**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.

**Reducing the risk of extinction is always priority number one.   
Bostrom 12** [Faculty of Philosophy and Oxford Martin School, University of Oxford.], Existential Risk Prevention as Global Priority.  Forthcoming book (Global Policy). MP. http://www.existenti...org/concept.pdfEven if we use the most conservative of these estimates, which entirely ignores the   possibility of space colonization and software minds, **we find that the expected loss of an existential   catastrophe is greater than the value of 10^16 human lives**.  **This implies that the expected value of   reducing existential risk by a mere one millionth of one percentage point is at least a hundred times the   value of a million human lives.**  The more technologically comprehensive estimate of 10  54 humanbrain-emulation subjective life-years (or 10  52  lives of ordinary length) makes the same point even   more starkly.  Even if we give this allegedly lower bound on the cumulative output potential of a   technologically mature civilization a mere 1% chance of being correct, we find that the expected   value of reducing existential risk by a mere one billionth of one billionth of one percentage point is worth   a hundred billion times as much as a billion human lives. **One might consequently argue that even the tiniest reduction of existential risk has an   expected value greater than that of the definite provision of any ordinary good, such as the direct   benefit of saving 1 billion lives.**  And, further, that the absolute value of the indirect effect of saving 1  billion lives on the total cumulative amount of existential riskâ€”positive or negativeâ€”is almost   certainly larger than the positive value of the direct benefit of such an action.

## 1NC

#### US leads the private space sector now but other countries sectors are growing— US private sector is key to growth

Harding 7/16 [(Luke, a Guardian foreign correspondent. His book Shadow State is published by Guardian Faber. Click here for Luke's public key) “The space race is back on – but who will win?” The Guardian, 7/16/21. <https://www.theguardian.com/science/2021/jul/16/the-space-race-is-back-on-but-who-will-win>] RR

Half a century on, space has opened up. It is less ideological and a lot more crowded. About 72 countries have space programmes, including India, Brazil, Japan, Canada, South Korea and the UAE. The European Space Agency is active too, while the UK boasts the most private space startups after the US.

Space today is also highly commercial. On Sunday Richard Branson flew to the edge of space and back again in his Virgin Galactic passenger rocket. On Tuesday, Branson’s fellow billionaire Jeff Bezos is due to travel in his own reusable craft, New Shepard, built by the Amazon founder’s company Blue Origin and launched from west Texas.

Non-state actors play an increasingly important role in space exploration. Elon Musk’s SpaceX vehicles have made numerous flights to the International Space Station (ISS), and since last year they have transported people as well as cargo. Later this year Musk is due to send his own all-civilian crew into orbit – though he isn’t going himself.

Even so, space still reflects tensions on Earth. “Astropolitics follows terrapolitics,” says Mark Hilborne, a lecturer in defence studies at King’s College London. Up there anything goes, he adds. “Space governance is a bit fuzzy. Laws are few and very old. They are not written for asteroid mining or for a time when companies dominate.”

The biggest challenge to US space supremacy comes not from Russia – heir to the Soviet Union’s pioneering space programme, which launched the Sputnik satellite and got the first human into space in the form of Yuri Gagarin – but from China.

In 2011 Congress prohibited US scientists from cooperating with Beijing. Its fear: scientific espionage. Taikonauts are banned from visiting the ISS, which has hosted astronauts from 19 countries over the past 20 years. The station’s future beyond 2028 is uncertain. Its operations may yet be extended in the face of increasing Chinese competition.

In its annual threat assessment this April, the office of the US Director of National Intelligence (DNI) described China as a “near-peer competitor” pushing for global power. It warns: “Beijing is working to match or exceed US capabilities in space to gain the military, economic, and prestige benefits that Washington has accrued from space leadership.”

The Biden administration suspects Chinese satellites are being used for non-civilian purposes. The People’s Liberation Army integrates reconnaissance and navigation data in military command and control systems, the DNI says. “Satellites are inherently dual use. It’s not like the difference between an F15 fighter jet and a 737 passenger plane,” Hilborne says.

Once China completes the Tiangong space station next year, it is likely to invite foreign astronauts to take part in missions. One goal: to build new soft-power alliances. Beijing says interest from other countries is enormous. The low Earth orbit station is part of an ambitious development strategy in the heavens rather than on land – a sort of belt and rocket initiative.

According to Alanna Krolikowski, an assistant professor at the Missouri University of Science and Technology, a “bifurcation” of space exploration is under way. In one emerging camp are states led by China and Russia, many of them authoritarian; in the other are democracies and “like-minded” countries aligned with the US.

Russia has traditionally worked closely with the Americans, even when terrestrial relations were bad. Now it is moving closer to Beijing. In March, China and Russia announced plans to co-build an international lunar research station. The agreement comes at a time when Vladimir Putin’s government has been increasingly isolated and subject to western sanctions. In June, Putin and his Chinese counterpart Xi Jinping renewed a friendship treaty. Moscow is cosying up to Beijing out of necessity, at a time of rising US-China bipolarity.

These rival geopolitical factions are fighting over a familiar mountainous surface: the moon. In 2019 a Chinese rover landed on its far side – a first. China is now planning a mission to the moon’s south pole, to establish a robotic research station and an eventual lunar base, which would be intermittently crewed.

Nasa, meanwhile, has said it intends to put a woman and a person of colour on the moon by 2024. SpaceX has been hired to develop a lander. The return to the moon – after the last astronaut, commander Eugene Cernan, said goodbye in December 1972 – would be a staging post for the ultimate “giant leap”, Nasa says: sending astronauts to Mars.

Krolikowski is sceptical that China will quickly overtake the US to become the world’s leading spacefaring country. “A lot of what China is doing is a reprisal of what the cold war space programmes did in the 1960s and 1970s,” she said. Beijing’s recent feats of exploration have as much to do with national pride as scientific discovery, she says.

But there is no doubting Beijing’s desire to catch up, she adds. “The Chinese government has established, or has plans for, programmes or missions in every major area, whether it’s Mars missions, building mega constellations of telecommunications satellites, or exploring asteroids. There is no single area of space activity they are not involved in.”

“We see a tightening of the Russia-China relationship,” Krolikowski says. “In the 1950s the Soviet Union provided a wide range of technical assistance to Beijing. Since the 1990s, however, the Russian space establishment has experienced long stretches of underfunding and stagnation. China now presents it with new opportunities.”

Russia is poised to benefit from cost sharing, while China gets deep-rooted Russian technical expertise. At least, that’s the theory. “I’m sceptical this joint space project will materialise anytime soon,” says Alexander​ Gabuev, a senior fellow at the Carnegie Moscow Centre. Gabuev says both countries are “techno-nationalist”. Previous agreements to develop helicopters and wide-bodied aircraft saw nothing actually made, he says.

The Kremlin has been a key partner in managing and resupplying the ISS. US astronauts used Russian Soyuz rockets to reach the station, taking off from a cosmodrome in Kazakhstan, after the Space Shuttle programme was phased out. But this epoch seems to be coming to an end as private companies such as SpaceX take over. “I expect US-Russian relations to get worse,” Gabuev says, adding that Americans “no longer need” Russia’s help.

Moscow’s state corporation for space activities, Roscosmos, has faced accusations of being more interested in politics than space research. Last month the newspaper Novaya Gazeta reported that Roscosmos’s executive director of manned space programmes, former cosmonaut Sergei Krikalev, had been fired. His apparent crime: questioning an official decision to shoot a film on the Russian section of the ISS.

The film, Challenge, is about a female surgeon operating on a cosmonaut in space, and has been backed and financed by Roscosmos . It stars Yulia Peresild, who is due to head to space in October with director Klim Shipenko. The launch seems timed to beat Tom Cruise, who is due to shoot his own movie on board the ISS with director Doug Liman.

Krikalev, who spent more than 800 days in space and was in orbit when the USSR collapsed, apparently told Roscomos’s chief, Dmitry Rogozin, that the film was pointless. Rogozin – its co-producer – has called on the west to drop sanctions in return for Russia’s cooperation on space projects. Putin, Rogozin’s boss, appears to not be very interested in other planets, though, and is more concerned with nature and the climate crisis these days.

“Space is one of the areas that has traditionally transcended politics. The Mir space station worked at a time of east-west tensions. There was symbolic cooperation. Whether this will continue in the future is really up for debate,” Hilborne says. “The US is very sensitive about what happens in space.”

Most observers think the US will remain the world’s pre-eminent space power, thanks to its innovative and flourishing private sector. China’s Soviet-style state programme appears less nimble. Despite ambitious timetables, and billions spent by Beijing, it is unclear when – or even if – an astronaut will return to the moon. The 2030s, perhaps? Will they be American or Chinese? Or from a third country?

It may well be that the first person to boldly go again doesn’t merely represent a nation or carry a flag. More likely, they will emerge from a lunar lander wearing a spacesuit with a SpaceX logo on the back – a giant leap not only for mankind, but for galactic marketing.

#### Continued success of private space companies is key to secure space for the US.

Macias & Sheetz 2/3 [(Amanda, covers global trade and foreign policy for CNBC. She joined CNBC’s Washington bureau in 2018 from CBS Radio. Amanda studied Broadcast Journalism and Finance at the University of Missouri. She is a Knight-Bagehot Fellow in Economics and Business Journalism at Columbia University in New York.) (Micheal, Space Reporter) “Space Force general says success of private companies like SpaceX helps U.S. secure the space domain” CNBC, 2/3/21. <https://www.cnbc.com/2021/02/03/space-force-general-america-owns-space-with-help-from-elon-musks-spacex.html>] RR

WASHINGTON – The nation’s top general leading the U.S. military mission in space said Wednesday that he is excited about Wall Street and billionaire investment in the space industry, which has sparked renewed interest in the field among Americans and strong recruitment at the Pentagon’s youngest branch.

“There is a ton of excitement across America on space in all sectors,” said Gen. John Raymond, the U.S. Space Force’s chief of operations, when asked by CNBC about the strides made by private space companies like Elon Musk’s SpaceX.

“I’ve talked about people knocking on our door wanting to come into the Space Force in numbers greater than what we have slots to fill. I’ve talked in the past about how universities are seeing more students apply for space STEM degrees, which I think is going to be great for our nation,” Raymond added.

“I’m excited about all of it, both what we’re doing here on national security and what’s going on in the commercial industry that we can leverage the advantage,” the four-star general said without specifically naming any companies.

“The U.S. has always, has long understood that we are stronger with a secure and stable space domain and all of those sectors play into that,” Raymond said.

The U.S. Space Force, the Pentagon’s youngest branch, has increasingly looked to partner with the private sector as companies and investors pour into the space industry. The Pentagon is closely watching the progress of rocket builders like Rocket Lab, Astra and Virgin Orbit in addition to SpaceX.

Raymond’s comments came on the heels of SpaceX announcing this week that it will fly its first all-civilian crew into orbit later this year, a mission known as Inspiration 4.

The landmark flight, led by billionaire Jared Isaacman, is aimed at using high-profile space tourism to raise support for St. Jude Children’s Research Hospital. Three yet-to-be-announced passengers will accompany Isaacman on the multiday journey around the Earth, with two of the seats to be decided in public online competitions this month.

SpaceX announces first space mission with all-civilian crew

Raymond also called out NASA’s Crew-1 mission, which was the first operational launch of SpaceX’s Crew Dragon spacecraft.

“If you look at what’s going on in the civil sector with the launch of U.S. astronauts, and in this last launch a Japanese astronaut from U.S. soil on a commercial launch vehicle, there’s a ton of excitement there,” he said.

Raymond did not provide a reaction to SpaceX’s Starship rocket test flight on Tuesday, which resulted in an explosion as it attempted to land.

Starship prototype SN9 launched successfully to about 33,000 feet but, like the previous prototype flight in December, the rocket smashed into the ground while attempting to land.

Private investment in space companies last year set a fresh annual record, despite industry fears that the Covid-19 pandemic would end the past decade’s momentum, according to a report by Space Capital last month. Builders of rockets and satellites brought in $8.9 billion in 2020, with venture capital and angel investors continuing to pour funds into space businesses.

#### Space privatization key to US heg— Russia and China benefit from a weakened US.

Weichert 17 [(Brandon J., a former Congressional staff member who holds a Master of Arts in Statecraft & National Security Affairs from the Institute of World Politics in Washington, D.C. He is the founder of The Weichert Report: An Online Journal of Geopolitics, and is currently completing a book on national security space policy.) “The High Ground: The Case for U.S. Space Dominance,” Science Direct, 2017. <https://www.sciencedirect.com/science/article/abs/pii/S0030438717300108>] RR

The global order is currently disordered. New states with completely different values from the United States are rising to prominence. Many of those states possess strategic cultures opposed to the American hegemony that has defined the post-Cold War order.

Yet, the United States still maintains greater power, wealth, and capabilities than the other states seeking to displace her. For the United States to maintain its hegemonic position, it must also maintain a dominant position in space. As has been noted before, space is the ultimate high ground from which a state can dominate all of the other strategic domains (land, air, sea, and cyberspace). The United States has enjoyed the benefits from dominating this region. Yet, states like China and Russia are moving forward with their own plans not only to deny America access to space, but also to dominate this realm. These states would then benefit from commanding the high ground of space at America’s expense.

Since at least the Nixon Administration, space has come to be viewed in a militarized light. By the end of the Cold War, space had not only been militarized, but many were searching for a way to weaponize it. Just as the drift toward militarization of space was inexorable, so too is the desire for weaponization. As rival states begin to hone their space skills, the United States should seek to obtain the first move advantage by capitalizing on its already sizable lead in space by weaponizing it first. The placing of weapons in orbit would not only increase the costs of attacking existing U.S. space architecture, but it would also lend itself to increasing global stability by raising the costs of aggressive behavior on belligerents. Whatever negatives the weaponization of space may have, nothing is more negative for America than to find itself losing its dominance of space to a state that has placed weapons in orbit first.

To be passive and allow temporary budgetary constraints to dictate longterm space strategy will damage irrevocably the U.S. position in orbit. Our enemies are aware of our shortsighted preference for space superiority over dominance and are moving toward degrading the American advantage in space.23 Space dominance will not only rebuff rising states from challenging the United States, but it will also lend stability to the world order. This proactive stance was the goal of Ronald Reagan’s Strategic Defense Initiative. It must be the goal of U.S. policymakers today.24

#### US leadership in this decade solves global war and results in a peaceful end to Chinese revisionism **Erickson and Collins 10/21** [(Andrew, A professor of strategy in the U.S. Naval War College’s China Maritime Studies Institute)(Gabriel, Baker Botts fellow in energy and environmental regulatory affairs at Rice University’s Baker Institute for Public Policy) “A Dangerous Decade of Chinese Power Is Here,” Foreign Policy, 10/18/2021] U.S. and allied policymakers are facing the most important foreign-policy challenge of the 21st century. **China’s power is peaking**; so is the political position of Chinese President Xi Jinping and the Chinese Communist Party’s (CCP) **domestic strength.** In the long term, China’s **likely decline** after this peak is a **good thing.** But right now, it creates a **decade of danger** from a system that increasingly realizes it only has a **short time** to fulfill some of its **most critical**, long-held **goals.**

Within the next five years, China’s leaders are likely to conclude that its deteriorating demographic profile, structural economic problems, and technological estrangement from global innovation centers are eroding its leverage to annex Taiwan and achieve other major strategic objectives. As Xi internalizes these challenges, his foreign policy is likely to become even more accepting of risk, feeding on his nearly decadelong track record of successful revisionist action against the rules-based order. Notable examples include China occupying and militarizing sub-tidal features in the South China Sea, ramping up air and maritime incursions against Japan and Taiwan, pushing border challenges against India, occupying Bhutanese and Tibetan lands, perpetrating crimes against humanity in [Xinjiang](https://www.nytimes.com/interactive/2019/11/16/world/asia/china-xinjiang-documents.html), and coercively enveloping Hong Kong.

The relatively low-hanging fruit is plucked, but Beijing is emboldened to grasp the biggest single revisionist prize: Taiwan.

Beijing’s actions over the last decade have triggered backlash, such as with the so-called AUKUS deal, but concrete constraints on China’s strategic freedom of action may not fully manifest until after 2030. It’s remarkable and dangerous that China has paid few costs for its actions over the last 10 years, even as its military capacities have rapidly grown.

Beijing will likely conclude that under current diplomatic, economic, and force postures for both “gray zone” and high-end scenarios, the 2021 to late 2020s timeframe still favors China—and is attractive for its 68-year-old leader, who seeks a historical achievement at the zenith of his career.

U.S. planners must mobilize resources, effort, and risk acceptance to maximize power and thereby deter Chinese aggression in the coming decade—literally starting now—and innovatively employ assets that currently exist or can be operationally assembled and scaled within the next several years. That will be the first step to pushing back against China during the 2020s—a decade of danger—before what will likely be a waning of Chinese power.

As Beijing aggressively seeks to undermine the international order and promotes a narrative of inevitable Chinese strategic domination in Asia and beyond, it creates a dangerous contradiction between its goals and its medium-term capacity to achieve them. China is, in fact, likely nearing the apogee of its relative power; and by 2030 to 2035, it will cross a tipping point from which it may never recover strategically. Growing headwinds constraining Chinese growth, while not publicly acknowledged by Beijing, help explain Xi’s high and apparently increasing risk tolerance. Beijing’s window of strategic opportunity is sliding shut.

China’s skyrocketing household debt levels exemplify structural economic constraints that are emerging much earlier than they did for the United States when it had similar per capita GDP and income levels. Debt is often a wet blanket on consumption growth. A 2017 analysis published by the Bank for International Settlements found that once the household debt-to-GDP ratio in a sample of 54 countries exceeded 60 percent, “the negative long-run effects on consumption tend to intensify.” China’s household debt-to-GDP ratio surpassed that empirical danger threshold in late 2020. Rising debt service burdens thus threaten Chinese consumers’ capacity to sustain the domestic consumption-focused “dual circulation” economic model that Xi and his advisors seek to build. China’s growth record during the past 30 years has been remarkable, but past exceptionalism does not confer future immunity from fundamental demographic and economic headwinds.

As debt levels continue to rise at an absolute level that has accelerated almost continuously for the past decade, China also faces a hollowing out of its working-age population. This critical segment peaked in 2010 and has since declined, with the rate from 2015 to 2020 nearing 0.6 percent annually—nearly twice the respective pace in the United States. While the United States faces demographic challenges of its own, the disparity between the respective paces of decline highlights its relative advantage compared to its chief geopolitical competitor. Moreover, the United States can choose to access a global demographic and talent dividend via immigration in a way China simply will not be able to do.

Atop surging debt and worsening demographics, China also faces resource insecurity. China’s dependence on imported food and energy has grown steadily over the past two decades. Projections from Tsinghua University make a compelling case that China’s oil and gas imports will peak between 2030 and 2035. As China grapples with power shortages, Beijing has been reminded that supply shortfalls equal to even a few percentage points of total demand can have outsized negative impacts.

Domestic resource insufficiency by itself does not hinder economic growth—as the Four Asian Tigers’ multi-decade boom attests. But China is in a different position. Japan and South Korea never had to worry about the U.S. Navy interdicting inbound tankers or grain ships. In fact, the United States was avowedly willing to use military force to protect energy flows from the Persian Gulf region to its allies. Now, as an increasingly energy-secure United States pivots away from the Middle East toward the Indo-Pacific, there is a substantial probability that energy shipping route protection could be viewed in much more differentiated terms—with oil and liquefied natural gas cargoes sailing under the Chinese flag viewed very differently than cargoes headed to buyers in other regional countries.

Each of these dynamics—demographic downshifts, rising debts, resource supply insecurity—either imminently threatens or is already actively interfering with the CCP’s long-cherished goal of achieving a “moderately prosperous society.” Electricity blackouts, real estate sector travails (like those of Evergrande) that show just how many Chinese investors’ financial eggs now sit in an unstable $52 trillion basket, and a solidifying alignment of countries abroad concerned by aggressive Chinese behavior all raise questions about Xi’s ability to deliver. With this confluence of adverse events only a year before the next party congress, where personal ambition and survival imperatives will almost drive him to seek anointment as the only Chinese “leader for life” aside from former leader Mao Zedong, the timing only fuels his sense of insecurity. Xi’s anti-corruption campaigns and ruthless removal of potential rivals and their supporters solidified his power but likely also created a quiet corps of opponents who may prove willing to move against him if events create the perception he’s lost the “mandate of heaven.” Accordingly, the baseline assumption should be that Xi’s crown sits heavy and the insecurity induced is thereby intense enough to drive high-stake, high-consequence posturing and action.

While Xi is under pressure to act, the external risks are magnified because so far, he has suffered few consequences from taking actions on issues his predecessors would likely never have gambled on. Reactions to party predations in Xinjiang and [Hong Kong](https://home.treasury.gov/policy-issues/financial-sanctions/recent-actions/20210716_33) have been restricted to diplomatic-signaling pinpricks, such as sanctioning responsible Chinese officials and entities, most of whom lack substantial economic ties to the United States. Whether U.S. restraint results from a fear of losing market access or a belief that China’s goals are ultimately limited is not clear at this time.

While the CCP issues retaliatory sanctions against U.S. officials and proclaims a triumphant outcome to its hostage diplomacy, these tactical public actions mask a growing private awareness that China’s latitude for irredentist action is poised to shrink. Not knowing exactly when domestic and external constraints will come to bite—but knowing that when Beijing sees the tipping point in its rearview mirror, major rivals will recognize it too—amplifies Xi and the party’s anxiety to act on a shorter timeline. Hence the dramatic acceleration of the last few years.

Just as China is mustering its own strategic actions, so the United States must also intensify its focus and deployment of resources. The United States has taken too long to warm up and confront the central challenge, but it retains formidable advantages, agility, and the ability to prevail—provided it goes all-in now. Conversely, if Washington fails to marshal its forces promptly, its achievements after 2030 or 2035 will matter little. Seizing the 2020s would enable Beijing to ~~cripple~~ [destroy] the free and open rules-based order and entrench its position by economically subjugating regional neighbors (including key U.S. treaty allies) to a degree that could offset the strategic headwinds China now increasingly grapples with.

Deterrence is never certain. But it offers the highest probability of avoiding the certainty that an Indo-Pacific region dominated by a CCP-led China would doom treaty allies, threaten the U.S. homeland, and likely set the stage for worse to come. Accordingly, U.S. planners should immediately mobilize resources and effort as well as accept greater risks to deter Chinese action over the critical next decade.

The greatest threat is armed conflict over Taiwan, where U.S. and allied success or failure will be fundamental and reverberate for the remainder of the century. There is a high chance of a major move against Taiwan by the late 2020s—following an extraordinary ramp-up in People’s Liberation Army capabilities and before Xi or the party state’s power grasp has ebbed or Washington and its allies have fully regrouped and rallied to the challenge.

So how should policymakers assess the potential risk of Chinese action against Taiwan reaching dangerous levels by 2027 or possibly even earlier—as emphasized in the testimonies of Adms. Philip Davidson and John Aquilino? In June, Chairman of the Joint Chiefs Gen. Mark Milley testified to the House of Representatives that Xi had “challenged the People’s Liberation Army to accelerate their modernization programs to develop capabilities to seize Taiwan and move it from 2035 to 2027,” although China does not currently have the capabilities or intentions to conduct an all-out invasion of mainland Taiwan.

U.S. military leaders’ assessments are informed by some of the world’s most extensive and sophisticated internal information. But what’s striking is open-source information available to everyone suggests similar things. Moving forward, a number of open-source indicators offer valuable “early warning lights” that can help policymakers more accurately calibrate both potential timetables and risk readings as the riskiest period of relations—from 2027 onward—approaches.

Semiconductors supply self-sufficiency. Taiwan is the “OPEC+” of semiconductors, accounting for approximately two-thirds of global chip foundry capacity. A kinetic crisis would almost certainly disrupt—and potentially even completely curtail—semiconductor supplies. China presently spends even more each year on semiconductor imports (around $380 billion) than it does on [oil](http://english.customs.gov.cn/Statics/0aba4bfd-f8ed-477c-9d16-dc3def897b7b.html), but much of the final products are destined for markets abroad. Taiwan is producing cutting-edge 5-nanometer and 7-nanometer chips, but China produces around 80 percent of the rest of the chips in the world. The closer China comes to being able to secure “good enough” chips for “inside China-only” needs, the less of a constraint this becomes.

Crude oil, grain, strategic metals stockpiles—the commercial community (Planet Labs, Ursa Space Systems, etc.) has developed substantial expertise in cost-effectively tracking inventory changes for key input commodities needed to prepare for war.

Electric vehicle fleet size—the amount of oil demand displaced by electric vehicles varies depending on miles driven, but the more of China’s car fleet that can be connected to the grid (and thus powered by blockade-resistant coal), the less political burden Beijing will face if it has to weather a maritime oil blockade imposed in response to actions it took against Taiwan or other major revisionist adventures. China’s passenger vehicle fleet, now approximately 225 million units strong, counts nearly 6.5 million electric vehicles among its ranks, the lion’s share of which are full-battery electrics. China’s State Council seeks to have 20 percent of new vehicles sold in China be electric vehicles by 2025. This target has already basically been achieved over the last few months, meaning at least 3.5 to 4 million (and eventually many more) new elective vehicles will enter China’s car fleet each year from now on.

Local concentration of maritime vessels—snap exercises with warships, circumnavigations, and midline tests with swarms of aircraft highlight the growing scale of China’s threat to [Taiwan](https://www.andrewerickson.com/2021/06/quick-look-cmsis-4-6-may-2021-conference-large-scale-amphibious-warfare-in-chinese-military-strategy-taiwan-strait-campaign-focus/). But these assets alone cannot invade the island. To capture and garrison, Beijing would need not only air, missile, naval, and special operations forces but also the ability to move lots of equipment and—at the very least—tens of thousands of personnel across the Taiwan Strait. As such, Beijing would have to amass maritime transport assets. And given the scale required, this would alter ship patterns elsewhere along China’s coast in ways detectable with artificial intelligence-facilitated imagery analysis from firms like Planet Labs (or national assets).

Only the most formidable, agile American and allied deterrence can kick the can down the road long enough for China’s slowdown to shut the window of vulnerability. Holding the line is likely to require frequent and sustained proactive enforcement actions to disincentivize full-frontal Chinese assaults on the rules-based order in the Indo-Pacific. Chinese probing behavior and provocations must be met with a range of symmetric and asymmetric responses that impose real costs, such as publishing assets owned by Chinese officials abroad, cyber interference with China’s technological social control apparatus, “hands on” U.S. Navy and Coast Guard enforcement measures against Maritime Militia-affiliated vessels in the South China Sea, intensified air and maritime surveillance of Chinese naval bases, and visas and resettlement options to Hong Kongers, Uyghurs, and other threatened Chinese citizens—including CCP officials (and their families) who seek to defect and/or leave China. U.S. policymakers must make crystal clear to their Chinese counterparts that the engagement-above-all policies that dominated much of the past 25 years are over and the risks and costs of ongoing—and future—adventurism will fall heaviest on China.

Bombastic Chinese reactions to emerging cohesive actions verify the approach’s effectiveness and potential for halting—and perhaps even reversing—the revisionist tide China has unleashed across the Asian region. Consider the recent nuclear submarine deal among Australia, the United States, and the United Kingdom. Beijing’s strong public reaction (including toleration of [nuclear threats](https://www.globaltimes.cn/page/202109/1234460.shtml) made by the state-affiliated *Global Times*) highlights the gap between its global information war touting China’s irresistible power and deeply insecure internal self-perception. Eight nuclear submarines will ultimately represent formidable military capacity, but for a bona fide superpower that believes in its own capabilities, they would not be a game-changer. Consider the U.S.-NATO reaction to the Soviet Union’s commissioning of eight Oscar I/II-class cruise missile subs during the late Cold War. These formidable boats each carried 24 SS-N-19 Granit missiles specifically designed to kill U.S. carrier battle groups, yet NATO never stooped to public threats.

With diplomatic proofs of concepts like the so-called AUKUS deal, the Quadrilateral Security Dialogue, and hard security actions like the Pacific Deterrence Initiative now falling into place, it is time to comprehensively peak the non-authoritarian world’s protective action to hold the line in the Indo-Pacific. During this decade, U.S. policymakers must understand that under Xi’s strongman rule, personal political survival will dictate Chinese behavior. Xi’s recreation of a “one-man” system is a one-way, high-leverage bet that decisions he drives will succeed.

If Xi miscalculates, a significant risk given his suppression of dissenting voices while China raises the stakes in its confrontation with the United States, the proverbial “leverage” that would have left him with outsized returns on a successful bet would instead amplify the downside, all of which he personally and exclusively signed for. Resulting tensions could very realistically undermine his status and authority, embolden internal challengers, and weaken the party. They could also foreseeably drive him to double down on mistakes, especially if those led to—or were made in the course of—a kinetic conflict. Personal survival measures could thus rapidly transmute into regional or even global threats.

If Xi triggered a “margin call” on his personal political account through a failed high-stakes gamble, it would likely be paid in blood. Washington must thus prepare the U.S. electorate and its institutional and physical infrastructure as well as that of allies and partners abroad for the likelihood that tensions will periodically ratchet up to uncomfortable levels—and that actual conflict is a concrete possibility. Si vis pacem, para bellum (“if you want peace, prepare for war”) must unfortunately serve as a central organizing principle for a variety of U.S. and allied decisions during the next decade with China.

Given these unforgiving dynamics and stakes, implications for U.S. planners are stark: Do whatever remains possible to “peak” for deterrent competition against China by the mid-to-late 2020s, and accept whatever trade-offs are available for doing so.

Nothing we might theoretically achieve in 2035 and beyond is worth pursuing at the expense of China-credible capabilities we can realistically achieve no later than the mid-to-late 2020s.

## Case

### Poverty

#### Capitalism is the best weapon to combat poverty – historical correlation between economic freedom scores and extreme poverty rates prove

Ladan 19 [(Luka, the President and CEO of Zenica Public Relations and a Catalyst Policy Fellow. Prior to founding Zenica, Ladan served as Communications Director at a leading public affairs firm in Washington, D.C.) “Capitalism Remains the Best Way to Combat Extreme Poverty” Catalyst, 6/14/2019] BC

Again, America is not perfect. Poverty lingers, even here. But the status quo could be a whole lot worse: It may be difficult to become a member of the top “one percent,” but it is even harder to fall into extreme poverty.

The good fortunes of most can be traced to the free exchange of goods and services for mutual gain. While an imperfect system, capitalism remains our most effective weapon in fighting extreme poverty. As we’ve seen across continents, the freer an economy becomes, the less likely its people are to become entrapped in extreme poverty.

This can be corroborated by tracking the rise of “economic freedom,” which is related to the openness of a country’s markets and corresponding increases in living standards. Over the past 25 years, the global average economic freedom score—as calculated by the right-leaning Heritage Foundation—has increased by 3.2 percentage points, with many countries joining the ranks of at least the “moderately free.”

Indeed, global economic freedom has experienced a nearly six percent increase since 1995—after the Soviet Union’s collapse. Capitalism is more commonplace now than ever before.

And how have extreme poverty rates fared in that time? Trending down—way down.

During the early 1980s, more than 42 percent of the world’s population lived in extreme poverty (earning less than $2 a day). In the Soviet Union, for example, 20 percent of the population—over 43 million people—lived on less than 75 rubles a month (roughly $120).

Fast forward to the 21st century, and less than 10 percent of the world’s population is extremely poor—a 33 percent decrease. The left-leaning Brookings Institution estimates that someone escapes extreme poverty every 1.2 seconds.

Consider it this way: Even though the world’s population has increased by more than two billion people since 1990, the net number of extremely poor people has been slashed by nearly 1.2 billion. In today’s era of globalization, about 130,000 people rise out of poverty every single day. That’s like the entire city of New Haven, Connecticut leaving extreme poverty in a day’s time.

Or take China, which has opened many sectors of its economy in recent decades. Since 1995 alone, the Asian country’s economic freedom score increased from 52 to 58.4 points—outpacing the rest of the world. In roughly that same period of time, the Chinese economy lifted 800 million people out of extreme poverty. That’s right: 800 million Chinese people—nearly three times the U.S. population.

While still far from a “free economy,” China’s newfound openness to free-market principles is correlated with the most substantial example of poverty reduction in the history of the world. Even if correlation does not always equal causation, that accomplishment is difficult to ignore.

Granting people the freedom to voluntarily make mutually beneficial exchanges of goods and services has been the most effective anti-poverty solution to date. As more of the world allows the exercise of such freedom, expect poverty to decline even further.

#### Cap solves poverty

Pethokoukis 18 [(James, Senior Fellow; Editor, AEIdeas Blog; and DeWitt Wallace Chair) “Ending poverty by ‘ending capitalism’ is absolute nonsense. Just so, so wrong,” AEI, 10/18/18. <https://www.aei.org/economics/ending-poverty-by-ending-capitalism-is-absolute-nonsense-just-so-so-wrong/>] RR

First of all, the median income of the bottom 20 percent of households is up more than 70 percent since 1979 in real terms, according to the CBO. More to the point, poverty in America has declined considerably since LBJ declared a War on Poverty in 1964. Like other advanced capitalist economies, the United States redistributes some of its massive, market-generated wealth to improve living standards at the bottom. According to the Census Bureau’s Supplemental Poverty Measure — which unlike the official poverty measure takes into account key safety net programs such as the Earned Income Tax Credit and the Supplemental Nutrition Assistance Program — the poverty rate fell to 13.9 percent in 2017 from 26 percent in 1967. There’s even better news when one looks at “consumption-based” poverty measures, which calculates what a family consumes instead of how much income it earns. The work of visiting AEI scholar Bruce Meyer (along with his colleague James Sullivan) finds consumption-based poverty is more like 3 percent. Here is a relevant bit from a recent podcast chat we had:

Pethokoukis: Correct me if I have the numbers wrong, but if you look at just the official poverty rate measure you hear about in the news, since 1980 it seems kind of flat. But if you look at consumption, poverty has gone down fairly considerably. Is that right?

Meyer: Yes, so one of the statistics that I like least and I think is most misleading is the poverty rate. The official poverty rate says that we are at the same level of poverty now as we were in the 70s, which just does not fit.

Pethokoukis: So the Great Society failed, we spent all this money and poverty is no better.

Meyer: That’s essentially what the official statistics say, but you shouldn’t believe them for two main reasons. First, the official statistics don’t count much of what we’ve done to reduce poverty; so the official statistics look at pre-tax money income which omits the earned income tax credit, which omits food stamps, it omits housing benefits, it omits Medicaid. So, it gives you a very distorted picture of how those at the bottom are doing.

The second big reason that the official poverty statistic completely misleads the people taking them at face value is that the thresholds above which you have to be to not be poor go up too fast over time because they are indexed to inflation in a way that overstates the effects of inflation.

And you can see that again if you look at material circumstances in more objective ways of those at the bottom. If you look at the housing conditions of the bottom 20% of the income distribution, they look like the housing conditions of the middle class 30 years ago. So, the rates of air conditioning, central air conditioning, of washers and dryers in the apartment, have gone way up. The incidents of peeling paint, of water leaks in the ceiling or in the pipes, and the like have gone way down.

Pethokoukis: When I think about the house I grew up in, it was about half the size of my current house, it had no air conditioning, and I remember the leaks in the ceilings. I certainly am sure that my parents considered us a solidly middle-class household. But I guarantee if I drove by that house with my kids, they would say, “We didn’t know you were so poor.”

Meyer: I think that’s exactly right. I think that’s what a lot of us can see in how our lives have changed, but the official statistics don’t really reflect that, in significant part because of the overstatement of inflation and because of the omission of in-kind transfers and other government benefits.

And if Teen Vogue doesn’t understand what’s happening in the US, maybe it’s really too much to ask that it understand global trends, like the historic massive reduction in global poverty over recent decades. (Most Americans have no idea.) Over the past 30 years, the share of our fellow humans living in extreme poverty has decreased to 21 percent from 52 percent. That’s a billion fewer people in extreme poverty, largely in China and India. The Economist magazine — a publication quite willing to address flaws in the world’s capitalist economies — has put it this way:

The world’s achievement in the field of poverty reduction is, by almost any measure, impressive. . . . Most of the credit, however, must go to capitalism and free trade, for they enable economies to grow — and it was growth, principally, that has eased destitution. The world now knows how to reduce poverty. A lot of targeted policies — basic social safety nets and cash-transfer schemes help. So does binning policies like fuel subsidies to Indonesia’s middle class and China’s hukou household-registration system that boost inequality.

But the biggest poverty-reduction measure of all is liberalizing markets to let poor people get richer. That means freeing trade between countries (Africa is still cruelly punished by tariffs) and within them (China’s real great leap forward occurred because it allowed private business to grow). Both India and Africa are crowded with monopolies and restrictive practices. Many Westerners have reacted to recession by seeking to constrain markets and roll globalization back in their own countries, and they want to export these ideas to the developing world, too. It does not need such advice. It is doing quite nicely, largely thanks to the same economic principles that helped the developed world grow rich and could pull the poorest of the poor out of destitution.

You’ll find none of the above in the Teen Vogue piece, which means they’ve missed the story. Totally. Modern advanced economies — whether America, Sweden, the UK, or Germany — combine market-driven economies with social safety nets of one flavor or another. The result is high living standards and a low poverty level. But you can’t redistribute wealth without creating it. And that is what innovation-driven capitalism has done really well for the past two centuries. I would urge Teen Vogue editors and reporters to read “Factfulness: Ten Reasons We’re Wrong About the World–and Why Things Are Better Than You Think” by the late Hans Rosling, a fantastic book which examines all the ways in which very smart people are getting so many important things so very wrong — including poverty. Hard to believe this story has been up since April without any apparent modification.

#### Capitalism and tech innovation solves warming— covid proves.

Friedman 21 [(Thomas L., Mr. Friedman was awarded the 1983 Pulitzer Prize for international reporting (from Lebanon) and the 1988 Pulitzer Prize for international reporting (from Israel). He also won the 2002 Pulitzer Prize for commentary.) “Want to Save the Earth? We Need a Lot More Elon Musks.,” New York Times, 11/16/21. <https://www.nytimes.com/2021/11/16/opinion/glasgow-climate-change.html>] RR

This is not serious — not when you’re talking about reversing all the ways that we have destabilized Earth’s systems, from ice caps and ocean currents to coral reefs and tropical forests to the density of carbon dioxide in the atmosphere. This is pretend.

Serious was how we responded to Covid-19, when it really did feel like the world economy was ending: We fought back with the only tools we have that are as big and powerful as Mother Nature — Father Profit and New Tech.

We combined innovative biotech firms — like Pfizer-BioNTech, Moderna and some small start-ups — with today’s massive computing power and a giant market demand signal, and what did we get? In a little over a year after first being locked down by the virus, I had an effective mRNA vaccine against Covid-19 in my body — followed by a booster!

That was an amazing feat of biotechnology and computerized logistics to develop and deliver vaccines. And I hope the scientists, employees and shareholders of those vaccine innovators make boatloads of money — because it will incentivize others to apply a similar formula to stem climate change.

I have nothing against Glasgow. I admire those leaders who are trying to inspire the world to cut CO2 emissions, preserve biodiversity and hold each other to account. But we will not decarbonize the global economy with a lowest-common-denominator action plan of 195 countries. Not possible.

We will get there only when Father Profit and risk-taking entrepreneurs produce transformative technologies that enable ordinary people to have extraordinary impacts on our climate without sacrificing much — by just being good consumers of these new technologies.

In short: we need a few more Greta Thunbergs and a lot more Elon Musks. That is, more risk-taking innovators converting basic science into tools yet to be imagined to protect the planet for a generation yet to be born.

The good news — it’s happening. Two examples:

The first is Planet.com, which I alluded to briefly in last week’s column from Glasgow. Founded in 2010 by three former NASA scientists based in San Francisco, Planet has some 200 earth-imaging satellites in orbit, most the size of a loaf of bread, to observe the entire global land mass every 24 hours in high resolution — in order to make the changes unfolding on the ground “visible, accessible and actionable.” No government in the world has this capacity.

With these new deep transparency tools we can begin to reshape capitalism. For years, the rules and incentives of capitalism enabled oil and coal companies to extract fossil fuels — and industries to use them — without paying the true cost of the damage they were causing. That was easy to do because nature was hard to value; destruction was often hard to see in real time; and consumers had no tools to react. They had to wait for the courts.

“Capitalism has produced enormous wealth, but in part that’s because it has been able to treat nature as self-replenishing, hyper-abundant and free,” explained Andrew Zolli, Planet’s chief impact officer.

That will not be so easy anymore. Satellites are now “enabling us to put natural capital on every company and every country’s balance sheet,’’ so it will not take account of just your business profits and losses, “but all of your impacts’’ on the environment as well, Will Marshall, one of Planet’s three co-founders and its C.E.O., said to me.

Planet’s satellites plus AI, Marshall explained, can track a country’s trees, farmlands, coral reefs, coastal mangroves and smokestack emissions with incredible precision — down to three meters — and provide transparency to show which trees are being illegally logged by whom and whose factories are violating their carbon dioxide emissions promises.

That data can then be used — in theory — to trigger consumer boycotts, spread through social networks, against the government or the food or mining company doing the damage, or it can stimulate foreign aid or investment in the country or community protecting its natural resources.

For instance, Planet, with a group of scientific and philanthropic partners, has helped create a detailed map — the Allen Coral Atlas — of all the world’s remaining coral reefs. The Philippines is using the atlas’s data about sea grass to plan nine new marine-protected areas throughout the country. At the same time, in a partnership paid by Norway, Planet is tracking deforestation in 64 tropical rainforest countries, including Brazil. Using Planet’s pinpoint accuracy, the Brazilian government has vastly increased the number of cease-and-desist citations against illegal loggers, according to Planet’s Brazilian partner, MapBiomas.

Even more important, Marshall said, is how Planet’s commercial business also helps by, for example, enabling farmers to do precision agriculture by giving them fine-grain images of their crops so they know exactly where to add water and fertilizer or when to harvest. “This may have the biggest ecosystem impact of all,” he said. More efficient crop yields that use less water and fewer fertilizers end up “reducing the need to plow up more tropical forest and strengthens the environment generally.”

The other company I am watching is Helion Energy, based in Redmond, Wash., which is working on “the world’s first fusion power plant.” Fusion energy has long been the holy grail for clean power generation — and it always seems 20 years away. As the International Atomic Energy Agency notes on its website: “The sun, along with all other stars, is powered by a reaction called nuclear fusion. If nuclear fusion can be replicated on earth, it could provide virtually limitless clean, safe and affordable energy.”

Last June, as the website New Atlas reported, Helion published results confirming that its latest system had managed to heat a fusion plasma to a temperature over 100 million degrees Celsius, “which is significant, since it’s around the point at which there’s enough thermal energy to create large amounts of fusion.”

On Nov. 5, in the midst of Glasgow, Helion, across the Atlantic in Redmond, announced that it had raised $500 million in new financing in a round led by Sam Altman, C.E.O. of OpenAI and former president of Y Combinator, along with a Who’s Who of tech entrepreneurs.

The current generation of Helion’s system, Techcrunch.com reported, “wouldn’t be able to replace your Tesla Powerwall and solar panels — the size of a generator is roughly the size of a shipping container. But at 50 megawatts, the generators could power around 40,000 homes.” As New Atlas pointed out, “Helion projects it will generate electricity at rock-bottom prices of around $10 per MWh … less than a third the price of coal-fired power or today’s solar PV installations.”

Is Helion THE holy grail? Don’t know. There are other companies with promising approaches — like Commonwealth Fusion Systems — all racing to the same goal. I just know this: We got into this hole thanks to the worst of capitalism — letting companies privatize their gains from despoiling the environment and warming the climate — while socializing the losses among all of us.

We can get out of it, in part, by accelerating the best of American capitalism. We need to re-energize our innovation ecosystem to where government funds basic research that pushes the boundaries of physics, chemistry and biology and then combines that innovation with immigration policies that amass the world’s best pools of engineering talent and then unleashes that talent — propelled by risk-takers — to invent new clean technologies to slow global warming at the warp speed and scale we need.

#### It’s key to CCS – link-turns every impact.

Graciela ‘16 (/16 – Professor of Economics and of Statistics at Columbia University and Visiting Professor at Stanford University, and was the architect of the Kyoto Protocol carbon market (being interviewed by Marcus Rolle, freelance journalist specializing in environmental issues and global affairs, “Reversing Climate Change: Interview with Graciela Chichilnisky,” http://www.globalpolicyjournal.com/blog/01/09/2016/reversing-climate-change-interview-graciela-chichilnisky)//cmr

GC: Green capitalism is a new economic system that values the natural resources on which human survival depends. It fosters a harmonious relationship with our planet, its resources and the many species it harbors. It is a new type of market economics that addresses both equity and efficiency. Using carbon negative technology™ it helps reduce carbon in the atmosphere while fostering economic development in rich and developing nations, for example in the U S., EU, China and India. How does this work? In a nutshell Green Capitalism requires the creation of global limits or property rights nation by nation for the use of the atmosphere, the bodies of water and the planet’s biodiversity, and the creation of new markets to trade these rights from which new economic values and a new concept of economic progress emerges updating GDP as is now generally agreed is needed. Green Capitalism is needed now to help avert climate change and achieve the goals of the 2015 UN Paris Agreement, which are very ambitious and universally supported but have no way to be realized within the Agreement itself. The Carbon Market and its CDM play critical roles in the foundation of Green Capitalism, creating values to redefine GDP. These are needed to remain within the world’s “CO2 budget” and avoid catastrophic climate change. As I see it, the building blocks for Green Capitalism are then as follows; (1) Global limits nation by nation in the use of the planet’s atmosphere, its water bodies and biodiversity - these are global public goods. (2) New global markets to trade these limits, based on equity and efficiency. These markets are relatives of the Carbon Market and the SO2 market. The new market create new measures of economic values and update the concept of GDP. (3) Efficient use of Carbon Negative Technologies to avert catastrophic climate change by providing a smooth transition to clean energy and ensuring economic prosperity in rich and poor nations. These building blocks have immediate practical implications in reversing climate change and can assist the ambitious aims of Paris COP21 become a reality. MR: What is the greatest advantage of the new generation technologies that can capture CO2 from the air? GC: These technologies build carbon negative power plants, such as Global Thermostat, that clean the atmosphere of CO2 while producing electricity. Global Thermostat is a firm that is commercializing a technology that takes CO2 out of air and uses mostly low cost residual heat rather than electricity to drive the capture process, making the entire process of capturing CO2 from the atmosphere very inexpensive. There is enough residua heat in a coal power plant that it can be used to capture twice as much CO2 as the plant emits, thus transforming the power plant into a “carbon sink.” For example, a 400 MW coal plant that emits 1 million tons of CO2 per year can become a carbon sink absorbing a net amount of 1 million tons of CO2 instead. Carbon capture from air can be done anywhere and at any time, and so inexpensively that the CO2 can be sold for industrial or commercial uses such as plastics, food and beverages, greenhouses, bio-fertilizers, building materials and even enhanced oil recovery, all examples of large global markets and profitable opportunities. Carbon capture is powered mostly by low (85°C) residual heat that is inexpensive, and any source will do. In particular, renewable (solar) technology can power the process of carbon capture. This can help advance solar technology and make it more cost-efficient. This means more energy, more jobs, and it also means economic growth in developing nations, all of this while cleaning the CO2 in the atmosphere. Carbon negative technologies can literally transform the world economy. MR: One final question. You distinguish between long-run and short-run strategies in the effort to reverse climate change. Would carbon negative technologies be part of a short-run strategy? GC: Long-run strategies are quite different from strategies for the short-run. Often long-run strategies do not work in the short run and different policies and economic incentives are needed. In the long run the best climate change policy is to replace fossil fuel sources of energy that by themselves cause 45% of the global emissions, and to plant trees to restore if possible the natural sources and sinks of CO2. But the fossil fuel power plant infrastructure is about 87% of the power plant infrastructure and about $45-55 trillion globally. This infrastructure cannot be replaced quickly, certainly not in the short time period in which we need to take action to avert catastrophic climate change. The issue is that CO2 once emitted remains hundreds of years in the atmosphere and we have emitted so much that unless we actually remove the CO2 that is already there, we cannot remain long within the carbon budget, which is the concentration of CO2 beyond which we fear catastrophic climate change. In the short run, therefore, we face significant time pressure. The IPCC indicates in its 2014 5th Assessment Report that we must actually remove the carbon that is already in the atmosphere and do so in massive quantities, this century (p. 191 of 5th Assessment Report). This is what I called a carbon negative approach, which works for the short run. Renewable energy is the long run solution. Renewable energy is too slow for a short run resolution since replacing a $45-55 trillion power plant infrastructure with renewable plants could take decades. We need action sooner than that. For the short run we need carbon negative technologies that capture more carbon than what is emitted. Trees do that and they must be conserved to help preserve biodiversity. Biochar does that. But trees and other natural sinks are too slow for what we need today. Therefore, negative carbon is needed now as part of a blueprint for transformation. It must be part of the blueprint for Sustainable Development and its short term manifestation that I call Green Capitalism, while in the long run renewable sources of energy suffice, including Wind, Biofuels, Nuclear, Geothermal, and Hydroelectric energy. These are in limited supply and cannot replace fossil fuels. Global energy today is roughly divided as follows: 87% is fossil, namely natural gas, coal, oil; 10% is nuclear, geothermal, and hydroelectric, and less than 1% is solar power — photovoltaic and solar thermal. Nuclear fuel is scarce and nuclear technology is generally considered dangerous as tragically experienced by the Fukushima Daichi nuclear disaster in Japan, and it seems unrealistic to seek a solution in the nuclear direction. Only solar energy can be a long term solution: Less than 1% of the solar energy we receive on earth can be transformed into 10 times the fossil fuel energy used in the world today. Yet we need a short-term strategy that accelerates long run renewable energy, or we will defeat long-term goals. In the short term as the IPCC validates, we need carbon negative technology, carbon removals. The short run is the next 20 or 30 years. There is no time in this period of time to transform the entire fossil infrastructure — it costs $45-55 trillion (IEA) to replace and it is slow to build. We need to directly reduce carbon in the atmosphere now. We cannot use traditional methods to remove CO2 from smokestacks (called often Carbon Capture and Sequestration, CSS) because they are not carbon negative as is required. CSS works but does not suffice because it only captures what power plants currently emit. Any level of emissions adds to the stable and high concentration we have today and CO2 remains in the atmosphere for years. We need to remove the CO2 that is already in the atmosphere, namely air capture of CO2 also called carbon removals. The solution is to combine air capture of CO2 with storage of CO2 into stable materials such as biochar, cement, polymers, and carbon fibers that replace a number of other construction materials such as metals. The most recent BMW automobile model uses only carbon fibers rather than metals. It is also possible to combine CO2 to produce renewable gasoline, namely gasoline produced from air and water. CO2 can be separated from air and hydrogen separated from water, and their combination is a well-known industrial process to produce gasoline. Is this therefore too expensive? There are new technologies using algae that make synthetic fuel commercially feasible at competitive rates. Other policies would involve combining air capture with solar thermal electricity using the residual solar thermal heat to drive the carbon capture process. This can make a solar plant more productive and efficient so it can out-compete coal as a source of energy. In summary, the blueprint offered here is a private/public approach, based on new industrial technology and financial markets, self-funded and using profitable greenmarkets, with securities that utilize carbon credits as the “underlying” asset, based on the KP CDM, as well as new markets for biodiversity and water providing abundant clean energy to stave off impending and actual energy crisis in developing nations, fostering mutually beneficial cooperation for industrial and developing nations. The blueprint proposed provides the two sides of the coin, equity and efficiency, and can assign a critical role for women as stewards for human survival and sustainable development. My vision is a carbon negative economy that represents green capitalism in resolving the Global Climate negotiations and the North–South Divide. Carbon negative power plants and capture of CO2 from air and ensure a clean atmosphere together innovation and more jobs and exports: the more you produce and create jobs the cleaner becomes the atmosphere. In practice, Green Capitalism means economic growth that is harmonious with the Earth resources.

**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.

Staying well under 2°C will require a concerted global effort. We must address everything from our energy systems to our personal choices to reduce emissions to the greatest extent possible. We must redouble our efforts to invent, test, and perfect systems of governance so that the large measure of international cooperation needed to achieve these goals can be realized in practice. The health of people for generations to come and the health of ecosystems crucially depend on an energy revolution beginning now that will take us away from fossil fuels and toward the clean renewable energy sources of the future. It will be nearly impossible to obtain other critical social goals, including for example the UN agenda 2030 with the Sustainable Development Goals, if we do not make immediate and profound progress stabilizing climate, as we are outlining here.

1. The Building Blocks Approach The 2015 Paris Agreement, which went into effect November 2016, is a remarkable, historic achievement. For the frst time, essentially all nations have committed to limit their greenhouse gas emissions and take other actions to limit global temperature and adapt to unavoidable climate change. 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 a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century” (UNFCCC, 2015). Nevertheless, the initial Paris Agreement has to be strengthened substantially within fve years if we are to prevent catastrophic warming; **current pledges place the world on track for up to 3.4°C by 2100 (UNEP, 2016b). Until now, no specifc policy roadmap exists that provides a realistic and reasonable chance of limiting global temperatures to safe levels and preventing unmanageable climate change**. This report is our attempt to provide such a plan— an outline of specifc solutions that serve as the building blocks for a comprehensive strategy for limiting the warming to well under 2°C and avoiding dangerous climate change (Figure 1). The frst building block is the full implementation of the nationally determined mitigation pledges under the Paris Agreement of the UN Framework Convention on Climate Change (UNFCCC) and strengthening global sister agreements, such as the Kigali Amendment to the Montreal Protocol to phase down HFCs, which can provide additional targeted, fast action mitigation at scale. For the second building block, numerous sub-national and city scale climate action plans have to be scaled up such as California’s Under 2 Coalition signed by 177 jurisdictions from 37 countries on six continents. The third building block is targeted measures to reduce emissions of shortlived climate pollutants (SLCPs), beginning now and fully implemented by 2030, along with major measures to fully decarbonize the global economy, causing the overall emissions growth rate to stop in 2020-2030 and reach carbon neutrality by 2050. Such a deep decarbonization would require an energy revolution similar to the Industrial Revolution that was based on fossil fuels. The fnal building block includes scalable and reversible carbon dioxide (CO2 ) removal measures, which can begin removing CO2 already emitted into the atmosphere. Such a plan is urgently needed. Climate change is not a linear problem. Instead, climate tipping points can lead to self-reinforcing, cascading climate change impacts (Lenton et al., 2008). Tipping points are more likely with increased temperatures, and many of the potential abrupt climate shifts could happen as warming goes from 1.5°C to 2°C, with the potential to push us well beyond the Paris Agreement goals (Drijfhout et al., 2015). In order to avoid dangerous climate change, we must address these concerns. **We must act now, and we must act fast. Reduction of SLCPs will result in fast, near-term reductions in warming, while present-day reductions of CO2 will result in long-term climate benefts**. This two-lever approach—aggressively cutting both SLCPs and CO2 –-will slow warming in the coming decades when it is most crucial to avoid impacts from climate change as well as maintain a safe climate many decades from now. To achieve the nearterm goals, we have outlined solutions to be implemented immediately. These solutions to bend down the rising emissions curve and thus bend the warming trajectory curve follow a 2015 assessment by the University of California under its Carbon Neutrality Initiative (Ramanathan et al., 2016). The solutions are clustered into categories of social transformation, governance improvement, market- and regulation-based solutions, technological innovation and transformation, and natural and ecosystem management. Additionally, we need to intensely investigate and pursue a third lever—ACE (Atmospheric Carbon Extraction). While many potential technologies exist, we do not know the extent to which they could be scaled up to remove the requisite amount of carbon from the atmosphere in order to achieve the Paris Agreement goals, and any delay in mitigation will demand increasing reliance on these technologies. Yet, there is still hope. Humanity can come together, as we have done in the past, to collaborate towards a common goal. We have no choice but to tackle the challenge of climate change. We only have the choice of when and how: **either now, through the ambitious plan outlined here, or later, through radical adaptation and societal transformations in response to an ever-deteriorating climate system that will unleash devastating impacts—some of which may be beyond our capacity to fully adapt to or reverse for thousands of years.**

2. Major Climate Disruptions: How Soon and How Fast? “Without adequate mitigation and adaptation, climate change poses unacceptable risks to global public health.” (WHO, 2016)

The planet has already witnessed nearly 1°C of warming, and another 0.6°C of additional warming is currently stored in the ocean to be released over the next two to four decades, if climate warming emissions are not radically reduced during that time (IPCC, 2013). The impacts of this warming on extreme weather, droughts, and foods are being felt by society worldwide to the extent that many think of this no longer as climate change but as climate disruption. Consider the business as usual scenario:

15 years from now: In 15 years, planetary warming will reach 1.5°C above pre-industrial global mean temperature (Ramanathan and Xu, 2010; Shindell et al., 2012). This exceeds the 0.5°C to 1°C of warming during the Eemian period, 115,000– 130,000 years ago, when sea-levels reached 6-9 meters (20-30 feet) higher than today (Hansen et al., 2016b). The impacts of this warming will affect us all yet will disproportionately affect the Earth’s poorest three billion people, who are primarily subsistence farmers that still rely on 18th century technologies and have the least capacity to adapt (IPCC, 2014a; Dasgupta et al., 2015). They thus may be forced to resort to mass migration into city slums and push across international borders (U.S. DOD, 2015). The existential fate of lowlying small islands and coastal communities will also need to be addressed, as they are primarily vulnerable to sea-level rise, diminishing freshwater resources, and more intense storms. In addition, many depend on fsheries for protein, and these are likely to be affected by ocean acidifcation and climate change. Climate injustice could start causing visible regional and international conficts. All of this will be exacerbated as the risk of passing tipping points increases (Lenton et al., 2008).

30 years from now: By mid-century, warming is expected to exceed 2°C, which would be unprecedented with respect to historical records of at least the last one million years (IPCC, 2014c). Such a warming through this century could result in sea-level rise of as much as 2 meters by 2100, with greater sea-level rise to follow. A group of tipping points are clustered between 1.5°C and 2°C (Figure 2) (Drijfhout et al., 2015). The melting of most mountain glaciers, including those in the Tibetan-Himalayas, combined with mega-droughts, heat waves, storms, and foods, would adversely affect nearly everyone on the planet.

80 years from now: In 80 years, warming is expected to exceed 4°C, increasing the likelihood of irreversible and catastrophic change (World Bank, 2013b). 4ºC warming is likely to expose as much as 75% of the global population to deadly heat (Mora et al., 2017). The 2°C and 4°C values quoted above and in other reports, however, are merely the central values with a 50% probability of occurrence (Ramanathan and Feng, 2008). There is a 5% probability the warming could be as high as 6°C due to uncertainties in the magnitude of amplifying feedbacks (see Section 4). This in turn could lead to major disruptions to natural and social systems, threatening food security, water security, and national security and fundamentally affecting the great majority of the projected 11.2 billion inhabitants of the planet in 2100 (UN DESA, 2015).

3. What Are the Wild Cards for Climate Disruption? Increasing the concentrations of greenhouse gases in the atmosphere increases radiative forcing (the difference between the amount of energy entering the atmosphere and leaving) and thus increases the global temperature (IPCC, 2013). However, climate wild cards exist that can alter the linear connection with warming and anthropogenic emissions by triggering abrupt changes in the climate (Lenton et al., 2008). Some of these wild cards have not been thoroughly captured by the models that policymakers rely on the most. These abrupt shifts are irreversible on a human time scale (<100 years) and will create a notable disruption to the climate system, condemning the world to warming beyond that which we have previously projected. These climate disruptions would divert resources from needed mitigation and upset mitigation strategies that we have already put in place.

1. Unmasking Aerosol Cooling: The frst such wild card is the unmasking of an estimated 0.7°C (with an uncertainty range of 0.3°C to 1.2°C) of the warming in addition to mitigating other aerosol effects such as disrupting rainfall patterns, by reducing emissions of aerosols such as sulfates and nitrates as part of air pollution regulations (Wigley, 1991; Ramanathan and Feng, 2008). Aerosol air pollution is a major health hazard with massive costs to public health and society, including contributing to about 7 million deaths (from household and ambient exposure) each year (WHO, 2014). While some aerosols, such as black carbon and brown carbon, strongly absorb sunlight and warm the climate, others refect sunlight back into space, which cools the climate (Ramanathan and Carmichael, 2008). The net impact of all manmade aerosols is negative, meaning that about 30% of the warming from greenhouse gases is being masked by co-emitted air pollution particles (Ramanathan and Carmichael, 2008). As we reduce greenhouse gas emissions and implement policies to eliminate air pollution, we are also reducing the concentration of aerosols in the air. Aerosols last in the atmosphere for about a week, so if we eliminate air pollution without reducing emissions of the greenhouse gases, the unmasking alone would lead to an estimated 0.7°C of warming within a matter of decades (Ramanathan and Feng, 2008). We must eliminate all aerosol emissions due to their health effects, but we must simultaneously mitigate emissions of CO2 , other greenhouse gases, and black carbon and co-pollutants to avoid an abrupt and very large jump in the near-term warming beyond 2°C (Brasseur and Roeckner, 2005).

2. Tipping Points**: It is likely that as we cross the 1.5°C to 2°C thresholds we will trigger so called “tipping points” for abrupt and nonlinear changes in the climate system with catastrophic consequences** for humanity and the environment (Lenton, 2008; Drijfhout et al., 2015). Once the tipping points are passed, the resulting impacts will range in timescales from: disruption of monsoon systems (transition in a year), loss of sea ice (approximately a decade for transition), dieback of major forests (nearly half a century for transition), reorganization of ocean circulation (approximately a century for transition), to loss of ice sheets and subsequent sea-level rise (transition over hundreds of years) (Lenton et al., 2008). Regardless of timescale, once underway many of these changes would be irreversible (Lontzek et al., 2015). There is also a likelihood of crossing over multiple tipping points simultaneously. Warming of close to 3°C would subject the system to a 46% probability of crossing multiple tipping points, while warming of close to 5°C would increase the risk to 87% (Cai et al., 2016). Recent modeling work shows a “cluster” of these tipping points could be triggered between 1.5°C and 2°C warming (Figure 2), including melting of land and sea ice and changes in highlatitude ocean circulation (deep convection) (Drijfhout et al., 2015). This is consistent with existing observations and understanding that the polar regions are particularly sensitive to global warming and have several potentially imminent tipping points. The Arctic is warming nearly twice as quickly as the global average, which makes the abrupt changes in the Arctic more likely at a lower level of global warming (IPCC, 2013). Similarly, the Himalayas are warming at roughly the same rate as the Arctic and are thus also more susceptible to incremental changes in temperature (UNEP-WMO, 2011). This gives further justifcation for limiting warming to no more than 1.5°C.

While all climate tipping points have the potential to rapidly destabilize climate, social, and economic systems, some are also **self-amplifying feedbacks that once set in motion increase warming in such a way that they perpetuate yet even more warming. Declining Arctic sea ice, thawing permafrost, and the poleward migration of cloud systems are all examples of self-amplifying feedback mechanisms, where initial warming feeds upon itself to cause still more warming acting as a force multiplier (Schuur et al., 2015).**

### Debris

#### Non UQ – squo debris thumps

Orwig 16 [(Jessica, MS in science and tech journalism from Texas A&M, BS in astronomy and physics from Ohio State) “Russia says a growing problem in space could be enough to spark a war,” Insider,’ January 26, 2016, https://www.businessinsider.com/russia-says-space-junk-could-spark-war-2016-1] TDI

NASA has already warned that the large amount of space junk around our planet is growing beyond our control, but now a team of Russian scientists has cited another potentially unforeseen consequence of that debris: War.

Scientists estimate that anywhere from 500,000 to 600,000 pieces of human-made space debris between 0.4 and 4 inches in size are currently orbiting the Earth and traveling at speeds over 17,000 miles per hour.

If one of those pieces smashed into a military satellite it "may provoke political or even armed conflict between space-faring nations," Vitaly Adushkin, a researcher for the Institute of Geosphere Dynamics at the Russian Academy of Sciences, reported in a paper set to be published in the peer-reviewed journal Acta Astronautica, which is sponsored by the International Academy of Astronautics.

**Time frame – Kessler effect 200 years away**

**Stubbe 17** [(Peter, PhD in law @ Johann Wolfgang Goethe University Frankfurt) “State Accountability for Space Debris: A Legal Study of Responsibility for Polluting the Space Environment and Liability for Damage Caused by Space Debris,” Koninklijke Brill Publishing, ISBN 978-90-04-31407-8, p. 27-31] TDI

The prediction of possible scenarios of the future evolution of the debris p o p ulation involves many uncertainties. Long-term forecasting means the prediction of the evolution of the future debris environment in time periods of decades or even centuries. Predictions are based on models84 that work with certain assumptions, and altering these parameters significantly influences the outcomes of the predictions. Assumptions on the future space traffic and on the initial object environment are particularly critical to the results of modeling efforts.85 A well-known pattern for the evolution of the debris population is the so-called Kessler effect’, which assumes that there is a certain collision probability among space objects because many satellites operate in similar orbital regions. These collisions create fragments, and thus additional objects in the respective orbits, which in turn enhances the risk of further collisions. Consequently, the num ber of objects and collisions increases exponentially and eventually results in the formation of a self-sustaining debris belt aroundthe Earth. While it has long been assumed that such a process of collisional cascading is likely to occur only in a very long-term perspective (meaning a time 1 n of several hundred years),87 a consensus has evolved in recent years that an uncontrolled growth of the debris population in certain altitudes could become reality much sooner.88 In fact, a recent cooperative study undertaken by various space agencies in the scope of i a d c shows that the current l e o debris population is unstable, even if current mitigation measures are applied. The study concludes:

Even with a 90% implementation of the commonly-adopted mitigation measures [...] the l e o debris population is expected to increase by an average of 30% in the next 200 years. The population growth is primarily driven by catastrophic collisions between 700 and 1000 km altitudes and such collisions are likely to occur every 5 to 9 years.89

**Probability – 0.1% chance of a collision.**

**Salter 16** [(Alexander William, Economics Professor at Texas Tech) “SPACE DEBRIS: A LAW AND ECONOMICS ANALYSIS OF THE ORBITAL COMMONS” 19 STAN. TECH. L. REV. 221 \*numbers replaced with English words] TDI

The probability of a collision is currently low. Bradley and Wein estimate that the maximum probability in LEO of a collision over the lifetime of a spacecraft remains below one in one thousand, conditional on continued compliance with NASA’s deorbiting guidelines.3 However, the possibility of a future “snowballing” effect, whereby debris collides with other objects, further congesting orbit space, remains a significant concern.4 Levin and Carroll estimate the average immediate destruction of wealth created by a collision to be approximately $30 million, with an additional $200 million in damages to all currently existing space assets from the debris created by the initial collision.5 The expected value of destroyed wealth because of collisions, currently small because of the low probability of a collision, can quickly become significant if future collisions result in runaway debris growth.

#### Debris creates existential deterrence by raising the bar for conflict – international norms fail

Miller 7/31 [(Gregory, Chair of the Department of Space Power at the Air Command and Staff College, Ph.D. in Political Science from The Ohio State University) “Deterrence by Debris: The Downside to Cleaning up Space,” Space Policy, 7/31/2021] JL

The danger of kinetic strikes increasing orbital debris is a common theme in the literature, but the positive deterrent effects of some debris are often overlooked. The debris resulting from destroyed satellites, or other space objects, creates a deterrent effect on actors who might otherwise violate international norms and strike at objects in space, either to test their capabilities or as an act of hostilities. This is not deterrence in the traditional sense, of one actor publicly threatening punishment in response to another actor’s unwanted actions. It is not deterrence by denial since the attacker is not damaged and may even achieve its objective. Nor is it deterrence by punishment because the debris itself does not threaten to punish the attacker’s country. But debris can increase the future costs to the aggressor, even if their initial attack succeeds, and thus it has a similar restraining effect on certain behavior. Like the automated response of the U.S. tripwire in West Germany, the threat that debris can pose to state interests acts as a form of deterrence, at least to prevent some actors from taking certain types of actions. Removing the danger of debris will weaken that restraint and thus weaken deterrence, making ASAT tests and hostile actions in space more likely.

Several factors may deter a state from launching kinetic tests or striking against an adversary’s interests in space. For one thing, if a state’s adversary has similar capabilities to destroy objects in space, deterrence would be a function of not wanting to escalate tensions. Although international law only explicitly prohibits states from placing weapons of mass destruction in orbit, international space law, like the Outer Space Treaty [30], does provide a framework for addressing the activities of one state that lead to the damage of another state’s property. Likewise, there are international norms (informal but expected rules of behavior) against the weaponization of space. But these norms seem to be in decline [31], and such norms only deter a state from engaging in certain types of behavior if the state cares about following norms, if it cares about how states perceive its behavior, or if it believes other states are willing to enforce the norms. The beauty of debris as a deterrent is that it does not rely on the enforcement of norms or the credibility of states to succeed.

#### Space debris creates existential deterrence and a taboo

Bowen 18 [(Bleddyn, lecturer in International Relations at the University of Leicester) “The Art of Space Deterrence,” European Leadership Network, February 20, 2018, https://www.europeanleadershipnetwork.org/commentary/the-art-of-space-deterrence/] TDI

Fourth, the ubiquity of space infrastructure and the fragility of the space environment may create a degree of existential deterrence. As space is so useful to modern economies and military forces, a large-scale disruption of space infrastructure may be so intuitively escalatory to decision-makers that there may be a natural caution against a wholesale assault on a state’s entire space capabilities because the consequences of doing so approach the mentalities of total war, or nuclear responses if a society begins tearing itself apart because of the collapse of optimised energy grids and just-in-time supply chains. In addition, the problem of space debris and the political-legal hurdles to conducting debris clean-up operations mean that even a handful of explosive events in space can render a region of Earth orbit unusable for everyone. This could caution a country like China from excessive kinetic intercept missions because its own military and economy is increasingly reliant on outer space, but perhaps not a country like North Korea which does not rely on space. The usefulness, sensitivity, and fragility of space may have some existential deterrent effect. China’s catastrophic anti-satellite weapons test in 2007 is a valuable lesson for all on the potentially devastating effect of kinetic warfare in orbit.