey Kortunov, director of the Russian International Affairs Council, which is affiliated with the Foreign Ministry. “There are also some areas where the best we could do is agree to disagree, such as Ukraine and human rights issues.” The plight of Mr. Navalny, which has evoked so much outrage in the West, seems unlikely to provide leverage in dealing with the Kremlin because – as Western moral authority fades – Russian public opinion appears indifferent, or even in agreement with its government’s actions. Recent surveys by the Levada Center in Moscow, Russia’s only independent pollster, found that fewer than a fifth of Russians approve of Mr. Navalny’s activities, while well over half disapprove. An April poll found that while 29% of Russians consider Mr. Navalny’s imprisonment unfair, 48% think it is fair. Russian opposition figure Alexei Navalny, shown here during a hearing in the Babuskinsky District Court in Moscow Feb. 12, 2021, is in poor health amid his hunger strike while in prison in Russia. He was recently moved to a prison hospital. Tensions around the Russian-backed rebel republics in eastern Ukraine have been much severer than usual, with a spike in violent incidents on the front line, a demonstrative Russian military buildup near the borders, and strong U.S. and NATO affirmations of support for Kyiv. The Russian narrative claims that Ukrainian President Volodymyr Zelenskiy triggered the crisis a month ago by signing a decree that makes retaking the Russian-annexed territory of Crimea official Ukrainian state policy. Mr. Zelenskiy has also appealed to the U.S. and Europe to expedite Ukraine’s membership in NATO, which Russia has long described as a “red line” that would lead to war. But Russian leaders, who have been at pains to deny any direct involvement in Ukraine’s war for the past seven years, now say openly that they will fight to defend the two rebel republics. Top Kremlin official Dmitry Kozak even warned that if conflict erupts, it could be “the beginning of the end” for Ukraine. “This is a very desperate situation,” says Vadim Karasyov, director of the independent Institute of Global Strategies in Kyiv. “We know the West is not going to help Ukraine militarily if it comes to war. So we need to find some kind of workable compromises, not more pretexts for war.” Time to turn eastward? In this increasingly vexed atmosphere, the Russians appear to be saying there is no point in Mr. Putin and Mr. Biden meeting unless an agenda has been prepared well in advance, setting out a few achievable goals and leaving aside areas where there can be no agreement. “Russia isn’t going to take part in another circus like we had with Trump in Helsinki in 2018,” says Sergei Markedonov, an expert with MGIMO University in Moscow. “What is needed is a deeper dialogue. That could begin if we had a real old-fashioned summit between Biden and Putin, one that has been calculated to yield at least some positive results. We need to find a modus vivendi going forward, and the present course is not leading there.” Alternatively, Russia may turn away from any hopes of even pragmatic rapprochement with the West, experts warn. Mr. Lukyanov, who maintains close contact with his Chinese counterparts, says they felt blindsided at a summit with U.S. foreign policy chiefs in Alaska last month, when what they expected to be a practical discussion of how to overcome the acrimonious Trump-era legacy in their relations turned into what they saw as a U.S. lecture about how China needs to obey the “rules-based” international order. “It was the Chinese, in the past, who were very cautious about participating” in anything that looked like an anti-Western alliance, says Mr. Lukyanov. “We are hearing a new tone from them now. Now our growing relationship with China isn’t just about compensating for a lack of relations with the U.S. It’s about the need to build up a group of countries that will resist the U.S., aimed at containing U.S. activities and policies that are harmful to our two countries.”

#### Space weapons heighten potential for escalation and make perceptions of US-Russia space conflict key.

Alexey Arbatov et al, head of the Center for International Security at the Primakov National Research Institute of World Economy and International Relations, Major General Vladimir Dvorkin, a principal researcher at the Center for International Security at the Primakov National Research Institute of World Economy and International Relations and Peter Topychkanov, fellow at the Carnegie Moscow Center’s Nonproliferation Program, ‘17 “Russian And Chinese Perspectives On Non-Nuclear Weapons And Nuclear Risks” *Carnegie Endowment for International Peace Publications,* <https://www.russiamatters.org/sites/default/files/media/files/Entanglement_interior_FNL.pdf>

Against this background, Russian military and technical experts are currently engaged in efforts to elaborate strategies for fighting an air-space war. The following is an attempt to frame such an integrated doctrine by one of its main theoreticians, Colonel Yuri Krinitsky from the Military Air-Space Defense Academy: “The integration of aerial and space-based means of attack has transformed airspace and space into a specific field of armed conflict: an air-space theater of military operations. United, systematically organized actions of [U.S.] air-space power in this theater should be countered with united and systematically organized actions by the Russian Air-Space Defense Forces. This is required under the National Security Strategy of the Russian Federation and Air-Space Defense Plan approved by the Russian president in 2006.”6 This document goes on to list the tasks of the Air-Space Defense Forces as “monitoring and reconnaissance of the airspace situation; identifying the beginning of an aerial, missile, or space attack; informing state organs and the military leadership of the Russian Federation about it; repelling air-space attacks; and defending command sites of the top levels of state and military command authorities, strategic nuclear forces’ groupings, and the elements of missile warning systems.”7 While picking apart in detail the organizational, operational, and technical aspects of the Air-Space Defense Forces (now part of the Air-Space Forces),8 military analysts step around the basic question of what constitutes “the means of air-space attack” (SVKN in Russian, MASA in English). This term and “air-space attack” are broadly used in official documents (including the Military Doctrine) and statements, as well as in the new names of military organizations (such as the Air-Space Forces), and in a seemingly infinite number of professional articles, books, and pamphlets. If MASA refers to aircraft and cruise missiles, then what does space have to do with it? To be sure, various military communication and intelligence, reconnaissance, and surveillance satellites are based in space, but these assets also serve the Navy and Ground Forces without the word “space” tacked onto their names. If MASA refers to long-range ballistic missiles, which have trajectories that pass mostly through space, then this threat is not new but has existed for more than sixty years. There was—and still is—no defense against a massive ballistic missile strike, and none is likely in the future in spite of U.S. and Russian efforts at missile defense. In the past (and possibly now), one of the possible tasks of ballistic missiles was to break “corridors” in the enemy’s air-defense system to enable bombers to penetrate it. But with ballistic missiles being armed with more warheads with improved accuracy, and with the advent of longrange air-launched cruise missiles, it is increasingly unnecessary for bombers to be able to penetrate enemy air defenses. Coordination between air and notional “space” systems has apparently moved to the background of strategic planning. Anyway, this tactic was never considered as air-space warfare before now. MASA may be used in reference to potential hypersonic boost-glide weapons, which are discussed below. But their role and capabilities are not yet known, so it would clearly be premature to build the theory of air-space war on them, and even more so to start creating defenses against them. In any case, referring to those weapons as MASA is farfetched: besides a short boost phase, their entire trajectory is in the upper atmosphere at speeds greater than airplanes but lower than ballistic missiles. It is, therefore, even less apt to describe such systems as space arms than it is to refer to traditional long-range ballistic missiles as such. Finally, as for theoretically possible space-based weapons that would conduct strikes against targets on the ground, at sea, and in the air, they do not yet exist, and their future viability is far from clear. Even if the concept of air-space war is ill-defined, the military and technical experts who propound it reach a predictable conclusion with regard to the capabilities needed to fight one. They typically argue that Russia needs “to counter the air-space attack system with an air-space defense system. . . . A prospective system for destroying and suppressing MASA should be a synergy of anti-missile, anti-satellite, and air-defense missiles, and air units, and radio-electronic warfare forces. And its composition should be multilayered.”9 Such calls are being translated into policy. Most notably, the air-space defense program, for which the military’s top brass and industrial corporations lobbied, is the single largest component of the State Armaments Program through 2020, accounting for about 20 percent of all costs when the program was first announced in 2011—about 3.4 trillion rubles ($106 billion at the time).10 Along with the modernization of the missile early-warning system by the development and deployment of new Voronezh-type land-based radars and missile-launch detection satellites, the program envisages the deployment of twenty-eight missile regiments of S-400 Triumph air-defense systems (about 450 to 670 launchers), and thirty-eight battalions equipped with the next-generation S-500 Vityaz (recently renamed Prometey) systems (300 to 460 launchers).11 In total, the plan is to manufacture up to 3,000 missile interceptors of the two types, for which three new production plants were built. A new integrated and fully automatic command-and-control system is being created to facilitate operations by the Air-Space Defense Forces. The Moscow A-135 missile defense system (now renamed A-235) is being modernized with non-nuclear kinetic interceptors to engage incoming ballistic missiles (previously the interceptors were armed with nuclear warheads).12 The current Russian economic crisis, which has resulted in defense budget cuts in fiscal year 2017, may slow down the air-space armament programs and the scale of arms procurement, but the underlying momentum will be unaffected unless stopped or redirected by a major change in Russia’s defense posture. In a sense, Russian policy may be explained by the visceral desire of the military to break out from the deadlock—the “strangulating effect”—of mutual assured nuclear destruction, which has made further arms development, high-technology competition, and supposedly fascinating global war scenarios senseless (indeed, it prompted U.S. and Soviet leaders of the 1970s and 1980s to agree that, as then U.S. president Ronald Reagan put it, “a nuclear war cannot be won and must never be fought.”13) During the four decades of the Cold War, several generations of the Soviet military and defense industrial elite had learned and become accustomed to competing with the most powerful possible opponent, the United States, and such competition became their raison d’être. The end of the Cold War and of the nuclear arms race in the early 1990s deprived them of this supposedly glorious quest, and opposing rogue states and terrorists was not a noble substitute. U.S. and NATO operations in Yugoslavia and Iraq, however, provided a new hightechnology challenge, defined in Russia as air-space warfare, which was eagerly embraced as a new and fascinating domain of seemingly endless competition with a worthy counterpart. Besides, this new dimension of warfare doubtless gave the military and associated defense industries an opportunity to impress political leadership with newly discovered esoteric and frightening threats, justifying the prioritization of national defense, and hence arms procurement programs and large defense budgets. In any case, the Russian strategy for air-space war is directly connected to the problem of entanglement. Astonishingly—and this makes the concept look quite scholastic—its framers shed no light on the single most important question: Is the context for air-space war a global (or regional) nuclear war, or a non-nuclear war that pits Russia against the United States and NATO? If it is the former, then in the event of the large-scale use of ballistic missiles armed with nuclear warheads (and in the absence of effective missile defense systems), the Russian Air-Space Forces would be unlikely to function effectively. Except for issuing warnings about incoming missile attacks, they would not be able to fulfill the tasks assigned to them by Russia’s Military Doctrine, including “repelling air-space attacks and defending command sites of the top levels of state and military administration, strategic nuclear forces’ units, and elements of missile warning systems.”14 Alternatively, if air-space war assumes a non-nuclear conflict, then the concept raises serious doubts of a different nature. Russian state and military leaders have regularly depicted terrifying scenarios of large-scale conflicts being won through non-nuclear means. Former deputy defense minister General Arkady Bakhin, for example, has described how “leading world powers are staking everything on winning supremacy in the air and in space, on carrying out massive air-space operations at the outbreak of hostilities, to conduct strikes against sites of strategic and vital importance all across the country.”15 It is difficult to imagine, however, that such a conflict, in reality, would not quickly escalate to a nuclear exchange, especially as strategic forces and their C3I systems were continually attacked by conventional munitions. Right up until the mid-1980s, the military leadership of the USSR believed that a major war would likely begin in Europe with the early use by Warsaw Pact forces of hundreds of tactical nuclear weapons “as soon as [they] received information” that NATO was preparing to launch a nuclear strike.16 After that, Soviet armies would reach the English Channel and the Pyrenees in a few weeks, or massive nuclear strikes would be inflicted by the USSR and the United States on one another, and the war would be over in a few hours, or at most in a few days, with catastrophic consequences.17 After the end of the Cold War, the task of elaborating probable major war scenarios was practically shelved because such a war had become unthinkable in the new political environment. However, strategic thinking on the next high-technology global war apparently continued in secret (and probably not only in Russia). Now, at a time of renewed confrontation between Russia and the West, the fruits of that work are finally seeing the light of day. In all likelihood, the authors of the strategy imagine that over a relatively long period of time—days or weeks—the West would wage a campaign of air and missile strikes against Russia without using nuclear weapons. Russia, in turn, would defend against such attacks and carry out retaliatory strikes with long-range conventional weapons. Notably, in 2016, Russian Defense Minister Sergei Shoigu stated that “by 2021, it is planned to increase by four times the combat capabilities of the nation’s strategic non-nuclear forces, which will provide the possibility of fully implementing the tasks of non-nuclear deterrence.”18 In other words, the basic premise is that the U.S.-led campaigns against Yugoslavia in 1999 or Iraq in 1990 and 2003 (which are often cited by experts in this context) may be implemented against Russia—but with different results, thanks to the operations of the Russian Air-Space Forces, the Strategic Rocket Forces, and the Navy against the United States and its allies. The emphasis on defensive and offensive strategic non-nuclear arms does not exclude, but—on the contrary—implies the limited use of nuclear weapons at some point of the armed conflict. Sergei Sukhanov, one of the most authoritative representatives of the defense industries as the constructor general of the Vympel Corporation, which is responsible for designing strategic defense systems, has exposed the whole panorama of Russia’s contemporary strategic logic on the interactions between offensive and defensive systems and between nuclear and non-nuclear systems: If we cannot exclude the possibility of the large-scale use of air-space attacks by the U.S. and other NATO countries (i.e., if we accept that the Yugoslavian strategy might be applied against Russia), then it is clearly impossible to solve the problem by fighting off air-space attacks with weapons that would neutralize them in the air-space theater, since this would require the creation of highly effective air- and missile defense systems across the country. Therefore, the strategy for solving the air-space defense tasks faced in this eventuality should be based on deterring the enemy from large-scale air-space attacks by implementing the tasks facing air-space defense in this eventuality at a scale that would avoid escalation but force the enemy to refrain from further airspace attack.19 (Emphasis added.) In other words, because of the inevitable limitations in Russia’s ability to defend against air-space attacks, Sukhanov argues that Russia may have to resort to the limited use of nuclear weapons in order to compel the United States and its allies into backing down. This basic logic is widely accepted in Russia. Judging by the available information, the United States does not have—and is not expected to have for the foreseeable future—the technological means or the operational plans to wage non-nuclear air-space warfare against Russia. However, the fact that a major war with the United States and NATO is *seen* in contemporary Russian strategic thinking as a prolonged endeavor involving an integrated technological and operational continuum of nuclear and non-nuclear operations, defensive and offensive capabilities, and ballistic and aerodynamic weapons creates a breeding ground for entanglement. The result could be the rapid escalation of a local non-nuclear conflict to a global nuclear war. The remainder of this chapter discusses how new and emerging military technologies might contribute to such an escalation.

#### Nuke war causes extinction – it won’t stay limited

Edwards 17 [(Paul N. Edwards, CISAC’s William J. Perry Fellow in International Security at Stanford’s Freeman Spogli Institute for International Studies. Being interviewed by EarthSky/card is only parts of the interview directly from Paul Edwards.) “How nuclear war would affect Earth’s climate,” EarthSky, September 8, 2017, earthsky.org/human-world/how-nuclear-war-would-affect-earths-climate] TDI

We are not talking enough about the climatic effects of nuclear war. The “nuclear winter” theory of the mid-1980s played a significant role in the arms reductions of that period. But with the collapse of the Soviet Union and the reduction of U.S. and Russian nuclear arsenals, this aspect of nuclear war has faded from view. That’s not good. In the mid-2000s, climate scientists such as Alan Robock (Rutgers) took another look at nuclear winter theory. This time around, they used much-improved and much more detailed climate models than those available 20 years earlier. They also tested the potential effects of smaller nuclear exchanges. The result: an exchange involving just 50 nuclear weapons — the kind of thing we might see in an India-Pakistan war, for example — could loft 5 billion kilograms of smoke, soot and dust high into the stratosphere. That’s enough to cool the entire planet by about 2 degrees Fahrenheit (1.25 degrees Celsius) — about where we were during the Little Ice Age of the 17th century. Growing seasons could be shortened enough to create really significant food shortages. So the climatic effects of even a relatively small nuclear war would be planet-wide. What about a larger-scale conflict? A U.S.-Russia war currently seems unlikely, but if it were to occur, hundreds or even thousands of nuclear weapons might be launched. The climatic consequences would be catastrophic: global average temperatures would drop as much as 12 degrees Fahrenheit (7 degrees Celsius) for up to several years — temperatures last seen during the great ice ages. Meanwhile, smoke and dust circulating in the stratosphere would darken the atmosphere enough to inhibit photosynthesis, causing disastrous crop failures, widespread famine and massive ecological disruption. The effect would be similar to that of the giant meteor believed to be responsible for the extinction of the dinosaurs. This time, we would be the dinosaurs. Many people are concerned about North Korea’s advancing missile capabilities. Is nuclear war likely in your opinion? At this writing, I think we are closer to a nuclear war than we have been since the early 1960s. In the North Korea case, both Kim Jong-un and President Trump are bullies inclined to escalate confrontations. President Trump lacks impulse control, and there are precious few checks on his ability to initiate a nuclear strike. We have to hope that our generals, both inside and outside the White House, can rein him in. North Korea would most certainly “lose” a nuclear war with the United States. But many millions would die, including hundreds of thousands of Americans currently living in South Korea and Japan (probable North Korean targets). Such vast damage would be wrought in Korea, Japan and Pacific island territories (such as Guam) that any “victory” wouldn’t deserve the name. Not only would that region be left with horrible suffering amongst the survivors; it would also immediately face famine and rampant disease. Radioactive fallout from such a war would spread around the world, including to the U.S. It has been more than 70 years since the last time a nuclear bomb was used in warfare. What would be the effects on the environment and on human health today? To my knowledge, most of the changes in nuclear weapons technology since the 1950s have focused on making them smaller and lighter, and making delivery systems more accurate, rather than on changing their effects on the environment or on human health. So-called “battlefield” weapons with lower explosive yields are part of some arsenals now — but it’s quite unlikely that any exchange between two nuclear powers would stay limited to these smaller, less destructive bombs.

### Contention 2 is Mining

#### Asteroid mining spikes the risk of satellite-dust collisions

Scoles 15 [(Sarah Scoles, freelance science writer, contributor at Wired and Popular Science, author of the books Making Contact and They Are Already Here) “Dust from asteroid mining spells danger for satellites,” New Scientist, May 27, 2015, <https://www.newscientist.com/article/mg22630235-100-dust-from-asteroid-mining-spells-danger-for-satellites/>] TDI

* Study this is citing – Javier Roa, Space Dynamic Group, Applied Physics Department, Technical University of Madrid. Casey J Handmer, Theoretical Astrophysics, California Institute of Technology. Both PhD Candidates. “Quantifying hazards: asteroid disruption in lunar distant retrograde orbits,” arXiv, Cornell University, May 14, 2015, <https://arxiv.org/pdf/1505.03800.pdf>

NASA chose the second option for its [Asteroid Redirect Mission](http://www.nasa.gov/content/what-is-nasa-s-asteroid-redirect-mission/), which aims to [pluck a boulder from an asteroid’s surface](https://www.newscientist.com/article/dn27243-rock-grab-from-asteroid-will-aid-human-mission-to-mars) and relocate it to a stable orbit around the moon. But an asteroid’s gravity is so weak that it’s not hard for surface particles to escape into space. Now a new model warns that debris shed by such transplanted rocks could intrude where many defence and communication satellites live – in geosynchronous orbit. According to [Casey Handmer](http://www.caseyhandmer.com/) of the California Institute of Technology in Pasadena and Javier Roa of the Technical University of Madrid in Spain, 5 per cent of the escaped debris will end up in regions traversed by satellites. Over 10 years, it would cross geosynchronous orbit 63 times on average. A satellite in the wrong spot at the wrong time will suffer a damaging high-speed collision with that dust. The study also looks at the “catastrophic disruption” of an asteroid 5 metres across or bigger. Its total break-up into a pile of rubble would increase the risk to satellites by more than 30 per cent ([arxiv.org/abs/1505.03800](http://arxiv.org/abs/1505.03800)).

#### Space dust wrecks satellites and debris exponentially spirals

Intagliata 17 [(Christopher Intagliata, MA Journalism from NYU, Editor for NPRs All Things Considered, Reporter/Host for Scientific American’s 60 Second Science) “The Sneaky Danger of Space Dust,” Scientific American, May 11, 2017, <https://www.scientificamerican.com/podcast/episode/the-sneaky-danger-of-space-dust/>] TDI

When tiny particles of space debris slam into satellites, the collision could cause the emission of hardware-frying radiation, Christopher Intagliata reports. Aside from all the satellites, and the space station orbiting the Earth, there's a lot of trash circling the planet, too. Twenty-one thousand [baseball-sized chunks](https://www.scientificamerican.com/article/orbital-debris-space-fence/) of debris, [according to NASA](https://www.orbitaldebris.jsc.nasa.gov/faq.html). But that number's dwarfed by the number of small particles. There's hundreds of millions of those. "And those smaller particles tend to be going fast. Think of picking up a grain of sand at the beach, and that would be on the large side. But they're going 60 kilometers per second." Sigrid Close, an applied physicist and astronautical engineer at Stanford University. Close says that whereas mechanical damage—like punctures—is the worry with the bigger chunks, the dust-sized stuff might leave more insidious, invisible marks on satellites—by causing electrical damage. "We also think this phenomenon can be attributed to some of the failures and anomalies we see on orbit, that right now are basically tagged as 'unknown cause.'" Close and her colleague Alex Fletcher modeled this phenomenon mathematically, based on plasma physics behavior. And here's what they think happens. First, the dust slams into the spacecraft. Incredibly fast. It vaporizes and ionizes a bit of the ship—and itself. Which generates a cloud of ions and electrons, traveling at different speeds. And then: "It's like a spring action, the electrons are pulled back to the ions, ions are being pushed ahead a little bit. And then the electrons overshoot the ions, so they oscillate, and then they go back out again.” That movement of electrons creates a pulse of electromagnetic radiation, which Close says could be the culprit for some of that electrical damage to satellites. The study is in the journal Physics of Plasmas. [Alex C. Fletcher and Sigrid Close, [Particle-in-cell simulations of an RF emission mechanism associated with hypervelocity impact plasmas](http://aip.scitation.org/doi/full/10.1063/1.4980833)]

#### Earth observation satellites key to warming adaptation

Alonso 18 [(Elisa Jiménez Alonso, communications consultant with Acclimatise, climate resilience organization) “Earth Observation of Increasing Importance for Climate Change Adaptation,” Acclimatise, May 2, 2018, <https://www.acclimatise.uk.com/2018/05/02/earth-observation-of-increasing-importance-for-climate-change-adaptation/>] TDI

Earth observation (EO) satellites are playing an increasingly important role in assessing climate change. By providing a constant and consistent stream of data about the state of the climate, EO is not just improving scientific outcomes but can also inform climate policy. Managing climate-related risks effectively requires accurate, robust, sustained, and wide-ranging climate information. Reliable observational climate data can help scientists test the accuracy of their models and improve the science of attributing certain events to climate change. Information based on projections from models and historic data can help decision makers plan and implement adaptation actions. Providing information in data-sparse regions Ground-based weather and climate monitoring systems only cover about 30% of the Earth’s surface. In many parts of the world such data is incomplete and patchy due to poorly maintained weather stations and a general lack of such facilities. EO satellites and rapidly improving satellite technology, especially data from open access programmes, offer a valuable source information for such data-sparse regions. This is especially important since countries and regions with a lack of climate data are often particularly vulnerable to climate change impacts. International efforts for systematic observation The importance of satellite-based observations is also recognised by the international community. Following the recommendations of the World Meteorological Organization’s (WMO) Global Climate Observing System (GCOS) programme, the UNFCCC strongly encourages countries that support space agencies with EO programmes to get involved in GCOS and support the programme’s implementation. The Paris Agreement highlights the need for and importance of effective and progressive responses to the threat of climate change based on the best available scientific knowledge. This implies that climate knowledge needs to be strengthened, which includes continuously improving systematic observations of the Earth’s climate. To meet the need of such systematic climate observations, GCOS developed the concept of the Essential Climate Variable, or ECV. According to WMO, an ECV “is a physical, chemical or biological variable or a group of linked variables that critically contributes to the characterization of Earth’ s climate.” In 2010, 50 ECVs which would help the work of the UNFCCC and IPCC were defined by GCOS. The ECVs, which can be seen below, were identified due to their relevance for characterising the climate system and its changes, the technical feasibility of observing or deriving them on a global scale, and their cost effectiveness. The 50 Essential Climate Variables as defined by GCOS. One effort supporting the systemic observation of the climate is the European Space Agency’s (ESA) Climate Change Initiative (CCI). The programme taps into its own and its member countries’ EO archives that have been established in the last three decades in order to provide a timely and adequate contribution to the ECV databases required by the UNFCCC. Robust evidence supporting climate risk management Earth observation satellites can observe the entire Earth on a daily basis (polar orbiting satellites) or continuously monitor the disk of Earth below them (geostationary satellites) maintaining a constant watch of the entire globe. Sensors can target any point on Earth even the most remote and inhospitable areas which helps monitor deforestation in vast tropical forests and the melting of the ice caps. Without insights offered by EO satellites there would not be enough evidence for decision makers to base their climate policies on, increasing the risk of maladaptation. Robust EO data is an invaluable resource for collecting climate information that can inform climate risk management and make it more effective.

#### Warming causes extinction

Klein 14[(Naomi Klein, award-winning journalist, syndicated columnist, former Miliband Fellow at the London School of Economics, member of the board of directors of 350.org), *This Changes Everything: Capitalism vs. the Climate*, pp. 12-14]

In a 2012 report, the World Bank laid out the gamble implied by that target. “As global warming approaches and exceeds 2-degrees Celsius, there is a risk of triggering nonlinear tipping elements. Examples include the disintegration of the West Antarctic ice sheet leading to more rapid sea-level rise, or large-scale Amazon dieback drastically affecting ecosystems, rivers, agriculture, energy production, and livelihoods. This would further add to 21st-century global warming and impact entire continents.” In other words, once we allow temperatures to climb past a certain point, where the mercury stops is not in our control.¶ But the bigger problem—and the reason Copenhagen caused such great despair—is that because governments did not agree to binding targets, they are free to pretty much ignore their commitments. Which is precisely what is happening. Indeed, emissions are rising so rapidly that unless something radical changes within our economic structure, 2 degrees now looks like a utopian dream. And it’s not just environmentalists who are raising the alarm. The World Bank also warned when it released its report that “we’re on track to a 4-C warmer world [by century’s end] marked by extreme heat waves, declining global food stocks, loss of ecosystems and biodiversity, and life-threatening sea level rise.” And the report cautioned that, “there is also no certainty that adaptation to a 4-C world is possible.” Kevin Anderson, former director (now deputy director) of the Tyndall Centre for Climate Change, which has quickly established itself as one of the U.K’s premier climate research institutions, is even blunter; he says 4 degrees Celsius warming—7.2 degrees Fahrenheit—is “incompatible with an organized, equitable, and civilized global community.”¶ We don’t know exactly what a 4 degree Celsius world would look like, but even the best-case scenario is likely to be calamitous. Four degrees of warming could raise global sea levels by 1 or possibly even 2 meters by 2100 (and would lock in at least a few additional meters over future centuries). This would drown some island nations such as the Maldives and Tuvalu, and inundate many coastal areas from Ecuador and Brazil to the Netherlands to much of California and the northeastern United States as well as huge swaths of South and Southeast Asia. Major cities likely in jeopardy include Boston, New York, greater Los Angeles, Vancouver, London, Mumbai, Hong Kong, and Shanghai.¶ Meanwhile, brutal heat waves that can kill tens of thousands of people, even in wealthy countries, would become entirely unremarkable summer events on every continent but Antarctica. The heat would also cause staple crops to suffer dramatic yield losses across the globe (it is possible that Indian wheat and U.S. could plummet by as much as 60 percent), this at a time when demand will be surging due to population growth and a growing demand for meat. And since crops will be facing not just heat stress but also extreme events such as wide-ranging droughts, flooding, or pest outbreaks, the losses could easily turn out to be more severe than the models have predicted. When you add ruinous hurricanes, raging wildfires, fisheries collapses, widespread disruptions to water supplies, extinctions, and globe-trotting diseases to the mix, it indeed becomes difficult to imagine that a peaceful, ordered society could be sustained (that is, where such a thing exists in the first place).¶ And keep in mind that these are the optimistic scenarios in which warming is more or less stabilized at 4 degrees Celsius and does not trigger tipping points beyond which runaway warming would occur. Based on the latest modeling, it is becoming safer to assume that 4 degrees could bring about a number of extremely dangerous feedback loops—an Arctic that is regularly ice-free in September, for instance, or, according to one recent study, global vegetation that is too saturated to act as a reliable “sink”, leading to more carbon being emitted rather than stored. Once this happens, any hope of predicting impacts pretty much goes out the window. And this process may be starting sooner than anyone predicted. In May 2014, NASA and the University of California, Irvine scientists revealed that glacier melt in a section of West Antarctica roughly the size of France now “appears unstoppable.” This likely spells down for the entire West Antarctic ice sheet, which according to lead study author Eric Rignot “comes with a sea level rise between three and five metres. Such an event will displace millions of people worldwide.” The disintegration, however, could unfold over centuries and there is still time for emission reductions to slow down the process and prevent the worst. ¶ Much more frightening than any of this is the fact that plenty of mainstream analysts think that on our current emissions trajectory, we are headed for even more than 4 degrees of warming. In 2011, the usually staid International Energy Agency (IEA) issued a report predicting that we are actually on track for 6 degrees Celsius—10.8 degrees Fahrenheit—of warming. And as the IEA’s chief economist put it: “Everybody, even the school children, knows that this will have catastrophic implications for all of us.” (The evidence indicates that 6 degrees of warming is likely to set in motion several major tipping points—not only slower ones such as the aforementioned breakdown of the West Antarctic ice sheet, but possibly more abrupt ones, like massive releases of methane from Arctic permafrost.) The accounting giant PricewaterhouseCoopers as also published a report warning businesses that we are headed for “4-C , or even 6-C” of warming.¶ These various projections are the equivalent of every alarm in your house going off simultaneously. And then every alarm on your street going off as well, one by one by one. They mean, quite simply, that climate change has become an existential crisis for the human species. The only historical precedent for a crisis of this depth and scale was the Cold War fear that we were headed toward nuclear holocaust, which would have made much of the planet uninhabitable. But that was (and remains) a threat; a slim possibility, should geopolitics spiral out of control. The vast majority of nuclear scientists never told us that we were almost certainly going to put our civilization in peril if we kept going about our daily lives as usual, doing exactly what we were already going, which is what climate scientists have been telling us for years. ¶ As the Ohio State University climatologist Lonnie G. Thompson, a world-renowned specialist on glacier melt, explained in 2010, “Climatologists, like other scientists, tend to be a stolid group. We are not given to theatrical rantings about falling skies. Most of us are far more comfortable in our laboratories or gathering data in the field than we are giving interviews to journalists or speaking before Congressional committees. When then are climatologists speaking out about the dangers of global warming? The answer is that virtually all of us are now convinced that global warming poses a clear and present danger to civilization.”