## 1AC

### 1AC – Framing

**The standard is maximizing expected wellbeing**

**First, pleasure and pain are intrinsically valuable. People consistently regard pleasure and pain as good reasons for action, despite the fact that pleasure doesn’t seem to be instrumentally valuable for anything.**

**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] SJDI

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.

**Moreover, *only* pleasure and pain are intrinsically valuable. All other values can be explained with reference to pleasure; Occam’s razor requires us to treat these as instrumentally valuable.**

**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] SJDI

I think several things should be said in response to Moore’s challenge to hedonists. First, **I do not think the burden of proof lies on hedonists to explain why the additional values are not intrinsic values. If someone claims that X is intrinsically valuable, this is a substantive, positive claim, and it lies on him or her to explain why we should believe that X is in fact intrinsically valuable.** Possibly, this could be done through thought experiments analogous to those employed in the previous section. Second, **there is something peculiar about the list of additional intrinsic values** that counts in hedonism’s favor**: the listed values have a strong tendency to be well explained as things that help promote pleasure and avert pain.** To go through Frankena’s list, life and consciousness are necessary presuppositions for pleasure; activity, health, and strength bring about pleasure; and happiness, beatitude, and contentment are regarded by Frankena himself as “pleasures and satisfactions.” The same is arguably true of beauty, harmony, and “proportion in objects contemplated,” and also of affection, friendship, harmony, and proportion in life, experiences of achievement, adventure and novelty, self-expression, good reputation, honor and esteem. Other things on Frankena’s list, such as understanding, **wisdom, freedom, peace, and security, although they are perhaps not themselves pleasurable, are important means to achieve a happy life, and as such, they are things that hedonists would value highly.** **Morally good dispositions and virtues, cooperation, and just distribution of goods and evils, moreover, are things that, on a collective level, contribute a happy society, and thus the traits that would be promoted and cultivated if this were something sought after.** To a very large extent, the intrinsic values suggested by pluralists tend to be hedonic instrumental values. Indeed, pluralists’ suggested intrinsic values all point toward pleasure, for while the other values are reasonably explainable as a means toward pleasure, pleasure itself is not reasonably explainable as a means toward the other values. Some have noticed this. Moore himself, for example, writes that though his pluralistic theory of intrinsic value is opposed to hedonism, its application would, in practice, look very much like hedonism’s: “Hedonists,” he writes “do, in general, recommend a course of conduct which is very similar to that which I should recommend.”24 Ross writes that “[i]t is quite certain that by promoting virtue and knowledge we shall inevitably produce much more pleasant consciousness. These are, by general agreement, among the surest sources of happiness for their possessors.”25 Roger Crisp observes that “those goods cited by non-hedonists are goods we often, indeed usually, enjoy.”26 What Moore and Ross do not seem to notice is that their observations give rise to two reasons to reject pluralism and endorse hedonism. The first reason is that if **the suggested non-hedonic intrinsic values are potentially explainable by appeal to just pleasure and pain** (which, following my argument in the previous chapter, we should accept as intrinsically valuable and disvaluable), **then—by appeal to Occam’s razor—we have at least a pro tanto reason to resist the introduction of any further intrinsic values and disvalues. It is ontologically more costly to posit a plurality of intrinsic values and disvalues, so in case all values admit of explanation by reference to a single intrinsic value and a single intrinsic disvalue, we have reason to reject more complicated accounts.** **The fact that suggested non-hedonic intrinsic values tend to be hedonistic instrumental values does not, however, count in favor of hedonism solely in virtue of being most elegantly explained by hedonism; it also does so in virtue of creating an explanatory challenge for pluralists.** The challenge can be phrased as the following question: **If the non-hedonic values suggested by pluralists are truly intrinsic values in their own right, then why do they tend to point toward pleasure and away from pain?**27

**Moral uncertainty means preventing extinction should be our highest priority.  
Bostrom 12** [Nick Bostrom. Faculty of Philosophy & Oxford Martin School University of Oxford. “Existential Risk Prevention as Global Priority.” Global Policy (2012)]  
These reflections on **moral uncertainty suggest** an alternative, complementary way of looking at existential risk; they also suggest a new way of thinking about the ideal of sustainability. Let me elaborate.¶ **Our present understanding of axiology might** well **be confused. We may not** nowknow — at least not in concrete detail — what outcomes would count as a big win for humanity; we might not even yet **be able to imagine the best ends** of our journey. **If we are** indeedprofoundly **uncertain** about our ultimate aims,then we should recognize that **there is a great** option **value in preserving** — and ideally improving — **our ability to recognize value and** to **steer the future accordingly. Ensuring** that **there will be a future** version of **humanity** with great powers and a propensity to use them wisely **is** plausibly **the best way** available to us **to increase the probability that the future will contain** a lot of **value.** To do this, we must prevent any existential catastrophe.

### 1AC – Plan

#### Plan: States should ban the appropriation of Mars by private entities.

### 1AC – Advantage

#### Private companies are gearing up to colonize Mars

Sheetz 4/23 [(Michael, a Space Reporter for CNBC.com) “INVESTING IN SPACE Elon Musk wants SpaceX to reach Mars so humanity is not a ‘single-planet species’” CNBC, 4/23/2021. https://www.cnbc.com/2021/04/23/elon-musk-aiming-for-mars-so-humanity-is-not-a-single-planet-species.html] BC

SpaceX founder and CEO Elon Musk remains focused on his vision for the company: Establishing a permanent human presence on Mars, with its Starship rockets carrying people to and from the red planet.

“We don’t want to be one of those single planet species, we want to be a multi-planet species,” Musk said on Friday, speaking after the company launched its Crew-2 mission to orbit.

“It’s been now almost half a century since humans were last on the moon. That’s too long, we need to get back there and have a permanent base on the moon — again, like a big permanently occupied base on the moon. And then build a city on Mars to become a spacefaring civilization, a multi-planet species,” Musk also said.

Starship is the enormous stainless steel rocket that SpaceX has been building and testing at its development facility in Boca Chica, Texas. Starship’s goal is to launch cargo and people on missions to the moon and Mars. Current Starship prototypes stand at about 150 feet tall, or about the size of a 15-story building, and each one is powered by three Raptor rocket engines.

Musk has previously estimated that it will cost about $5 billion to fully develop Starship, although SpaceX has not disclosed how much it has spent on the program to date. The company has steadily raised funds in the past few years, to fund both Starship and its similarly ambitious Starlink project, with SpaceX’s valuation soaring to about $74 billion — making it one of the most valuable private companies in the world.

Additionally, SpaceX last week won a $2.9 billion contract from NASA, to help the space agency land astronauts on the moon’s surface with the first crewed mission targeting 2024.

″[Starship has] mostly been funded internally thus far and its pretty expensive. As you can tell, if you’ve been watching videos, we’ve blown up a few of them,” Musk said.

The company has performed multiple successful test flights of Starship, although landing attempts after the last four high-altitude flights ended in fiery explosions. Despite the the prototypes’ destruction, SpaceX sees the test flights as progress toward creating a rocket that is fully reusable. SpaceX’s current Falcon fleet of rockets is partially reusable, as the company can land and reuse the rocket’s boosters.

But Musk hopes Starship transforms space travel into something more akin to commercial air travel. The rocket’s enormous size would also make it capable of launching several times as much cargo at once — for comparison, while SpaceX’s Falcon 9 rockets can send as many as 60 Starlink satellites at a time, SpaceX says Starship will be able to launch 400 Starlink satellites at a time.

Musk remains “highly confident” that SpaceX will land humans on Mars by 2026, saying last December that it’s an achievable goal “about six years from now.” He added that SpaceX plans to send a Starship rocket without crew “in two years.”

In the meantime, SpaceX has many milestones to go before Starship can carry passengers. The rocket has yet to reach orbit. Musk last year said that the company will fly “hundreds of missions with satellites before we put people on board.”

Musk may be focused on Mars, but the hurdles of Starship’s development are not lost on the space billionaire.

“It’s a tough vehicle to build because we’re trying to crack this nut of a rapid and fully reusable rocket,” Musk said. “But the thing that’s really important to revolutionize space is a rapidly reusable rocket that’s reliable, too.”

#### Scenario one is terrestrial war – colonies foster global suspicion and miscalculation which make conflict exponentially more likely

Morton 18 [(Adam, a retired philosopher attached to the University of British Columbia. He is a philosophical generalist with a particular interest in issues about knowledge and about how people understand one another. His book Should We Colonize Other Planets?​ is available now.) “Colonizing Other Planets Could Trigger War on Earth | Opinion” News Week, 11/22/2018. https://www.newsweek.com/colonizing-other-planets-could-trigger-war-earth-and-ecological-disaster-1226630] BC

Plans for the exploration and even colonization of other planets are very much in the air, and getting to Mars in particular has become a billionaire's hobby lately. Elon Musk would like to establish a human colony on Mars in a matter of decades. (For the foreseeable future—a century, I would venture—Mars will be the only real possibility.) But planetary colonies may be a bad idea, even a disastrous idea. So, it is important to see the arguments against them, as well as their appeal. I begin with a reason that is sometimes made central to proposals for colonies—the idea that we should achieve them as soon as it is feasible.

It is a call for escape from imminent danger. The idea is that nuclear war, ecological catastrophe, or the rise of artificially intelligent robots, will wipe out humans on Earth. But a colony far away might survive, so that the species continues. Stephen Hawking is among those who have argued, or usually just pronounced, for versions of this (and if you want scientific authority, it is hard to do better). But the idea has serious flaws. It is hard to think of even a post-apocalyptic Earth that is less hospitable to any terrestrial life than Mars, let alone elsewhere in the solar system, so the challenges are enormous. But let us ignore that. Suppose that a colony had a reasonable chance of surviving, would the argument from danger justify founding it soon? I think not.

One danger is nuclear and biological war: One nation or ethnic group fears or hates another enough to unleash bombs or viruses. In a bad scenario they succeed. Millions die, and their territory becomes uninhabitable. In the worst scenario, the other side retaliates or the affliction spreads and eventually everyone is dead. But people survive on Mars. Which people? They will include members of one group or their opponents, so if the aim really is to wipe out this group it will be directed at the colonists as well. They are hated, and they are capable of retaliation. Bomb-bearing rockets are much simpler to make than people-bearing rockets. And someone crazy enough to push the button would be crazy enough to direct them at the hated enemy wherever they are found. So, the colony would not be safe. At any rate, it will not be not safe enough that founding it is a better bet than making war less likely on Earth. Worse, any nation party to founding a colony will arouse suspicion in its enemies that it is scheming to start and survive a war. And this makes war more rather than less likely.

#### Nuclear war causes extinction – famine and climate change

Starr 15 [(Steven, Director of the University of Missouri’s Clinical Laboratory Science Program and a senior scientist at the Physicians for Social Responsibility) “Nuclear War, Nuclear Winter, and Human Extinction,” Federation of American Scientists, 10/14/2015] DD

While it is impossible to precisely predict all the human impacts that would result from a nuclear winter, it is relatively simple to predict those which would be most profound. That is, a nuclear winter would cause most humans and large animals to die from nuclear famine in a mass extinction event similar to the one that wiped out the dinosaurs.

Following the detonation (in conflict) of US and/or Russian launch-ready strategic nuclear weapons, nuclear firestorms would burn simultaneously over a total land surface area of many thousands or tens of thousands of square miles. These mass fires, many of which would rage over large cities and industrial areas, would release many tens of millions of tons of black carbon soot and smoke (up to 180 million tons, according to peer-reviewed studies), which would rise rapidly above cloud level and into the stratosphere. [For an explanation of the calculation of smoke emissions, see Atmospheric effects & societal consequences of regional scale nuclear conflicts.]

The scientists who completed the most recent peer-reviewed studies on nuclear winter discovered that the sunlight would heat the smoke, producing a self-lofting effect that would not only aid the rise of the smoke into the stratosphere (above cloud level, where it could not be rained out), but act to keep the smoke in the stratosphere for 10 years or more. The longevity of the smoke layer would act to greatly increase the severity of its effects upon the biosphere.

Once in the stratosphere, the smoke (predicted to be produced by a range of strategic nuclear wars) would rapidly engulf the Earth and form a dense stratospheric smoke layer. The smoke from a war fought with strategic nuclear weapons would quickly prevent up to 70% of sunlight from reaching the surface of the Northern Hemisphere and 35% of sunlight from reaching the surface of the Southern Hemisphere. Such an enormous loss of warming sunlight would produce Ice Age weather conditions on Earth in a matter of weeks. For a period of 1-3 years following the war, temperatures would fall below freezing every day in the central agricultural zones of North America and Eurasia. [For an explanation of nuclear winter, see Nuclear winter revisited with a modern climate model and current nuclear arsenals: Still catastrophic consequences.]

Nuclear winter would cause average global surface temperatures to become colder than they were at the height of the last Ice Age. Such extreme cold would eliminate growing seasons for many years, probably for a decade or longer. Can you imagine a winter that lasts for ten years?

The results of such a scenario are obvious. Temperatures would be much too cold to grow food, and they would remain this way long enough to cause most humans and animals to starve to death.

Global nuclear famine would ensue in a setting in which the infrastructure of the combatant nations has been totally destroyed, resulting in massive amounts of chemical and radioactive toxins being released into the biosphere. We don’t need a sophisticated study to tell us that no food and Ice Age temperatures for a decade would kill most people and animals on the planet.  Would the few remaining survivors be able to survive in a radioactive, toxic environment?

#### Scenario 2 is nanobot proliferation – it is uniquely incentivized by colonization

Morton 18 [(Adam, a retired philosopher attached to the University of British Columbia. He is a philosophical generalist with a particular interest in issues about knowledge and about how people understand one another. His book Should We Colonize Other Planets?​ is available now.) “Colonizing Other Planets Could Trigger War on Earth | Opinion” News Week, 11/22/2018. https://www.newsweek.com/colonizing-other-planets-could-trigger-war-earth-and-ecological-disaster-1226630] BC

Another danger is the rise of smart robots. But again, there is no escape in space. Space travel and running a colony use as much computation as they can get. This was true of the moon landings and it is even truer now. Human beings have an essential role in plans and design, but on the trip itself they are mostly just going along for the ride. So, imagine, just for the sake of argument, that hyper-calculating artificial intelligences are in a position to threaten human civilization. The extension of that civilization on another planet relies even more on those very powers, which will have to be networked to earthly computation. If mere humans can hack into machinery in targeted countries to disrupt them, then these super-capable but malevolent AIs will have no problem. Whatever their "motives," these will be the same elsewhere as on earth, and space is less of an obstacle to the flow of (mis)information and commands than to the flow of people and physical objects. No safety there.

#### It expedites self-replication – extinction

Del Monte 17 [(Louis, a bestselling author, award-winning physicist, CEO of Del Monte & Associates, Inc., and a featured speaker. He is considered a top futurist on artificial intelligence technology, nanoweapons, autonomous weapons, directed energy weapons, and the future of warfare) “Are Nanoweapons Paving the Road to Human Extinction?” HuffPost, 6/3/2017. https://www.huffpost.com/entry/are-nanoweapons-paving-the-road-to-human-extinction\_b\_59332a52e4b00573ab57a3fe] BC

What is it about nanobots that make them the ideal weapons? Let us address this question by taking several examples. About a third of all US fighter planes today are drones. Today’s drones are approximately one-third the size of a manned fighter jet, like the F-35. However, a new class of drones is in development, bird and even insect size drones. For example, in 2014, the Army Research Laboratory announced the creation of a “fly drone” weighing only a small fraction of a gram. This drone could conceivable fly into an adversary’s command post and provide surveillance or into the adversary’s dining area to deposit a nano poison. An insect fly drone provides the military with both surveillance and assignation capabilities. This gives a completely new meaning to “fly on the wall.”

As electronic processors shrink into the nanoscale, becoming nanoprocessors, about 1/1000 the diameter of a human hair, conceivably they could provide the fly drone with artificial intelligence. In effect, it could autonomously carry out its programmed mission.

You may wonder, How does all of this threaten human extinction? To address this question, imagine a scenario where the US military releases millions of artificially intelligent fly drones within an adversary’s boarders, programmed to target the populace via commonalities in their DNA. If each fly drone had the capability to assassinate a few people, conceivably they could wipe out an entire nation.

Although this may sound like science fiction, the United States is within a decade of having the capability. The US Army is already testing a fly drone. As for poisons, as little as 100 nano grams of botulism H will kill a human. That quantity of poison is too small to see or taste, yet lethal and small enough for a fly drone to carry. In my book, Nanoweapons: A Growing Threat To Humanity, I classify this type of weapon as a strategic nanoweapon. This classification parallels strategic nuclear weapons that have the capability to destroy nations.

While artificially intelligent insect drones are already a scary proposition, the next step in their development is even more frightening, namely self-replicating insect drones, or more generically self- replicating nanobots. Given the exponential advance in nano electronics and artificial intelligence, characterized by Moore’s law, it is likely we will see the emergence of self-replicating nanobots in the 2050s.

Self-replicating nanobots are the ultimate invention. In medicine, they will flow through our blood preventing diseases and curing injuries. In military applications, they will have the capability to completely destroy an adversary, from its populace to its structures. This scenario was depicted in the sci-fi movie, The Day the Earth Stood Still.

Strategic nanoweapons, like their nuclear counterparts, pose a threat to humanity. The major issue is control. Will we be able to deploy strategic nanoweapons and maintain control over them? If, for example, we lost control of self-replicating nanobots, we would face a technological plague, one that we currently have no way of stopping.

#### Scenario 3 is warming – colonization attempts ensure earthly ecological catastrophe

Morton 18 [(Adam, a retired philosopher attached to the University of British Columbia. He is a philosophical generalist with a particular interest in issues about knowledge and about how people understand one another. His book Should We Colonize Other Planets?​ is available now.) “Colonizing Other Planets Could Trigger War on Earth | Opinion” News Week, 11/22/2018. https://www.newsweek.com/colonizing-other-planets-could-trigger-war-earth-and-ecological-disaster-1226630] BC

The third danger is ecological. We are ruining the climate and polluting the oceans. We could develop technology that mitigated or even reversed the dangers. It would be easier than developing technology for surviving on Mars, where we must grow food and create oxygen in a very cold and dark environment without much protection from radiation and a limited supply of water. Moreover, getting enough people to Mars to make a colony that could survive without help from home, self-sufficient technologically and with enough genetic diversity that our already rather uniform species would have a future, would involve a lot of rockets. Musk talks in terms of 10,000 flights, although some plans require more. And this would be just to get things started. We just do not know what the impact on the earth and its atmosphere of the launches and the prior manufacturing would be. It would not be positive, at any rate. And industrial power and scientific brains would be diverted away from the needs of earth to the well-being of the colony. It is not what we need; you would only think that we could afford it if you were blind to how desperate things really are. So again, the colony solution is likely to make the earthly situation even more dire.

These are problems for human colonies as refugees on any planet. What about colonies for other purposes, from exploiting resources to the destiny of humanity? There are so many possible purposes, and the means and destinations are so varied, that there is not going to be a single simple answer. But some of the dangers are common to many of the plans. There is the possibility of triggering war or ecological catastrophe on earth, already mentioned. There is the folly of sending vulnerable humans to do jobs that robots can do more safely and cheaply. There is the diversion of resources, effort, and commitment from the pressing needs of our planet. To appreciate many of these, one has to take fully on board quite how inhospitable to anything like human life most planets are. Cold, radiation, lack of oxygen and lack of the food-providing soil that has built up on earth over billions of years: all of these are a problem anywhere in the solar system except for our one place. And there is the extreme neediness of human beings, who have to keep their body temperature constant and their brains constantly operating, and who flourish only when they maintain complex delicate social systems. This is a matter of biology rather than of physics; we have evolved to fit our own planet and we require enormous resources to survive anywhere else.

Of course, there are replies to consider. Of course, the full range of possibilities cannot be discussed in a few sentences. Of course, a flash of rhetoric is no substitute for a real analysis. That is the main point. These are complex and many-sided issues that need to be thought out carefully. Separating the realistic from the science fictional, opportunities from nightmares, is not an easy job. It asks for skills that are spread among people and disciplines: scientific sophistication, technological savvy, an eye for future developments, both scientific and social. And, often neglected, a sensitivity to issues about the long-term fate of the human species. Moreover, the stakes are high, so we need a component of what the psychologist Gary Klein calls "premortem" thinking, assuming for the sake of argument that a plan will lead to disaster and conceiving of the most likely route that disaster will take. This is to ask a lot. (I have contributed to it in a recent book.) But we do not have to be rushed; we can put our heads together and think it out properly. Disappointing as it may be to realize that colonization gives no solution to imminent existential threats, the silver lining is that we have time to make proper plans and separate the view real and attractive possibilities from hype and wishful thinking.

**Warming causes extinction – any reduction should be prioritized above every other impact**

**Ramanathan et al. 17** [Veerabhadran Ramanathan is Victor Alderson Professor of Applied Ocean Sciences and director of the Center for Atmospheric Sciences at the Scripps Institution of Oceanography, University of California, San Diego, Dr. William Collins is an internationally recognized expert in climate modeling and climate change science. He is the Director of the Climate and Ecosystem Sciences Division (CESD) for the Earth and Environmental Sciences Area (EESA) at the Lawrence Berkeley National Laboratory (LBNL), Prof. Dr Mark Lawrence, Ph.D. is scientific director at the Institute for Advanced Sustainability Studies (IASS) in Potsdam, Örjan Gustafsson is a Professor in the Department of Environmental Science and Analytic Chemistry at Stockholm University, Shichang Kang is Professor, Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences (CAS); CAS Center for Excellence in Tibetan Plateau Earth Sciences, and Molina, M.J., Zaelke, D., Borgford-Parnell, N., Xu, Y., Alex, K., Auffhammer, M., Bledsoe, P., Croes, B., Forman, F., Haines, A., Harnish, R., Jacobson, M.Z., Lawrence, M., Leloup, D., Lenton, T., Morehouse, T., Munk, W., Picolotti, R., Prather, K., Raga, G., Rignot, E., Shindell, D., Singh, A.K., Steiner, A., Thiemens, M., Titley, D.W., Tucker, M.E., Tripathi, S., & Victor, D., authors come from the following 9 countries - US, Switzerland, Sweden, UK, China, Germany, Australia, Mexico, India, “Well Under 2 Degrees Celsius: Fast Action Policies to Protect People and the Planet from Extreme Climate Change,” Report of the Committee to Prevent Extreme Climate Change, September 2017, http://www.igsd.org/wp-content/uploads/2017/09/Well-Under-2-Degrees-Celsius-Report-2017.pdf] TDI

**Climate change is becoming an existential threat with warming in excess of 2°C within the next three decades and 4°C to 6°C within the next several decades. Warming of such magnitudes will expose as many as 75% of the world’s population to deadly heat stress in addition to disrupting the climate and weather worldwide. Climate change is an urgent problem requiring urgent solutions**. This paper lays out urgent and **practical solutions that are ready for implementation now, will deliver benefits in the next few critical decades**, and places the world on a path to achieving the longterm targets of the Paris Agreement and near-term sustainable development goals. The approach consists of four building blocks and 3 levers to implement ten scalable solutions described in this report by a team of climate scientists, policy makers, social and behavioral scientists, political scientists, legal experts, diplomats, and military experts from around the world. These solutions will enable society to decarbonize the global energy system by 2050 through efficiency and renewables, drastically reduce short-lived climate pollutants, and stabilize the climate well below 2°C both in the near term (before 2050) and in the long term (post 2050). It will also reduce premature mortalities by tens of millions by 2050. As an insurance against policy lapses, mitigation delays and faster than projected climate changes, the solutions include an Atmospheric Carbon Extraction lever to remove CO2 from the air. The amount of CO2 that must be removed ranges from negligible, if the emissions of CO2 from the energy system and SLCPs start to decrease by 2020 and carbon neutrality is achieved by 2050, to a staggering one trillion tons if the carbon lever is not pulled and emissions of climate pollutants continue to increase until 2030.

There are numerous living laboratories including 53 cities, many universities around the world, the state of California, and the nation of Sweden, who have embarked on a carbon neutral pathway. These laboratories have already created 8 million jobs in the clean energy industry; they have also shown that **emissions of greenhouse gases and air pollutants can be decoupled from economic growth**. Another favorable sign is that **growth rates of worldwide carbon emissions have reduced from 2.9% per year during the first decade of this century to 1.3% from 2011 to 2014 and near zero growth rates during the last few years. The carbon emission curve is bending, but we have a long way to go and very little time for achieving carbon neutrality**. We need institutions and enterprises that can accelerate this bending by scaling-up the solutions that are being proven in the living laboratories. We have less than a decade to put these solutions in place around the world to preserve nature and our quality of life for generations to come. The time is now.

The Paris Agreement is an historic achievement. For the first time, effectively all nations have committed to limiting their greenhouse gas emissions and taking other actions to limit global temperature change. Specifically, 197 nations agreed to hold “the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels,” and achieve carbon neutrality in the second half of this century.

**The climate has already warmed by 1°C. The problem is running ahead of us, and under current trends we will likely reach 1.5°C in the next fifteen years and surpass the 2°C guardrail by mid-century with a 50% probability of reaching 4°C by end of century**. Warming in excess of 3°C is likely to be a global catastrophe for three major reasons:

• **Warming in the range of 3°C to 5°C is suggested as the threshold for several tipping points in the physical and geochemical systems; a warming of about 3°C has a probability of over 40% to cross over multiple tipping points, while a warming close to 5°C increases it to nearly 90%, compared with a baseline warming of less than 1.5°C, which has only just over a 10% probability of exceeding any tipping point.**

**• Health effects of such warming are emerging as a major if not dominant source of concern. Warming of 4°C or more will expose more than 70% of the population, i.e. about 7 billion by the end of the century, to deadly heat stress and expose about 2.4 billion to vector borne diseases such as Dengue, Chikengunya, and Zika virus among others**. Ecologists and paleontologists have proposed that warming in excess of 3°C, accompanied by increased acidity of the oceans by the buildup of CO2 , can become a major causal factor for exposing more than 50% of all species to extinction. 20% of species are in danger of extinction now due to population, habitat destruction, and climate change.

The good news is that **there may still be time to avert such catastrophic changes**. The Paris Agreement and **supporting climate policies must be strengthened substantially within the next five years to bend the emissions curve down faster, stabilize climate, and prevent catastrophic warming**. To the extent those efforts fall short, societies and **ecosystems will be forced to contend with substantial needs for adaptation—a burden that will fall disproportionately on the poorest three billion who are least responsible for causing the climate change problem.**

Here we propose a policy roadmap with a realistic and reasonable chance of limiting global temperature to safe levels and preventing unmanageable climate change—an outline of specific science-based policy pathways that serve as the building blocks for a three-lever strategy that could limit warming to well under 2°C. The projections and the emission pathways proposed in this summary are based on a combination of published recommendations and new model simulations conducted by the authors of this study (see Figure 2). We have framed the plan in terms of four building blocks and three levers, which are implemented through 10 solutions. The first building block would be fully implementing the nationally determined mitigation pledges under the Paris Agreement of the UN Framework Convention on Climate Change (UNFCCC). In addition, several sister agreements that provide targeted and efficient mitigation must be strengthened. Sister agreements include the Kigali Amendment to the Montreal Protocol to phase down HFCs, efforts to address aviation emissions through the International Civil Aviation Organization (ICAO), maritime black carbon emissions through the International Maritime Organization (IMO), and the commitment by the eight countries of the Arctic Council to reduce black carbon emissions by up to 33%. There are many other complementary processes that have drawn attention to specific actions on climate change, such as the Group of 20 (G20), which has emphasized reform of fossil fuel subsidies, and the Climate and Clean Air Coalition (CCAC). HFC measures, for example, can avoid as much as 0.5°C of warming by 2100 through the mandatory global phasedown of HFC refrigerants within the next few decades, and substantially more through parallel efforts to improve energy efficiency of air conditioners and other cooling equipment potentially doubling this climate benefit.

For the second building block, numerous subnational and city scale climate action plans have to be scaled up. One prominent example is California’s Under 2 Coalition signed by over 177 jurisdictions from 37 countries in six continents covering a third of world economy. The goal of this Memorandum of Understanding is to catalyze efforts in many jurisdictions that are comparable with California’s target of 40% reductions in CO2 emissions by 2030 and 80% reductions by 2050—emission cuts that, if achieved globally, would be consistent with stopping warming at about 2°C above pre-industrial levels. Another prominent example is the climate action plans by over 52 cities and 65 businesses around the world aiming to cut emissions by 30% by 2030 and 80% to 100% by 2050. There are concerns that the carbon neutral goal will hinder economic progress; however, real world examples from California and Sweden since 2005 offer evidence that economic growth can be decoupled from carbon emissions and the data for CO2 emissions and GDP reveal that growth in fact prospers with a green economy.

The third building block consists of two levers that we need to pull as hard as we can: one for drastically reducing emissions of short-lived climate pollutants (SLCPs) beginning now and completing by 2030, and the other for decarbonizing the global energy system by 2050 through efficiency and renewables. Pulling both levers simultaneously can keep global temperature rise below 2°C through the end of the century. If we bend the CO2 emissions curve through decarbonization of the energy system such that global emissions peak in 2020 and decrease steadily thereafter until reaching zero in 2050, there is less than a 20% probability of exceeding 2°C. This call for bending the CO2 curve by 2020 is one key way in which this report’s proposal differs from the Paris Agreement and it is perhaps the most difficult task of all those envisioned here. Many cities and jurisdictions are already on this pathway, thus demonstrating its scalability. Achieving carbon neutrality and reducing emissions of SLCPs would also drastically reduce air pollution globally, including all major cities, thus saving millions of lives and over 100 million tons of crops lost to air pollution each year. In addition, these steps would provide clean energy access to the world’s poorest three billion who are still forced to resort to 18th century technologies to meet basic needs such as cooking. For the fourth and the final building block, we are adding a third lever, ACE (Atmospheric Carbon Extraction, also known as Carbon Dioxide Removal, or “CDR”). This lever is added as an insurance against surprises (due to policy lapses, mitigation delays, or non-linear climate changes) and would require development of scalable measures for removing the CO2 already in the atmosphere. The amount of CO2 that must be removed will range from negligible, if the emissions of CO2 from the energy system and SLCPs start to decrease by 2020 and carbon neutrality is achieved by 2050, to a staggering one trillion tons, if CO2 emissions continue to increase until 2030, and the carbon lever is not pulled until after 2030. This issue is raised because the NDCs (Nationally Determined Contributions) accompanying the Paris Agreement would allow CO2 emissions to increase until 2030. We call on economists and experts in political and administrative systems to assess the feasibility and cost-effectiveness of reducing carbon and SLCPs emissions beginning in 2020 compared with delaying it by ten years and then being forced to pull the third lever to extract one trillion tons of CO2

The fast mitigation plan of requiring emissions reductions to begin by 2020, which means that many countries need to cut now, is urgently needed to limit the warming to well under 2°C. Climate change is not a linear problem. Instead, we are facing non-linear climate tipping points that can lead to self-reinforcing and cascading climate change impacts. Tipping points and selfreinforcing feedbacks are wild cards that are more likely with increased temperatures, and many of the potential abrupt climate shifts could happen as warming goes from 1.5°C in 15 years to 2°C by 2050, with the potential to push us well beyond the Paris Agreement goals.

Where Do We Go from Here?

**A massive effort will be needed to stop warming at 2°C, and time is of the essence. With unchecked business-as-usual emissions, global warming has a 50% likelihood of exceeding 4ºC and a 5% probability of exceeding 6ºC in this century, raising existential questions for most, but especially the poorest three billion people. A 4ºC warming is likely to expose as many as 75% of the global population to deadly heat.** Dangerous to catastrophic impacts on the health of people including generations yet to be born, on the health of ecosystems, and on species extinction have emerged as major justifications for mitigating climate change well below 2ºC, although we must recognize that the uncertainties intrinsic in climate and social systems make it hard to pin down exactly the level of warming that will trigger possibly catastrophic impacts. To avoid these consequences, we must act now, and we must act fast and effectively. This report sets out a specific plan for reducing climate change in both the near- and long-term. With aggressive urgent actions, we can protect ourselves. Acting quickly to prevent catastrophic climate change by decarbonization will save millions of lives, trillions of dollars in economic costs, and massive suffering and dislocation to people around the world. This is a global security imperative, as it can avoid the migration and destabilization of entire societies and countries and reduce the likelihood of environmentally driven civil wars and other conflicts.

#### Scenario 4 is space militarization – colonizing Mars brings geopolitical tensions to space – any developments will be weaponized

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Part 3: Mars Domination

Mars is widely accepted by the scientific community to be the most plausible planet for the first human habitation on a celestial body and, consequently, the most likely location for the first space colony and eventually a second planet for humankind. Thus, Mars is a desirable goal for nations involved in space exploration for many reasons. The territory on Mars, for example, will most likely become marketable for economic value to civilians in the long term. The Outer Space Treaty prevents ownership of territory on celestial bodies but makes no mention of ownership or sale for profit of structures built on, or items brought to, celestial bodies, just as there is no explicit language in the treaty preventing profit-based resource exploitation on celestial bodies by either governments, organizations, or private nationals.32 Additionally, the inevitability of Mars becoming a second planet inhabited by humanity must be considered, along with all of the implications of living spaces and ownership of property that will eventually follow. Denying this inevitability and claiming it as outlawed by international law due to the prohibition on appropriating territory on a celestial body would essentially equate owning property on Earth as also outlawed by international law. After all, Earth is also a celestial body. Language in the treaty encourages expansion into space and essentially says that if persons, governments, or organizations build something on a celestial body, they own that building33 and can do what they want with it, including selling it. They cannot, however, claim to own the planet's ground outside the building—yet. Resources on Mars, while still not mapped out as substantially as lunar resources have been, will likewise create new markets for economic prosperity and national wealth, including more 3He deposits from solar winds like those found in lunar regolith along with substantially high concentrations of iron.34

In addition to buildings constructed on celestial bodies, spacecraft and facilities constructed in space and on celestial bodies are also considered to be the territory of the owning nation, which means that the UN Charter applies to facilities and spacecraft in space and on celestial bodies. UN Charter Article 2(4), in particular, protects space explorers and potential future residents on Mars by prohibiting the "use of force against the territorial integrity" of another nation party to the treaty,35 which all space-faring nations are. Article 51 further dictates that if attacked, "the inherent right of . . . self-defense" shall not be impaired.36 Article V of the Outer Space Treaty prescribes that, in space, all humans are bound to "render all possible assistance to" each other as "envoys of Mankind."37 Essentially, a peaceful international course is possible—even mandated—for human expansion into space. Unfortunately, the PRC and the RF regard space and celestial bodies as territorial goals,38 leading to the assumption that attempts will be made to control and defend such territories as necessary to achieve space superiority, control over space resources, and managerial power over the future colonization of Mars.

Control over Mars, in addition to affecting resource exploitation, transportation, and scientific advancements, also has implications for the direction of humanity in space. Establishment of a human colony, or human colonies, on Mars will eventually lead to territorial spaces, development of the land and air (potentially involving terraforming the planet for atmospheric enhancement), and security issues. While an established colony on the Red Planet is still likely decades away, trends within the PRC and RF governments suggest that any established colony on Mars under their jurisdiction would be authoritarian, weaponized, and secret. Given the nature of weather on Mars, fortified structures are easily justified, and the lack of a conventional weapons ban on celestial bodies makes weaponization of such a colony both legal and desirable, mainly because of the third inherently desired factor—secrecy. The inevitability of PRC and RF presence on Mars also suggests that any US developments will also include fortifications and weaponization. While the Outer Space Treaty mandates cooperation between nations on celestial bodies, the extreme distance between Earth and Mars means that a compliance verification system with effective monitoring and enforcement will be complicated, if not impossible, for the foreseeable future. For these reasons, a nation that effectively controls near-Earth space and establishes a security presence on the Moon will effectively be in a position to control Mars.

#### Space weaponization causes extinction –

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Here on Earth, the air, land, and sea are zones of conflict, clashes and combat. There is a growing perception that next up is the ocean of space, transformed into an arena for warfare.

There is ongoing chatter regarding military use of space by various nations. The freshly established U.S. Space Force, for instance, is busily shaping how best to protect U.S. and allied interests in the increasingly contested and congested space domain.

What conditions could lead to clashes in space? Is such a situation a given, or can conflicts be short-circuited ahead of time? Could nations "slip into" off-planet muscle-flexing, quarreling and actual warfighting in space that might spark confrontation here on terra firma?

Space.com contacted several leading military space and security experts, asking for their opinions on the current status of the militarization of space.

Pass interference

The term "warfare in space" could entail things that are already taking place, said Mark Gubrud, an adjunct assistant professor in the Curriculum in Peace, War & Defense at the University of North Carolina, Chapel Hill. He pointed to jamming satellite communications, laser dazzling of photo-snapping satellites, hacking systems to selectively block or eavesdrop on phone or data streams, and probing systems to see if they can be hacked.

"While the full extent of such activities may not be known, they appear to occur sporadically up to now," Gubrud said. According to some reports, he said, the U.S. and perhaps others have made extensive use of the ability to intercept and interfere with commercial telecom traffic, though this is an asymmetric capability of major powers that presents little risk of escalation.

Gubrud said that all of these forms of harmful interference could potentially lead to escalation risks as they are more widely and commonly practiced and as adversaries develop reciprocal capabilities.

"Therefore, we should build on the United Nations Outer Space Treaty with a further treaty that bans all forms of harmful interference and weapons for causing interference," he said.

Absence of binding commitments

The greatest danger will arise from a massive proliferation of Earth-based anti-satellite systems that are able to affect spacecraft in geosynchronous orbit and beyond, or the pre-deployment of various types of such weapons in space that would allow them to reach their targets within minutes or seconds, rather than hours, Gubrud said.

"Here the potential for rapid escalation becomes a severe threat to nuclear stability, as the main confronting powers would almost certainly be the US, Russia and China," he said. The only good news here is that this hasn't happened yet, he added, probably because there is enough recognition of how dangerous it would be.

"So really, the path to war in space is a space arms race, one that has long been postponed but that is only made more imminent and potentially explosive as technology advances in the absence of binding commitments to space arms control," Gubrud concluded.

Tailgating

Space is already weaponized by dual-use robotic spacecraft serving as weapons to disable our satellites, said Brian Chow, an independent policy analyst with over 25 years' experience as a senior physical scientist specializing in space and national security.

"Because their peaceful uses are important to space prosperity, they should not be banned," Chow said. "Actually, we can accept some rules and measures so that we can enjoy the benefits of these spacecraft and prevent them from harming our satellites at the same time."

Chow senses that the present problem is that the international community has not prohibited spacecraft, whether peaceful or hostile, from staying arbitrarily close to satellites operated by another nation. An adversary is not prevented from placing its dual-use spacecraft close to our satellites in peacetime.

"Once these spacecraft are in place, mounting attacks from such a close range would give us insufficient warning time to fashion a defense and save our targeted satellites," Chow told Space.com.

The international community is ambiguous about whether a nation is allowed to tailgate another country's satellites, Chow said. Also, the current U.S. national security space strategy is ambiguous about preemptive self-defense, including when it faces a threat from space stalkers, he said.

Dangerous ambiguities

The uncertainties surrounding preemption and stalking are dangerous, Chow said. For instance, China could reason that space stalkers would be the best type of anti-satellite system, because it would present the United States with two bad choices.

"First, the United States could preemptively destroy the space stalkers to save the targeted satellites so as to maintain space support to military operations during crisis and war," Chow said. "However, without discussing and resolving these two ambiguities with the international community in peacetime, the United States could be condemned as the aggressor who fired the first shot, which led to a war in space possibly spreading to Earth — something both sides tried to avoid," Chow said.

Secondly, Chow said that the United States may not be able to fight effectively without the support of some critical satellites.

"Facing these two bad choices, the United States might end up not intervening at all. This would be the perfect outcome for China, as it prevented U.S. intervention without firing a single shot," Chow said. "If we keep using the current space policy

without necessary and needed changes, the U.S. and other nations could 'stumble into' such conflicts."