# Pen R5 Neg vs Ayala AM

# 1NC

### 1

#### CP: Private entities ought to place 500 Earth Observation satellites in Geostationary Orbit every 5 years

#### Solves stationary EO – continued observation

NESDIS n.d. “Geostationary Satellites” <https://www.nesdis.noaa.gov/current-satellite-missions/currently-flying/geostationary-satellites> TG

NOAA’s most sophisticated Geostationary Operational Environmental Satellites (GOES), known as the GOES-R Series, provide advanced imagery and atmospheric measurements of Earth’s Western Hemisphere, real-time mapping of lightning activity, and improved monitoring of solar activity and space weather.

GOES satellites orbit 22,236 miles above Earth’s equator, at speeds equal to the Earth's rotation. This allows them to maintain their positions over specific geographic regions so they can provide continuous coverage of that area over time.

#### That’s the internal link in Hamill – we inserted the key lines

Lunar Basing solves Earth Observatory – specifically Super-Volcanoes and Arctic Aviation.

Hamill 16, Patrick. "Atmospheric observations from the moon: A lunar earth-observatory." 2016 Ieee International Geoscience and Remote Sensing Symposium (Igarss). IEEE, 2016. (Department of Physics and Astronomy at San Jose State University)//Elmer

There are many reasons for placing an Earth atmospheric observatory on the Moon. Perhaps the most obvious reason is that from the Moon one can observe a single location on Earth for a relatively long period of time (hours, rather than seconds for a satellite in LEO).

#### EO sats observe and solve

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

Earth observation (EO) satellites are playing an increasingly important role in assessing climate change. By providing a constant and consistent stream of data about the state of the climate, EO is not just improving scientific outcomes but can also inform climate policy.

Managing climate-related risks effectively requires accurate, robust, sustained, and wide-ranging climate information. Reliable observational climate data can help scientists test the accuracy of their models and improve the science of attributing certain events to climate change. Information based on projections from models and historic data can help decision makers plan and implement adaptation actions.

Providing information in data-sparse regions

Ground-based weather and climate monitoring systems only cover about 30% of the Earth’s surface. In many parts of the world such data is incomplete and patchy due to poorly maintained weather stations and a general lack of such facilities.

EO satellites and rapidly improving satellite technology, especially data from open access programmes, offer a valuable source information for such data-sparse regions. This is especially important since countries and regions with a lack of climate data are often particularly vulnerable to climate change impacts.

#### Their preempts form the Deng ev:

#### 1] Replacement solves longevity

#### 2] Stationary observation solves long term trands

#### 3] Large quantity of sats allow universal coverage in all conditions

## Case

#### Their 1AC claimed that the aff was key to moon dust research and moon basing couldn’t happen without that research – we’re impact turning that –

#### First, defense --

#### Their author concludes moon dust doesn’t mess with moon-based observation.

Hamill 16, Patrick. "Atmospheric observations from the moon: A lunar earth-observatory." 2016 Ieee International Geoscience and Remote Sensing Symposium (Igarss). IEEE, 2016. (Department of Physics and Astronomy at San Jose State University) SM

The lunar surface is covered in electrostatically charged fine dust particles of diameter 70 µm. This dust has sharp edges (not having been exposed to weathering) and is expected to cling to surfaces to which it is exposed. It is believed that the dust is disturbed by the changing electric field at the terminator and rises to heights of several meters [9]. This effect may have been observed by the Apollo astronauts. The dust may damage unshielded equipment [10]. Some investigators have even suggested that the presence of dust would make telescopic observations impossible, but the evidence from Chang’e 3 shows that this is not the case. (It might be mentioned that the Chang’e 3 instrumentation is protected during sunrise and sunset.) Furthermore, the retroreflectors placed on the lunar surface by NASA Astronauts and Soviet robotic rovers over forty years ago still reflect laser beams, indicating that even over long periods of time optical surfaces are not completely degraded by the lunar dust [11].

#### But dust definitely still stops moon basing.

Niiler 21 Eric Niiler “The Next Big Challenge for Lunar Astronauts? Moon Dust” 08.19.2021 <https://www.wired.com/story/the-next-big-challenge-for-lunar-astronauts-moon-dust/> SM

AS NASA AND private space companies prepare to send equipment—and eventually astronauts—back to the moon, they are facing a nearly invisible threat to any future lunar outpost: tiny particles of dust. Ground-up lunar rock, known as regolith, clogs drills and other delicate instruments, and it's so sharp that it scratches space suits. Because the dust absorbs sunlight, it can also overheat sensitive electronics.

Dust particles also pose a health risk. Even though Apollo-era astronauts only went outside during a few days on each mission, some reported burning eyes and stuffy nasal passages when they returned from moon walks and took off their dust-covered space suits inside the capsule. Images from the Apollo 17 mission, which focused on geology and featured seven-hour trips in the lunar rover, show astronaut Gene Cernan’s face covered in dust, like some outer space coal miner. During a technical briefing when he returned to Earth, Cernan told NASA officials that lunar dust was nothing to sneeze at. "I think dust is probably one of our greatest inhibitors to a nominal operation on the moon,” Cernan said. “I think we can overcome other physiological or physical or mechanical problems, except dust."

The grit clogged the radiators that removed heat and carbon dioxide from space suits and wore a hole in the knee of Cernan’s outer space suit, according to Phil Abel, who researches moon dust as manager of the Tribology and Mechanical Components Branch at NASA’s Glenn Research Center. (Tribology is the study of wear and friction.) The Apollo 17 astronauts brought dust into the capsule, where it smelled like gunpowder and caused lunar module pilot Harrison Schmitt to have hay fever symptoms, according to a report from a NASA workshop on lunar dust in 2020.

Here’s how one Apollo 12 astronaut described what happened when he returned to the lunar module after a walk on the moon: “The [module] was filthy dirty and had so much dust that when I took my helmet off, I was almost blinded. Junk immediately got into my eyes.” (The quote appears in a 2009 NASA report entitled “The Risk of Adverse Health Effects From Lunar Dust Exposure.”)

Researchers at Stony Brook University exposed human lung and brain cells to lunar dust and found that it killed 90 percent of the cells, according to a study published in the journal GeoHealth in 2018. In fact, respiratory health is a top concern if and when humans return to the moon, according to Abel. “These particles get lodged down deep in your lungs, and that’s a long-term health risk,” Abel says. “There was some concern at the time that if we had needed to do more on the moon’s surface, some of the space suits would have started to leak at too high a rate. It’s something we have been working on to improve.”

#### Not reverse causal – even if we’re aware extreme weather and warming are happening there’s no way to stop it – they haven’t read ev that we can stop super-volcanoes even if we know they’re erupting soon.

#### Hamill says that lunar observation lets us know when volcanic fumes are high enough to threaten aircraft, not predict when natural disasters occur – this ev is one line and does not grant a more generalized warrant about natural disasters

#### AI prediction methods coming now and solve.

Joshi 19 “How AI Can And Will Predict Disasters” NAVEEN JOSHI [Naveen Joshi, columnist, is Founder and CEO of Allerin, which develops engineering and technology solutions focused on optimal customer experiences. Naveen works in AI, Big Data, IoT and Blockchain.] 3/15/2019 <https://www.forbes.com/sites/cognitiveworld/2019/03/15/how-ai-can-and-will-predict-disasters/?sh=57a309075be2> SM

How AI Can And Will Predict Disasters

Recently, the regions around the Dead Sea in Jordan were flooded, causing the death of 21 children who were on a school trip, and injuring 35 more. Such disasters affect millions of people every year and cause property damage worth hundreds of billions. In 2017 alone, almost 335 natural disasters have affected more than 95.6 million people, and killed 9,697, costing around US $335 billion.

But, the impact of these phenomena can be reduced if we were able to predict their occurrence. AI-powered systems can already predict the prices of stocks, which involve the analysis of numerous variables. Likewise, researchers are applying artificial intelligence to accurately predict natural disasters. By predicting the occurrence of natural disasters, we can save thousands of lives and take appropriate measures to reduce property damage.

Using AI to predict natural disasters

Artificial intelligence has been helping us in various applications such as customer service, trading and healthcare. And now, researchers have found that AI can be used to predict natural disasters. With enormous amounts of good quality datasets, AI can predict the occurrence of numerous natural disasters, which can be the difference between life and death for thousands of people. Some of the natural disasters that can be predicted by AI are:

Earthquakes

Researchers are collecting enormous amounts of seismic data for analysis using deep learning systems. Artificial intelligence can use the seismic data to analyze the magnitude and patterns of earthquakes. Such data can prove beneficial to predict the occurrence of earthquakes. For example, Google and Harvard are developing an AI system that can predict the aftershocks of an earthquake. Scientists have studied more than 131,000 earthquakes and aftershocks to build a neural network. The researchers tested the neural network on 30,000 events, and the system predicted the aftershock locations more precisely when compared to traditional methods.

Similarly, multiple researchers are creating their own applications to predict earthquakes and aftershocks. In the future, we may be able to foresee earthquakes and authorities can start evacuation operations accordingly. Currently, Japan is using satellites to analyze images of the earth to predict natural disasters. AI-based systems look for changes in the images to predict the risk of disasters such as earthquakes and tsunamis. Moreover, these systems also monitor aging infrastructure. Artificial intelligence systems can detect deformations in structures, which can be used to reduce the damage caused by collapsing buildings and bridges, or subsiding roads.

Floods

Google is building an AI platform to predict floods in India and warn users via Google Maps and Google Search. The data for training the AI system is collected with the help of rainfall records and flood simulations. Similarly, researchers are developing AI-based systems that can learn from rainfall and climate records and tested with flood simulations, which can predict floods better than the traditional systems. Alternatively, AI can also be used to monitor urban flooding. Researchers at the University of Dundee in the United Kingdom are monitoring urban flooding by collecting crowd-sourced data with Twitter and other mobile apps. The data contains images and information about the location and situations in a locality, which is recognized by the AI. Such systems can be used to monitor and predict the damage done by floods along with other methods. Likewise, applications based on artificial intelligence and deep learning is useful for disaster management.

Volcanic eruptions

Researchers have always struggled with finding methods to effectively predict natural disasters such as volcanic eruptions. But now, scientists are training AI to recognize tiny ash particles from volcanoes. The shape of the ash particles can be used to identify the type of volcano. Such developments can help in predicting eruptions and creating volcanic hazard mitigation techniques.

IBM is developing Watson that will predict volcanic eruptions using seismic sensors and geological data. IBM is aiming to forecast the locations and the intensity of eruptions with the help of Watson. Such applications can help to prevent the loss of life in areas surrounding active volcanoes.

Hurricanes

Every year hurricanes cost property damage worth millions of dollars. Hence, meteorological departments are looking for better techniques to predict natural disasters like hurricanes and cyclones, and track their path and intensity. With more effective prediction techniques, the concerned authorities can save more lives and reduce property damage.

Recently, NASA and Development Seed tracked Hurricane Harvey using satellite images and machine learning. The method proved to be six times better than the usual techniques, as the hurricane can be tracked every hour instead of every six hours with the traditional methods. Therefore, the developments in technology are helping in monitoring hurricanes and foreseeing the path of hurricanes, which can assist in mitigation efforts.

#### Solves extreme weather predictions specifically.

NERSC 21 “Deep-learning model speeds extreme weather predictions” DECEMBER 8, 2021 National Energy Research Scientific Computing Center [National Energy Research Scientific Computing Center] <https://phys.org/news/2021-12-deep-learning-extreme-weather.html> SM

Deep-learning model speeds extreme weather predictions

A depiction of digital twin Earth adapted from the EU's Destination Earth project.

Climate change is one of the greatest challenges facing humanity today. To help address this, researchers from Lawrence Berkeley National Laboratory (Berkeley Lab), Caltech, and NVIDIA trained the Fourier Neural Operator (FNO) deep learning model—which learns complex physical systems accurately and efficiently—to emulate atmospheric dynamics and provide high-fidelity extreme weather predictions across the globe a full five days in advance.

The researchers used decades of data from ERA5, the European Center for Medium-range Weather Forecasts' high-resolution Earth dataset, to train the FNO model, which was scaled up to 128 NVIDIA A100 GPUs on Perlmutter, the new HPC system at the National Energy Research Scientific Computing Center (NERSC). The team developed a global FNO weather forecasting model at 30-km resolution, an order of magnitude greater resolution than state-of-the-art deep learning Earth emulators. The model predicts wind velocities and pressures at multiple levels in the atmosphere up to 120 hours in advance with high fidelity. In a case study on the massive 2016 hurricane Matthew, the model's predictions of the hurricane's winds and track were within the uncertainties of the NOAA National Hurricane Center's forecast cones. In addition, the model can predict the behavior of certain classes of extreme weather events across the globe days in advance in just 0.25 seconds on a single NVIDIA GPU.

Physics-informed deep learning models such as the FNO offer the potential for accurate predictions of the spatio-temporal evolution of the Earth system orders of magnitude faster than traditional numerical models. This is an ongoing effort, and the team is investigating the comparative accuracy of deep learning and traditional numerical weather models in collaboration with experts in atmospheric modeling and numerical weather prediction.

The FNO model developed through the Berkeley Lab/Caltech/NVIDIA collaboration is a significant step toward building a digital twin Earth, the researchers noted. Digital twin Earths are digital replicas of planet Earth—simulators grounded in physics, driven by AI, and constrained by real-time data. As described in the ambitious 10-year EU project Destination Earth, a digital twin Earth will give both expert and non-expert users tailored access to high-quality information, services, models, forecasts, and visualizations in the realms of climate monitoring, modeling, mitigation, and adaptation. This video shows a demonstration of digital twin Earth using the FNO model.

The FNO climate collaboration was one of several science success stories described by NVIDIA co-founder and CEO Jensen Huang during a keynote presentation at the recent GPU Technology Conference. In his talk, Huang emphasized that the combination of accelerated computing, physics, machine learning, and giant computer systems can provide "a million-x leap" to enable simulating and predicting climate change reliably and accurately.

#### Ecological tipping points are “scientific garbage” and lack data---effects are slow and localized

Brook et al. 18 — Barry W. Brook, ARC Australian Laureate Professor and Chair of Environmental Sustainability at the University of Tasmania in the Faculty of Science, Engineering & Technology, Erle C. Ellis, Ph.D., Cornell University, 1990 Professor, Geography & Environmental Systems University of Maryland, and Jessie C. Buettel, “What Is the Evidence for Planetary Tipping Points?” In Effective Conservation Science: Data Not Dogma, Chapter 8, Oxford University Press (2018). http://ecotope.org/people/ellis/papers/brook\_2018.pdf

\*The Nine Planetary Boundaries Brook Et Al. Refer Too Are, “Land-Use Change, Rate of Biodiversity Loss, Phosphorus Cycle, Global Freshwater Use, Ocean Acidification, Climate Change, Stratospheric Ozone Depletion, Atmospheric Aerosol Loading, Chemical Pollution, Terrestrial Net Primary Production, and Biodiversity Intactness”

As living standards, technological capacities,

and human welfare have continued to improve, concerns have mounted about possible natural limits to economic and population growth. Climate change, habitat loss, and recent extinctions are examples of impacts on natural systems that have been used as markers of global environmental degradation associated with the expanding influence of humans (Barnosky et al., 2012; McGill et al., 2015). Past civilizations have faced rapid declines and even collapsed in the face of regional environmental degradation, drought, and other environmental challenges (Scheffer, 2016; Butzer and Endfield, 2012). This begs the question of whether long-term societal relationships with the planet’s ecology may be approaching a global tipping point as the human population hurtles toward ten billion people. If this is indeed the case, the future of both biodiversity and humanity hangs in the balance. The hypothesis is that without urgent action to prevent reaching a global tipping point, the natural life support systems that sustain humanity may fail abruptly, with drastic consequences. 8.1 Regional tipping points yes— but what about global tipping points? There is strong evidence for rapid global shifts in the biosphere in the distant past, sometimes taking the form of mass extinction events, which have been linked to biophysical tipping points (Hughes et al., 2013). Tipping points occur when components of a system respond gradually to an external forcing to a point at which the response becomes nonlinear and abrupt. This response is often amplified through positive feedback interactions that induce an eventual state (or regime) shift (Lenton, 2013). Tipping points are well documented in studies of local ecosystems, such as lakes, that undergo regime shifts driven by alterations of energy or nutrient flows when thresholds are crossed and hysteresis prevails (Scheffer et al., 2015). Various tipping elements, some definite and others speculative, have also been noted in the Earth’s climate system (Lenton et al., 2008). Given this context, it would seem logical and indeed intuitive to conclude that the Earth system is susceptible and sensitive to planetary regime shifts caused by human alteration of Earth’s ecology. James Lovelock’s original Earth-system conception of “Gaia,” for instance, focused on interconnections and positive feedbacks between the geosphere and the biosphere, which act to promote stability and resilience (Lovelock and Margulis, 1974). But within this same framework, a temporary global forcing event, invoking disconnections and positive feedbacks, could lead to a rapid transition to an alternative stable state, as has been observed in many local systems (Kefi et al., 2016). This conceptual model invites the question of whether identifiable “boundaries” exist within the interacting components of the Earth system. If they do—and they are transgressed—then the planetary biosphere might be dramatically and permanently altered (Brook et al., 2013). 8.2 Planetary boundaries as a seductive policy framework The planetary boundaries concept, coined less than a decade ago (Rockström et al., 2009), represents the idea that contemporary societies have potentially transgressed the historical “natural” conditions— the “safe operating space”—under which human societies have historically thrived. However, to mark the boundaries of a planetary safe “reference state,” defined baselines are required. One possibility that has been suggested is the climatic conditions that marked the last 10 000 years of our current warm interglacial period, the Holocene, in which agricultural and urban societies first arose, should be used as a safe space (Steffen et al., 2015). Other safe spaces (or conversely boundaries) might be similarly recognized. In total, nine planetary boundaries have been hypothesized in association with Earth-system processes that, if sufficiently distorted, might potentially cause harmful changes in Earth’s functioning as a wholistic system (Table 8.1). This perspective has led some to postulate the potential breaching of critical thresholds, pushing the Earth out of the Holocene and consequently inducing a shift in the stability of the system (Barnosky et al., 2012). To quote: “Crossing these boundaries could generate abrupt or irreversible environmental changes.” (stockholmresilience.org/ research/planetary-boundaries.html). A hope often expressed is that flagging the crossing of these boundaries as a significant risk will provoke decision makers and the public into taking actions to mitigate harmful global changes (McAlpine et al., 2015). Such a framework, of global tipping points counterbalanced by secure safe spaces within planetary boundaries, is conceptually elegant and politically seductive. Notably, this implies two possible conditions—a state in which environmental change is without risk, and another in which risk is clear and action necessary. Such a framework is both constraining and liberating, and clearly defines a safe zone in which human societies may go about their activities without risk. As a consequence, if such clear knowledge on the risks of altering global environmental processes existed, a defined set of boundaries could be extremely useful to decision makers. But is there evidence of global tipping-point dynamics with safe space and global risk clearly demarcated? 8.3 The search for mechanisms and evidence in support of the nine planetary boundaries Since its original publication, the planetary boundaries framework, including the related concepts of a “safe operating space” and global regime shifts, have become increasingly prevalent in scientific and policy discussions concerned with global change (Corlett, 2015). This work has been heavily cited, updated, and actively promoted as a policy tool. But there has also been a counter-vailing critique that challenges the universality, utility, and even the underlying validity of the planetary boundaries framework (Brook and Blomqvist, 2016; Lenton and Williams, 2013). The underlying bases for this debate stem from disagreements over technical and scientific issues, including questions of scale, scientific underpinning, deterministic “boundary setting,” and the generality of mechanisms proposed. Most of the nine processes and systems listed in Table 8.1 lack theoretical mechanisms or evidence for a causal connection from local perturbations to global “boundary crossing” (Brook et al., 2013). The exceptions are the atmospheric and oceanic systems, which seem to most closely fit the characteristics required for a globally “scaled-up” version of the coupled, non-linear dynamics that have been shown to undergo phase shifts. But for others, like global land use or worldwide biodiversity, it is difficult to conceive how aggregated local-to-regional measures are representative of a coherent planetary system that is prone to tipping (Mace et al., 2014). Moreover, anthropogenic pressures vary geographically, and the system responses to stressors can be highly heterogeneous (Reyer et al., 2015). While global tipping points have been hypothesized, their exact “position” has not been determined. If the boundaries did exist at a global level, there is a good chance they could not be known until well after the regime shift or boundary crossing had occurred. This is because of our lack of our understanding of complex systems and the wild fluctuations in state variables that have occurred historically and continue to occur, without any evidence of an irreversible global collapse. Finally, implementing policies that avoid crossing planetary boundaries is a “global commons” problem, and everything we know from climate action indicates that it is difficult to generate agreements that address such risk when there is uncertainty about thresholds (Barrett and Dannenberg, 2012). 8.4 The problem with going from local process to a global tipping point For at least six of the nine proposed boundaries, the operational scales of these “Earth system processes” are local or regional (Table 8.1), yet the proposed boundaries represent global aggregations (the sum of many component sub-systems). The value assigned to any particular boundary is, in virtually all cases, speculative and represents an arbitrary point along a continuum of possible values, as opposed to a phase shift due to global non-linear dynamics. The most plausible threshold is for ocean acidification, because it is directly related to the calcite and aragonite compensation depth (i.e., something that is inherently quantifiable). The others are purely supported by a statement to the effect that “this stress or change from the baseline is deemed excessive.” This lack of scientific underpinning for these boundaries raises significant questions on the biological and physical relevance of such thresholds for the Earth system. What is currently needed are explicit efforts to link long-term monitoring to the choice of these boundary values (Robert et al., 2013). Unquestioning acceptance of these boundaries that in turn guide subsequent global assessment (as in Newbold et al., 2016) will only inhibit our understanding of human impacts. In addition to masking finer-grained detail, globally averaged or aggregated metrics are also often difficult to link to directed action. For instance, the recent Paris Agreement to limit average global temperature rise to less than 2 °C above pre-industrial levels was ultimately re-framed as a plethora of national goals or aspirations based on carbon-emissions intensity (Rogelj et al., 2016). This is partly because a “global temperature,” averaged across all the Earth system, is not a real physical phenomenon or quantity observed in any place. As such, it cannot be used to guide or monitor local system states. What can be monitored and altered are the trajectories of the underlying drivers of system changes (e.g., carbon emissions intensity, in the climate case), and these therefore ought to be the domain of targets. Even if one can identify and measure a global environmental attribute, it does not automatically follow that it is associated with a real-world threshold that, when crossed, leads to irreversible change. Asserting “safe” global limits on indicators like land-use change (the boundary of a maximum of 15% of land given over to cultivation, see Table 8.1) or decline in the local species abundance of originally present species (e.g., “10% loss relative to undisturbed habitat” as is the case in Newbold et al., 2016) is totally arbitrary. Such thinking ignores inherent complexity and promotes a “one size fits all” mode of thinking for conservation management that elides the very real need for locally appropriate solutions. Trying to avoid crossing a global land-use or biodiversity boundary might also lead to perverse outcomes locally, such as if restoring a “safe level” of biodiversity intactness in the world’s most fertile and productive regions (where most food originates) triggers undesirable trade-offs such as the displacement of farming to marginal regions that require more land, greater inputs, and hardship. In the context of food production, Running (2012) recently argued that at most an additional 10% of harvestable annual net global primary production (NPP) of terrestrial plants could be co-opted for future human use without crossing out of the planetary safe space. The implications of this assertion are draconian. Global NPP has been essentially steady, even with the massive agricultural expansion that has occurred over the last century. Thus, because the allocation of NPP is essentially a zerosum activity, asserting that humans can only get at most an additional 10% of that NPP implies future shortages of food, fiber, fodder, and fuel for people (Erb et al., 2012; Lewis, 2012). Policy based on this boundary would be fraught with human suffering, while the boundary itself has little mechanistic support or clear evidence of existence. In a similar vein, seeking to achieve uniform limits on practices such as nitrogen or phosphorus fertilizer use would inevitably lead to winners and losers at local scales (de Vries et al., 2013), because of differences in soil fertility and the legacies of historical farming practices (Erb et al., 2012; Carpenter and Bennett, 2011). For instance, while nitrogen fertilizer has been over-used in many developed countries, increases are urgently needed in sub-Saharan Africa to close the yield gap (Mueller et al., 2014). Given the consistent need for regionally appropriate limits, what practical use is a globally defined boundary? 8.5 Finding the research questions in an arena that is rife with competing visions of desirable futures Planetary boundaries are typically based on biogeochemical and ecological principles. Their frame is simple: if we pass threshold “X,” then the following ecological degradation or regime shift will occur. What this framing neglects is that there are inevitable trade-offs between human development goals and environmental protection/risk. Policy based on any assumed boundary will substantially impact development options. For the most part, truly natural areas are not the main “life support systems” for humanity; instead, people rely on those ecosystems that have been modified or engineered (Ellis et al., 2013). If it comes down to a choice between improved human development and the potential risk of transgressing an uncertain (and data poor) planetary boundary, it may be that society is willing to accept that risk. Science has a vital role in guiding environmental management. Ultimately, however, science must intersect with human decisions: physical laws are not negotiable, but our response to them is (Larsen et al., 2015). Global change is not a societal construct, so we must avoid the temptation to couch scientific models as policy directives. Value judgements do (and must) play a key role in determining how people respond to global environmental challenges and the possibility of inflexible planetary boundaries. What has become starkly apparent from the debate on planetary tipping points and possible global regime changes is the need for a concerted research agenda aimed at the potential links between biophysical and social systems to determine possible boundary “positions.” This research could come in the form of: (1) empirical examinations of regime shifts (or not) under gradual degradation; (2) models that explicitly link ecosystem changes and hypothesized boundaries to specific upheavals; and (3) explorations of how the framing of a boundary influences decision makers. For instance, our approach to Earth-system simulations is sophisticated for climatic components but lacks the resolution and mechanisms needed to test ideas on the planetary interconnectedness of nutrient and energy flows, or feedbacks across global biomes (Harfoot et al., 2014). The Madingley model of ecosystem dynamics (https://madingley.github. io/about) offers one promising example of an innovative attempt in this direction, because its design goals are to explicitly capture the scaling of processes that affect biodiversity from local to global scales (Purves et al., 2013). We can also seek a better understanding of the mechanistic underpinnings of the drivers of changes in global systems, such as land-use change and agricultural intensification. This could generate empirically based “bottomup” forecasts of trajectories, which, when linked to multi-ecosystem models, should improve our forecasts of the risks of planetary state shifts (Brook and Blomqvist, 2016). One of the appeals of planetary boundaries is the hypothesis that it resonates as a narrative for environmental action. The question is: how do decision-makers respond to these boundary arguments? Some research suggests that thresholds inhibit collective actions against tragedies of the commons (Barrett and Dannenberg, 2012). This is a field ripe for theoretical and empirical study. We also need to ask the hard questions about whether conceptual models like planetary boundaries the most effective strategy and engagement tool for conservation and mitigation are. The difficulty in getting international agreement on climate targets (e.g., the 2 °C “guardrail”) is an obvious case in point (Symons and Karlsson, 2015). Perhaps focusing on planetary opportunities: leverage points for guiding global change in better directions (e.g., carbon-neutral energy systems) is potentially a more effective focus of scientific attention (DeFries et al., 2012). By focusing on something to be averted as opposed to an outcome to be achieved, we risk breeding complacency on one side of a boundary, and hopelessness on the other. To summarize the above: the biosphere, and much of the geosphere, responds to external pressures in many and varied ways. The global human enterprise is driving large-scale changes in most components of the Earth system, but in a haphazard fashion, with responses often being weakly connected or transmitted slowly at a cross-continental scale. What we observe, for the global processes compiled in Table 8.1, is largely just the sum of all those changes. Acknowledging this reality should not be taken as diminishing the seriousness of these impacts or denying that major changes are occurring to the biosphere, atmosphere, and hydrosphere due to human activity. But it does make it implausible that the planet, or indeed most of its component systems, are primed to tip irreversibly to a radically different state that is inhospitable. Although the goal of sustainable stewardship of our planet is a laudable and an achievable one, the mechanisms and opportunities to conserve biodiversity and ecosystems lie mostly in targeted, localized actions (Jonas et al., 2014).

#### Second, offense --

#### 1] Moon basing causes US-China war due to competing property claims

Copp 21 If China and the US Claim the Same Moon-Base Site, Who Wins? TARA COPP [SENIOR PENTAGON REPORTER, DEFENSE ONE] AUGUST 8, 2021 <https://www.defenseone.com/technology/2021/08/if-china-and-us-claim-same-moon-base-site-who-wins/184352/> SM

If China and the US Claim the Same Moon-Base Site, Who Wins?

Relatively few craters are attractive, and there’s no consensus about avoiding conflict over them.

There’s a not-so-quiet race back to the moon underway, but the two largest factions, with China and Russia on one side, and the United States and its partners on the other, are not recognizing each others’ proposed rules on what’s allowed once they get there.

Lawmakers and space policy analysts are concerned: How do you avoid conflict in space if the international laws and policies on Earth no longer apply?

“Many terrestrial military doctrines are not applicable in space, or at least not as applicable. If you get beyond 50 miles, or at least 62 miles, suddenly different rules apply. We need to start being aware of that,” says Rep. Jim Cooper, D-Tenn.

There’s already some aggressive international elbowing over the rules of satellite operations. As with the moon, there’s no consensus yet on how to respond to aggression in Earth orbit, the head of U.S. Space Command Gen. James Dickinson told attendees at last week’s Sea Air Space conference.

“The behavior of some of our adversaries in space may surprise you,” Dickinson said. “If similar actions have been taken in other domains, they'd likely be considered provocative, aggressive, or maybe even irresponsible. And in response, the U.S. government would take corresponding actions using all levers of national power, a demarche, or a sanction or something to indicate we won't tolerate that type of behavior, but we're not quite there yet in space policy.”

In 1967, the U.N. General Assembly adopted a treaty on the use of outer space that promised cooperation and banned nuclear weapons, military maneuvers, and military installations off-planet. The agreement also requires countries to take “appropriate international consultations” before making any moves that would “cause potentially harmful interference” with other space programs, and allows countries to “request consultation” if they believe such interference is likely.

This treaty “forecasted very well” the issues that that might arise as space exploration expanded, said James Lake, a senior associate at Canyon Consulting who co-wrote an article on lunar security issues in this month’s Space Force Journal. “The question remains: is that text sufficient? That’s something we are going to find out fairly soon.”

Notably, a treaty annex that prohibits military activity on the moon went unratified by Russia, China, and the United States. It’s likely both the China-Russia and U.S.-led partnerships will begin their moon bases without any sort of agreement between them in place.

In June, the China National Space Agency and Russia’s Roscosmos announced they would begin surveying locations for their International Lunar Research Station this year, and pick a site by 2025.

In 2020, NASA, together with the nations partnering with the U.S. under the Artemis Accords, outlined its Artemis Base Camp project. The Artemis nations aim to to send astronauts back to the moon by 2024.

In addition to those two major alliances, private firms such as Blue Origin are also working on private moon bases.

But there may be only a few locations on the moon where it would make economic sense to build a base, said Bleddyn Bowen, a professor at the University of Leicester and author of War in Space: Strategy, Spacepower, Geopolitics.

“Water ice, for example, might be in limited pockets, for example, making the territories around certain craters on the polar regions, perhaps more desirable,” Bowen said.

So what happens if each decides on the same crater as the best spot to begin moon operations?

“If you have a situation like that, where you're trying to do something in the exact same spot, it’s essentially who gets there first,” said Alex Gilbert, a researcher and space resources doctoral student at the Payne Institute at the Colorado School of Mines. “And if you're not first, then the only alternative is to forcibly remove the current occupant.”

The Artemis nations have endorsed the idea of “safety zones” on the moon, to require communication between two space operations that want to operate in the same area.

“Even if you set up a base and you declare a safety zone, people can still go into that safety zone. It's just something that it's really to be used as a tool to get parties to talk to each other,” he said.

But there’s already a risk those zones will instead be used as a way to rope off sites from competitors, he said.

“One thing that is really kind of important to understand about safety zones is that everyone kind of has their own definition,” Gilbert said.

“Whoever gets there first can use the resources, but no nation can ‘claim’ the territory,” said Laura Duffy, a space systems engineer with Canyon Consulting who co-wrote “Cislunar Spacepower, The New Frontier,” with Lake with Lake in this month’s Space Force Journal.

It’s not just water, but rare earth metals and helium-3 that will be up for grabs on the moon, making a treaty for its peaceful use critical, Duffy said.

“The Moon must be available for open and free use, according to the Artemis Accords and Outer Space Treaty,” she said.

But neither Russia nor China are expected to join the Artemis Accords.

Until now, U.S. space defense has largely concentrated around the objects orbiting Earth. That changed this year, when the U.S. Space Force and U.S. Space Command were tasked with protecting U.S. assets up to 272,000 miles away, a volume called “cislunar space” that extends slightly beyond the Moon’s orbit.

They have some catching up to do, said Rep. Frank Lucas, R-Okla., the ranking member of the Science, Space and Technology Committee. Lucas believes the 2019 landing of China’s Chang'e-4 spacecraft on the far side of the moon should have been this generation’s Sputnik moment.

“But with all of the chaos in the world, and COVID-19, and all of this environment we're working in, we missed it,” he said.

Those far-side moon operations meant China had developed the technology to operate and communicate with its landed rover out of line of sight—and out of view of almost all of the U.S. ability to see what they’re doing.

The achievement allows China “to accomplish scientific, military, or other endeavors without observation or repercussion,” Duffy and Lake wrote. The authors urged that the U.S. needs to speed its monitoring efforts, such as the Cislunar Highway Patrol System, or CHPS, that is being developed by the Air Force Research Laboratory.

#### US-China war goes nuclear

Talmadge 18, Caitlin [**PoliSci PhD from MIT**, Government BA from Harvard, Prof of Security Studies at Georgetown’s Walsh School of Foreign Service.] “Beijing’s Nuclear Option.” Foreign Affairs. October 15, 2018. <https://www.foreignaffairs.com/articles/china/2018-10-15/beijings-nuclear-option> TG

As China’s power has grown in recent years, so, too, has the risk of war with the United States. Under President Xi Jinping, China has increased its political and economic pressure on Taiwan and built military installations on coral reefs in the South China Sea, fueling Washington’s fears that Chinese expansionism will threaten U.S. allies and influence in the region. U.S. destroyers have transited the Taiwan Strait, to loud protests from Beijing. American policymakers have wondered aloud whether they should send an aircraft carrier through the strait as well. Chinese fighter jets have intercepted U.S. aircraft in the skies above the South China Sea. Meanwhile, U.S. President Donald Trump has brought long-simmering economic disputes to a rolling boil.

A war between the two countries remains unlikely, but the prospect of a military confrontation—resulting, for example, from a Chinese campaign against Taiwan—no longer seems as implausible as it once did. And the odds of such a confrontation going nuclear are higher than most policymakers and analysts think.

Members of China’s strategic com­munity tend to dismiss such concerns. Likewise, U.S. studies of a potential war with China often exclude nuclear weapons from the analysis entirely, treating them as basically irrelevant to the course of a conflict. Asked about the issue in 2015, Dennis Blair, the former commander of U.S. forces in the Indo-Pacific, estimated the likelihood of a U.S.-Chinese nuclear crisis as “somewhere between nil and zero.”

This assurance is misguided. If deployed against China, the Pentagon’s preferred style of conventional warfare would be a potential recipe for nuclear escalation. Since the end of the Cold War, the United States’ signature approach to war has been simple: punch deep into enemy territory in order to rapidly knock out the opponent’s key military assets at minimal cost. But the Pentagon developed this formula in wars against Afghanistan, Iraq, Libya, and Serbia, none of which was a nuclear power.

China, by contrast, not only has nuclear weapons; it has also intermingled them with its conventional military forces, making it difficult to attack one without attacking the other. This means that a major U.S. military campaign targeting China’s conventional forces would likely also threaten its nuclear arsenal. Faced with such a threat, Chinese leaders could decide to use their nuclear weapons while they were still able to.

As U.S. and Chinese leaders navigate a relationship fraught with mutual suspicion, they must come to grips with the fact that a conventional war could skid into a nuclear confrontation. Although this risk is not high in absolute terms, its consequences for the region and the world would be devastating. As long as the United States and China continue to pursue their current grand strategies, the risk is likely to endure. This means that leaders on both sides should dispense with the illusion that they can easily fight a limited war. They should focus instead on managing or resolving the political, economic, and military tensions that might lead to a conflict in the first place.

#### 2] Independently causes space militarization

O’Donnell 19 “The Political Realities behind Establishing a Moon Base” Wes O’Donnell [Managing Editor, Edge] 2/26/2019 <https://amuedge.com/the-political-realities-behind-establishing-a-moon-base/> SM

International Conflicts May Expand to Space

No nation has placed weapons in orbit, but some advanced military nations have become dependent on space-based systems for everything from weapons targeting and navigation to intelligence collection. As nations look to establish a semi-permanent presence on the moon, conflict will become inevitable with the lunar surface having a role in how events on Earth play out. In much the same way as the Wright brothers’ plane evolved into a strategic bomber, earthly conflict will expand to spacecraft and a manned presence on the moon.

It seems far-fetched to think in these terms, but mankind has proven adept at turning many scientific achievements into weapons of war. For example, during the past 30 years, Internet access has become nearly omnipresent. But the Internet also serves as a venue for disinformation campaigns and cyberattacks.

It’s also relevant to point out that the systems that maintain human life in space would work equally well for soldiers. All of these advancements to further scientific research and maintain life aboard the International Space Station can easily be adapted to military purposes. It’s now just a matter of funding to build military space systems based on established technology.

In 1959, the U.S. Army conducted a study called Project Horizon that considered establishing a moon base with construction occurring throughout the 1960s. The formal establishment of NASA in February 1958 shelved the project. However, the study demonstrated the military’s long-held desire for a permanent space presence.

Repairing and Protecting Technological Assets in Space

With space-based systems now ubiquitous, there is a need for platforms in space to protect technological assets and repair them when necessary. That will mean having humans in space to manage these systems.

The U.S., China and Russia have the capability to shoot down satellites. Replacing these satellites would require rocket launches with replacement equipment on board.

With space-based systems, however, those assets could be repaired or replaced faster from orbiting stock or from a lunar base. From a U.S. perspective, this would save time and money. Also, it would lessen the potential impact of losing launch centers at Vandenberg AFB and Cape Canaveral in an international conflict involving missile attacks.

Militarization of the Moon

It is certainly a possibility that the moon will be militarized in some fashion. China’s questioning the limits of national sovereignty in space puts in doubt Beijing’s adherence to the 1967 Outer Space Treaty.

That treaty defines the moon as the “province of all mankind” and reserves it for peaceful purposes. But the speed with which contemporary leaders have forsaken international treaties could throw this status into doubt.

Some Chinese legal scholars, for instance, claim that the space above China, at least that which is in geosynchronous orbit, is sovereign Chinese territory. Clearly, by including anything within that geosynchronous orbit, these scholars are referring to the moon in much the same way that China makes claims to nearby territorial waters.

Currently, there is no treaty that delineates the vertical extent of a nation’s sovereignty into space. However, the Chinese claim suggests that Beijing might ignore existing international norms if they conflict with China’s interests.

The Unspoken Moon Race

The first manned mission to the moon was for the benefit “of all mankind.” Today’s extension of military affairs into space suggests that the once-peaceful endeavor of a lunar landing will eventually take on a combat dimension.

Scientific breakthroughs are currently taking the headlines and attention away from the pressing matter of preventing space-based military moves. The U.S., Russia and China have lunar missions planned into the 2030s. Whether those missions will actually take place largely depends on political will and national budgets.

A conventional conflict involving the U.S., Russia or China would be an impetus for the expansion of space-based military assets. That would make the current ventures to the moon ever more pressing during peacetime.

In essence, the current race to the moon certainly appears peaceful. But the potential to use the lunar body for war is certainly not lost on political or military leaders.

#### Unknown legal thresholds make inadvertent space escalation highly likely

MacDonald ’18 – senior director of the Nonproliferation and Arms Control Project with the Center for Conflict Analysis and Prevention, Adjunct Lecturer at Johns Hopkins School of Advanced International Studies. Bruce MacDonald, “Chapter 2. Space and Escalation” in *Outer Space; Earthly Escalation? Chinese Perspectives on Space Operations and Escalation*, A Strategic Multilayer Assessment (SMA) Periodic Publication, August 2018, <https://nsiteam.com/social/wp-content/uploads/2018/08/SMA-White-Paper_Chinese-Persepectives-on-Space_-Aug-2018.pdf>

Another dimension of the problem is the issue of the scale of the attack, both qualitatively and quantitatively. While jamming one or two satellites in isolation appears unlikely to quickly escalate into all-out space war (given the longstanding role of electronic warfare in past conflicts), attacking multiple intelligence-gathering satellites would carry a far higher risk of escalation. Somewhere between these two extremes, however, is an uncertain and unknowable boundary that divides offensive space actions that modestly threaten stability from those that are clearly destabilizing and escalatory. In this unpredictable environment, a country with no desire to spark an all-out space war may still prompt rapid escalation with modest offensive actions that inadvertently cross an unknown threshold. In addition, for technological, commercial, and other reasons the space and cyber domains are evolving far more rapidly than the conventional and nuclear domains, potentially rendering space and cyber strategies ineffective or irrelevant within a few years. In both space and cyberspace, we may learn firsthand how much escalation is too much only after it is too late to stop. Evolving space dynamics could undermine whatever current understanding we may have of crisis and strategic stability in space, and this imperfect grasp of general principles can only add to our uncertainty about the space and cyber offensive capabilities of particular adversaries. Therefore, uncertainty, bluffs, and worst-case thinking are bound to remain prominent forces in the strategic landscape of space. For example, rendezvous and proximity operations on satellites will become more common in the years to come, but they could easily be viewed in a crisis as potentially hostile acts—or in fact be used to commit hostile acts.

#### 3] Lunar basing causes collisions and space junk – independently turns the aff.

Mann 13 “Space: The Final Frontier of Environmental Disasters?” Adam Mann 7/15/2013 <https://www.wired.com/2013/07/space-environmentalism/> SM

Commercial or scientific bases on the lunar surface will need satellites for communication and navigation. Because of the moon’s size and mass, there aren’t stable orbits that hover above a certain spot analogous to the geostationary orbits around Earth. In order to provide a continuous link or GPS-like triangulation, there will need to be a constellation of satellites around the moon. Multiple satellites with multiple operators increase the chance of collision.

Unlike our planet, the moon lacks an atmosphere and it isn’t covered in oceans. This means that nothing can burn up and there’s no good way to dispose of dead satellites. The atmospheric friction that naturally drags down objects around Earth doesn't exist around the moon. And anything that is commanded to fall down to the lunar surface will remain intact until it impacts the ground, potentially hitting an astronaut or Apollo-era artifact. Mars, with its very thin atmosphere, could have similar problems with orbital debris. If nothing is done, space junk might be exported beyond low-Earth orbit, potentially endangering our exploration of other worlds.

#### Collisions cause miscalc and go nuclear.

Blatt 20 [Talia, joint concentration in Social Studies and Integrative Biology at Harvard, specialization in East Asian geopolitics and security issues] “Anti-Satellite Weapons and the Emerging Space Arms Race,” Harvard International Review, May 26, 2020, <https://hir.harvard.edu/anti-satellite-weapons-and-the-emerging-space-arms-race/> TG

Despite their deterrent functions, ASATs are more likely to provoke or exacerbate conflicts than dampen them, especially given the risk they [pose](https://thebulletin.org/2019/06/arms-control-in-outer-space-the-russian-angle-and-a-possible-way-forward/) to early warning satellites. These satellites are a crucial element of US ballistic missile defense, capable of [detecting missiles](https://www.globalsecurity.org/space/world/japan/warning.htm) immediately after launch and tracking their paths.

Suppose a US early warning satellite goes dark, or is shut down. Going dark could signal a glitch, but in a world in which other countries have ASATs, it could also signal the beginning of an attack. Without early warning satellites, the United States is much more susceptible to nuclear missiles. Given the strategy of counterforcing—[targeting](https://www.belfercenter.org/sites/default/files/files/publication/isec_a_00273_LieberPress.pdf) nuclear silos rather than populous cities to prevent a nuclear counterattack—the Americans might believe their nuclear weapons are imminently at risk. It could be [twelve hours](https://books.google.com/books?id=ET8lDwAAQBAJ&pg=PA1&lpg=PA1&dq=%22Protecting+Space+Assets%22+johnson-freese&source=bl&ots=6Oq0IdeBjw&sig=ACfU3U1G6Hj8QdP4JlCRNxA6i5XplZwHyg&hl=en&sa=X&ved=2ahUKEwj1n-jT2YzpAhUugnIEHUuMCu4Q6AEwA3oECAkQAQ#v=onepage&q=%22Protecting%20Space%20Assets%22%20johnson-freese&f=false) before the United States regains satellite function, which is too long to wait to put together a nuclear counterattack. The United States, therefore, might move to mobilize a nuclear attack against Russia or China over what might just be a piece of debris shutting off a satellite.

Additionally, accidental warfare, or strategic miscalculation, is uniquely likely in space. It is [much easier](https://books.google.com/books?id=VyXTDwAAQBAJ&pg=PA339&lpg=PA339&dq=space+offense+dominant&source=bl&ots=Mw0bgJ51qf&sig=ACfU3U3DeZiEHpr9nfszlCbJZIoyyssIpg&hl=en&sa=X&ved=2ahUKEwjrs-WD3IzpAhVulHIEHbL0AE4Q6AEwCXoECAoQAQ#v=onepage&q=space%20offense%20dominant&f=false) to hold an adversary’s space systems in jeopardy with destructive ASATs than it is to [sustainably defend](https://www.cnas.org/publications/commentary/the-us-military-should-not-be-doubling-down-on-space) a system, which is expensive and in some cases not technologically feasible because of limitations on satellite movement. Space is therefore [considered](https://books.google.com/books?id=VyXTDwAAQBAJ&pg=PA339&lpg=PA339&dq=space+offense+dominant&source=bl&ots=Mw0bgJ51qf&sig=ACfU3U3DeZiEHpr9nfszlCbJZIoyyssIpg&hl=en&sa=X&ved=2ahUKEwjrs-WD3IzpAhVulHIEHbL0AE4Q6AEwCXoECAoQAQ#v=onepage&q=space%20offense%20dominant&f=false) offense-dominant; offensive tactics like weapons development are prioritized over defensive measures, such as [improving GPS](https://www.politico.com/story/2018/04/06/outer-space-war-defense-russia-china-463067) or making satellites more resistant to jamming.

As a result, countries are left with poorly defended space systems and rely on offensive posturing, which increases the risk that their actions are perceived as aggressive and incentivizes rapid, risky counterattacks because militaries cannot rely on their spaced-based systems after first strikes.

There are several hotspots in which ASATs and offensive-dominant systems are particularly relevant. Early warning satellites [play](https://www.politico.com/story/2018/04/06/outer-space-war-defense-russia-china-463067) a central role in US readiness in the event of a conflict involving North Korea. News of North Korean missile launches comes from these satellites. Given North Korea’s [history](https://www.bbc.com/news/world-asia-pacific-11813699) of nuclear provocations, unflinchingly hostile rhetoric towards the United States and South Korea, and diplomatic opacity, North Korea is always a threatening, unknowable adversary, but recent developments have magnified the risk. With the health of Kim Jong-un [potentially in jeopardy](https://apnews.com/f5d302ae65b03838173e40848223b771), a succession battle or even civil war on the peninsula [raises the chances](https://www.express.co.uk/news/world/1273890/Kim-Jong-un-dead-North-Korea-nuclear-weapon-news-latest-death-US) of loose nukes. If the regime is terminal, traditional MAD risk calculus will become moot; with nothing to lose, North Korea would have no reason to hold back its nuclear arsenal. Or China [might decide](https://foreignpolicy.com/2020/04/28/kim-jong-un-china-north-korea/) to seize military assets and infrastructure of the regime. If the US does not have its early warning satellites because they have been taken out in an ASAT attack, the US, South Korea, and Japan are all in imminent nuclear peril, while China could be in a position to fundamentally reshape East Asian geopolitics.

The South China Sea is another hotspot in which ASATs could risk escalation. China [is developing](https://missiledefenseadvocacy.org/missile-threat-and-proliferation/todays-missile-threat/china-anti-access-area-denial-coming-soon/) Anti-Access Area Denial (A2/AD) in the South China Sea, a combination of long range radar with air and maritime defense meant to deny US freedom of navigation in the region. Given the disputed nature of territory in the South China Sea, the United States and its allies do not want China to successfully close off the region.

#### 4] Adaptation checks extinction from warming but CO2 prevents famine, collapse of ag, and ice age- those are coming now

Moore 16 (Dr. Patrick Moore is a Senior Fellow with the Energy, Ecology and Prosperity program at the Frontier Centre for Public Policy. He has been a leader in the international environmental field for over 40 years. Dr. Moore is a Co-Founder of Greenpeace and served for nine years as President of Greenpeace Canada and seven years as a Director of Greenpeace International. Following his time with Greenpeace, Dr. Moore joined the Forest Alliance of BC where he worked for ten years to develop the Principles of Sustainable Forestry, which have now been adopted by much of the industry. In 2013, he published Confessions of a Greenpeace Dropout – The Making of a Sensible Environmentalist, which documents his 15 years with Greenpeace and outlines his vision for a sustainable future. THE POSITIVE IMPACT OF HUMAN CO2 EMISSIONS ON THE SURVIVAL OF LIFE ON EARTH, June 2016, <https://fcpp.org/sites/default/files/documents/Moore%20-%20Positive%20Impact%20of%20Human%20CO2%20Emissions.pdf>)

CO2 in the Modern Era The most important question facing a species on Earth today is how long would it have been in the absence of human-caused CO2 emissions until the gradual depletion of CO2 in the atmosphere fell to levels that began to decrease biomass due to starvation, thus signaling the beginning of the end of life on Earth? It is commonly believed that volcanic activity results in massive emissions of CO2 comparable to or greater than human-caused emissions. This is not the case. Whereas the original atmospheric CO2 was the result of massive outgassing from the Earth’s interior, there is no evidence that large volumes of new CO2 were added to the atmosphere during the 140-million-year decline leading to the present era. The eruption of Mount Pinatubo, the largest in recent history, is estimated to have released the equivalent of 2 per cent of the annual human-caused CO2 emissions. Therefore, in the absence of human-caused emissions, it could reasonably be presumed that CO2 levels would have continued to fall as they had done for the previous 140 million years.20 Judging by the timing of the many glacial and interglacial periods during the Pleistocene Ice Age, the next major glaciation period could begin any time. Interglacial periods have generally been of 10,000 years’ duration, and this Holocene interglacial period began nearly 12,000 years ago. In the absence of human-caused CO2 emissions and other environmental impacts, there is no reason to doubt that another major glaciation would have occurred, following the pattern that has been established for at least the past 800,000 years, as established by the European Project for Ice Coring in Antarctica (EPICA),21 and presumably for the past 2.5 million years of the Pletstocene Ice Age. These glaciations have coincided with the Milankovitch cycles.22 (See Figure 5) The Milankovitch cycles are determined by oscillations in the Earth’s orbit and by cycles of the tilt of the Earth toward the sun. The strong correlation between the onset of major periods of glaciation during the past 800,000 years and the Milankovitch cycles has led the majority of earth scientists and climatologists to accept the hypothesis that the major glaciations are tied to the Milankovitch cycles in a causeeffect relationship. For 90 million years from the late Jurassic Period to the Early Tertiary Period, global temperature rose considerably while CO2 levels steadily declined. Then after the Paleocene-Eocene Thermal Maximum, there began a 50-million-year cooling trend in global temperature to the current era. (See Figure 6) The Paleocene-Eocene Thermal Maximum saw an average global temperature [13] FRONTIER CENTRE FOR PUBLIC POLICY as much as 16°C higher than the temperature today. Yet, the ancestors of every species living today must have survived through this period, as they had also survived through previous much colder climates. It is instructive to note that despite the numerous periods of extreme climatic conditions and cataclysmic events, every species alive today is descended from species that survived those conditions. This leads one to question the predictions of mass species extinction and the collapse of human civilization if the average global temperature exceeds a rise of 2°C above today’s level.25 It may seem surprising that the average global temperature could have been 16°C higher in previous ages, as this Figure 5. Graph showing the atmospheric CO2 concentration and temperature from Antarctica for the most recent four interglacial periods, closely tied to the Milankovitch cycles of 100,000 years. This graph is based on data from the 420,000 year record obtained from the Vostok ice cores drilled by Russian scientists.23 Note the gradual nature of the onset of colder temperatures and the rapid warming at the end of the cycle. Note that the peak warming during the most recent interglacial period (the Holocene) is lower than during the previous three interglacial periods.24 Figure 6. Global surface temperature from 65 million YBP showing the major cooling trend over the past 50 million years. While the poles were considerably warmer than they are today, there was much less warming in the tropics, which remained habitable throughout. The Earth is in one of the coldest periods during the past 600 million years.26 [14] FRONTIER CENTRE FOR PUBLIC POLICY would appear to render parts of the Earth that are warm today virtually uninhabitable. The key to understanding this is that when the Earth warms, it does so disproportionally, depending on the latitude. While the Arctic and Antarctic experience considerable warming, there is much less warming in the tropics. Thus, the tropical regions remain habitable while the high latitudes shift from polar to temperate, and during the warmest ages, they shift to a tropical climate. It is clear from the 800,000-year Antarctic ice core record that the coldest periods during major glaciations coincide with the lowest levels of CO2 in the atmosphere. (see Figure 5) The correlation is certainly strong enough during this period to suggest a causal relationship between CO2 and temperature. However, there is disagreement in the literature about which is the cause and which is the effect. Those who ascribe the warming over the past century to greenhouse gas emissions, CO2 in particular, also tend to agree with the position set forth in Al Gore’s An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do about It, that the warming during the interglacial periods is caused by rising CO2 levels.27 However, it is problematic to postulate how the Milankovitch cycles could cause an increase or decrease in atmospheric CO2 levels, whereas it is plausible that the Milankovitch cycles could cause a fluctuation in global temperature due to changes in solar radiation, which in turn could cause either CO2 outgassing from or absorption into the oceans. Indeed, both sets of ice core data from Antarctica show that changes in temperature usually precede changes in CO2 levels, suggesting that temperature change is the cause of change in the level of CO2. 28 Some have suggested that although the onset of warming after a glaciation is caused by the Milankovitch cycles, the subsequent outgassing of CO2 from the ocean then becomes the predominant driver of further warming.29 Presumably, it would also be postulated that the cooling leading to glaciation is triggered by the Milankovitch cycle and then driven by reduced CO2 levels due to ocean absorption. This hypothesis is not proven. It is extremely unlikely or perhaps impossible to imagine how CO2 could have increased from a pre-industrial 280 ppm to 400 ppm in the absence of human-caused emissions. No other species, existing or imagined in the near future, is capable of digging and drilling into the massive deposits of fossil fuels and then burning them so as to release CO2 back into the atmosphere from where it had come in the first place. Many scientists think this increase in atmospheric CO2 is the dominant cause of the slight warming (0.5C) of the atmosphere over the past 65 years. Only time will tell if this is the case. Since the Little Ice Age peaked around 1700, the climate has been warming in fits and starts for about 300 years. It is possible that the most recent warming is a continuation of the longer period of warming that had already begun long before human-caused CO2 emissions could have been a factor. [15] FRONTIER CENTRE FOR PUBLIC POLICY HIGHER CO2 CONCENTRATIONS WILL INCREASE PLANT GROWTH AND BIOMASS It has been well demonstrated that the increase in CO2 in the atmosphere is responsible for increased plant growth on a global scale. Many studies suggest that nearly 25 per cent of human-caused CO2 emissions, or 2.5 Gt of carbon annually, are absorbed by plants, thus increasing global plant biomass. A recent study postulates that up to 50 per cent of human CO2 emissions are absorbed by increased plant growth.30 This has been described as a “greening of the Earth” as CO2 reaches concentrations well above the near-starvation levels experienced during the major glaciations of the Pleistocene.31 The most prestigious Australian science body, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), has shown that CO2 particularly benefits plants that are adapted to dry climates. In higher CO2 environments, they become more efficient at photosynthesis, growing faster without using more water.32 One of the most impressive records comes from an experimental forest in Germany where there is a continuous Figure 8. Change in net primary productivity of vegetation 1982 to 2010. The driest regions, such as Western Australia, sub-Saharan Africa, western India and the Great Plains of North America, show the greatest increase in plant growth.36 Figure 7. Craig Idso,expert on CO2 and author of the CO2Science website34 demonstrating the growth-rate of pine trees under ambient conditions versus the addition of 150 ppm, 300 ppm and 450 ppm CO2. In a higher CO2 world there will be a great increase in the growth of food crops, forests, and wild landscapes around the world. Studies also demonstrate that higher CO2 levels in the oceans will result in increased growth of phytoplankton and other marine plants.35 [16] FRONTIER CENTRE FOR PUBLIC POLICY record of forest growth since 1870. Since 1960, as CO2 emissions began to rise rapidly, the growth rate of individual trees has increased by 32 per cent to 77 per cent. While some of this may be due to the slight increase in temperature since 1960, the much higher growth rate is consistent with laboratory and field studies on the effect of increased CO2 levels on plants.33 It is not widely known that greenhouse operators worldwide inject additional CO2 into their greenhouses in order to increase the growth and yield of their crops. Among horticulturalists, it is well known that this practice can increase growth by 40 per cent or more. This is because the optimum level of CO2 for plant growth is between 1,000 ppm and 3,000 ppm in air, much higher than the 400 ppm in the global atmosphere today.37 Every species on Earth, including our own, is descended from ancestors that thrived in climates with much higher levels of CO2 than are present today. Discussion The debate about climate change has one side insisting that the “science is settled.” Yet, there is no scientific proof that increased CO2 will result in disaster, as CO2 has been higher during most of the history of life on Earth than it is today. On the other hand, it can be stated without a doubt that if CO2 once again falls to the level it was only 18,000 years ago, or lower, there would be a catastrophe unlike any known in human history. We are advised by many scientists that we should be worried about CO2 levels climbing higher when, in fact, we should actually be worried about CO2 levels sinking lower. Atmospheric CO2 Concentrations in the Future If humans had not begun to use fossil fuels for energy, it is reasonable to assume that atmospheric CO2 concentration would have continued to drop as it has done for the past 140 million years. It is also reasonable to assume that the Earth’s climate would continue to fluctuate between relatively long periods of glaciation and relatively short periods of interglacial climate similar to the present climate. Given continued withdrawal of carbon from the atmosphere into the ocean sediments, it would only be a matter of time before CO2 dropped to 150 ppm or lower during a period of glaciation. At the average rate of 32 Kt of carbon lost annually, this would occur in less than two million years from now. In other words, the beginning of the end of most life on planet Earth would begin in fewer years into the future than our genus of primates, Homo, has existed as a distinct taxonomic unit. It is instructive to note that our species is a tropical species that evolved at the equator in ecosystems as warm or warmer than today’s. We were only able to leave the warmth of the tropical climate due to harnessing fire, wearing clothing and building shelters. This allowed us to settle in temperate climes and even Arctic conditions by the sea where domesticated dogs as well as marine mammals made life possible for a very small population. However, we cannot grow food crops in abundance on glaciers or in frozen soil. Moreover, we would not be able to grow much of anything anywhere if the level of CO2 went below 150 ppm. There is a distinct possibility that no amount of additional CO2 will shift the climate out of the next major period of glaciation. This is not a reason to abandon hope but rather to marvel at the fact that we can actually put some of the CO2 needed for life back into the atmosphere while at the same time enjoying abundant, reasonably priced energy from fossil fuels. There has been a gradual net loss of CO2 from the atmosphere during the past 550 million years from approximately 14,000 Gt to approximately 370 Gt at the lowest level during the height of the last glaciation. This is a reduction of nearly 98 per cent of one of the most essential nutrients for life on Earth. In the absence of human CO2 emissions over the past century, it is difficult to imagine how this process of continuous removal of CO2 would be interrupted. Massive volcanism on a scale not seen for more than 200 million years would be required to [17] FRONTIER CENTRE FOR PUBLIC POLICY bring about a reversal in the long-term CO2 trend that has now been achieved by human CO2 emissions. There is no doubt the Earth’s interior has cooled substantially over its roughly 4.6-billion-year existence. This makes massive volcanism an ever-decreasing likelihood. There is no other plausible natural mechanism to return carbon to the global atmosphere in the form of CO2. The present Holocene interglacial has already endured longer than some previous interglacial periods. The Holocene is also somewhat cooler than previous interglacial periods. Of more urgent concern than the possible starvation of life two million years from now is what would happen at the onset of the next glaciation, possibly a relatively short time from now. In the absence of human CO2 emissions, both temperature and CO2 would have dropped to levels that would result in a continuous reduction in plant growth, bringing in climatic conditions similar to or perhaps even more severe than those that occurred in previous glaciations. This would certainly lead to widespread famine and likely the eventual collapse of human civilization. This scenario would not require two million years but possibly only a few thousand. Even if the conditions of the Little Ice Age reoccurred in the next hundreds of years with a human population of nine billion or more, we can be sure the population would not be nine billion for long. There is a strong argument to be made that the Earth is already in a cooling trend that is descending into the next 100,000-year cycle of major glaciation. See Figure 5 and note that in the three preceding interglacial periods, there was a sharp peak followed by a steady downward trend in temperature. The peak temperature in this Holocene interglacial period was during the Holocene Optimum between 5,000 and 9,000 years ago. Since then, the warming peaks have been diminishing, and the cool periods have been colder. The Little Ice Age, which peaked about 300 years ago, was possibly the coldest period of climate since the Holocene Optimum.39 A Paradigm Shift in the Perception of CO2 Independent scientist James Lovelock provides an interesting example of both these contrasting predictions of future catastrophe versus salvation regarding CO2 Figure 9. Reconstructed Greenland mean temperature anomalies (top) and Antarctic CO2 concentration (bottom). Halving the temperature anomalies to allow for polar amplification gives a reasonable approximation of global temperature change in the Holocene. Since the Holocene Optimum began about 9,000 years before present (ka BP), global temperature has fallen by ~1°C, though CO2 concentration rose throughout.38 [18] FRONTIER CENTRE FOR PUBLIC POLICY emissions. He is undoubtedly one of the foremost experts in atmospheric chemistry,40 which is why NASA retained him to design part of the life-detection equipment for the first U.S. Mars landers.41 He concluded from the results that there is no life on Mars. Since publishing his first book on the Gaia hypothesis in 1979, Lovelock became concerned with human civilization’s impact on the global atmosphere.42 He became a strong advocate for reducing CO2 emissions, stating that humans had become a “rogue species” against Gaia (the Earth). He went so far as to state in 2006, ‘“Before this century is over, billions of us will die, and the few breeding pairs of people that survive will be in the Arctic where the climate remains tolerable . . . a broken rabble led by brutal warlords.”’43 Only four years later, in a public speech at London’s Science Museum in 2010, Lovelock recanted, stating, ‘It is worth thinking that what we are doing in creating all these carbon emissions, far from something frightful, is stopping the onset of a new ice age. If we hadn’t appeared on the earth, it would be due to go through another ice age and we can look at our part as holding that up. I hate all this business about feeling guilty about what we’re doing.’44 This abrupt reversal of Lovelock’s interpretation of CO2 is precisely what is required universally to avoid the tragedy of depriving billions of people of reasonably priced, reliable energy, especially those with a need to lift themselves out of poverty. There must be a total paradigm shift from demonizing fossil fuels and fearing CO2 as a toxic pollutant to celebrating CO2 as the giver of life that it is while continuing to use fossil fuels ever-more efficiently. Like Lovelock, we should be hopeful that CO2 will prove to be the moderate warming influence that it is predicted to be in theory. A somewhat warmer world with a higher level of CO2 in the atmosphere would result in a greener world with more plant biomass, higher yields of food crops and trees, a more hospitable climate in high northern latitudes and a possible reduction in the likelihood of another major glaciation. It is highly probable, and ironic, that the existence of life itself may have predetermined its own eventual demise due mainly to the development of CaCO3 as armour plating in marine organisms.45 The fact that humans appear able to reverse this fate temporarily due to our recycling of CO2 back into the atmosphere by burning fossil fuels for energy verges on the miraculous. Nevertheless, there is only so much fossil fuel, and once burned, it is not renewable in the short to medium term. The vast bulk of carbon is sequestered into carbonaceous rocks, mainly as CaCO3. Today, about 5 per cent of human CO2 emissions are derived from converting CaCO3 with heat into CO2 and CaO (lime) to manufacture cement. Therefore, when fossil fuels become scarce in future centuries, and if CO2 again begins to dwindle, we will have the option of producing additional CO2 by burning limestone with nuclear or solar energy, with lime for cement as a useful by-product. This has the potential to extend the existence of a highly productive living Earth into the far distant future. It is clear from the preceding discussion that rather than bringing on a catastrophic climate condition, human CO2 emissions are serving to reinstate a balance to the global carbon cycle. By reversing the 140-million-year decline in atmospheric CO2, we are helping to ensure the continuation of carbon-based life on Earth. [19] FRONTIER CENTRE FOR PUBLIC POLICY CONCLUSION CO2 is essential for life, and twice in the history of modern life there have been periods of steep decline in the concentration of CO2 in the global atmosphere. If this decline were to have continued at the same rate into the future, CO2 would eventually fall to levels insufficient to support plant life, possibly in less than two million years. More worrisome is the possibility in the nearer future that during a future glaciation, CO2 may fall to 180 ppm or lower, thus greatly reducing the growth of food crops and other plants. Human CO2 emissions have staved off this possibility so that at least during a period of glaciation, CO2 would be high enough to maintain a productive agricultural industry. A 140 million year decline in CO2 to levels that came close to threatening the survival of life on Earth can hardly be described as “the balance of nature”. To that extent human emissions are restoring a balance to the global carbon cycle by returning some of the CO2 back to the atmosphere that was drawn down by photosynthesis and CaCO3 production and subsequently lost to deep sediments. This extremely positive aspect of human CO2 emissions must surely be weighed against the unproven hypothesis that human CO2 emissions are mainly responsible for the slight warming of the climate in recent years and will cause catastrophic warming over the coming decades. The fact that the current warming began about 300 years ago during the Little Ice Age indicates that it may at least in part be the continuation of the same natural forces that have caused the climate to change through the ages.

#### Food shortages cause war and go nuclear.

FDI 12 Future Directions International, a Research institute providing strategic analysis of Australia’s global interests; citing Lindsay Falvery, PhD in Agricultural Science and former Professor at the University of Melbourne’s Institute of Land and Environment, “Food and Water Insecurity: International Conflict Triggers & Potential Conflict Points,” http://www.futuredirections.org.au/workshop-papers/537-international-conflict-triggers-and-potential-conflict-points-resulting-from-food-and-water-insecurity.html

There is a growing appreciation thatthe conflicts in the next century willmost likelybe fought over a lack of resources. Yet, in a sense, this is not new. Researchers point to the French and Russian revolutions as conflicts induced by a lack of food**.** More recently, Germany’s World War Two efforts are said to have been inspired, at least in part, by its perceived need to gain access to more **food.** Yet the general sense among those that attended FDI’s recent workshops, was that **the scale of the problem in the future could be** significantly greateras a result of population pressures, changing weather, urbanisation, migration, loss of arable land and other farm inputs, and increased affluence in the developing world. In his book, Small Farmers Secure Food, Lindsay Falvey, a participant in FDI’s March 2012 workshop on the issue of food and conflict, clearly expresses the problem and why countries across the globe are starting to take note. .He writes (p.36), “…if people are hungry, especially in cities, the state is not stable – riots, violence, breakdown of law and order and migration result.”¶ “Hunger feeds anarchy.”¶ This view is also shared by Julian Cribb, who in his book, The Coming Famine, writes that if “large regions of the world run short of food, land or water in the decades that lie ahead, then wholesale, bloody wars are liable to follow.” He continues: “An increasingly credible scenario for World War 3 is not so much a confrontation of super powers and their allies, as afestering**,** self-perpetuatingchainof resource conflicts.” He also says: “The wars of the 21st Century are less likely to be global conflicts with sharply defined sides and huge armies, than a scrappy mass of failed states, rebellions, civil strife, insurgencies, terrorism and genocides, sparked by bloody competition over dwindling resources.”¶ As another workshop participant put it, people do not go to war to kill; they go to war over resources, either to protect or to gain the resources for themselves.¶ Another observed that hunger results in passivity not conflict. Conflict is over resources, not because people are going hungry.¶ A study by the International Peace Research Institute indicates that where food security is an issue, it is more likely to result in some form of conflict.Darfur, Rwanda, Eritrea and the Balkansexperienced such wars. Governments, especially in developed countries, are increasingly aware of this phenomenon.¶ The UK Ministry of Defence, the CIA, theUS Center for Strategic and International Studies and the Oslo Peace Research Institute, all identify famine as a potential trigger for conflicts and possibly even nuclear war

#### 5] Warming solves Greenland’s economy and rare earth mineral shortages

McGinnis 12 (Paul E. McGinnis is a contributing writer to EcoWatch. He has interviewed a stellar array of change makers including Sylvia Earle, Dean Kamen, Ray Kurzweil, Fabien Cousteau and Josh Fox. Paul is also a New York based real estate broker, and green building and renovation consultant. He is a member of the U.S. Green Building Council, the Northeast Sustainable Energy Association, and the New York State Association of Realtors. McGinnis, P. E. “Greenland’s Ice Melt Ignites Race for Rare Earth Metals,” 11/12/2012, http://ecowatch.com/2012/11/12/greenlands-rare-earth-metals//ghs-kw)

Greenland’s vast, pristine, virtually-untouched terrain is becoming a hotbed for resource extraction. The Arctic is melting at an unprecedented rate, making Greenland’s natural resources, including high demand commodities such as oil, gas, gold, iron, copper and rare earth metals, more accessible. Insatiable international oil, gas and mining conglomerates are now aggressively vying to control access to the riches glaciers once denied. “This is not just a region of ice and polar bears,” Prime Minister of Greenland, Kuupik Kleist, told Reuters in the capital Nuuk, formerly known by its Danish name Godthab. “Developing countries are interested in a more political role in opening up of the Arctic. Greenland could serve as a stepping stone.” Greenland has less than 60,000 people living in an 836,109 square mile area. Comparatively, Greenland is almost a quarter the size of the continental U.S. Until recently, the country was regarded by strategists as barren wasteland with little political or economic import. But now this once overlooked arctic island is being targeted by government and politically connected entities, anxious to extract what lies beneath the glacier ice sheet. The powerful and deep-pocketed interests include China, the U.S., Russia and the European Union. Many in Greenland are excited about the attention the remote island nation is attracting and are happy to have world powers courting Greenland looking to strike it rich. Greenlanders are hoping they too will get rich along with the foreign investors. Henrik Stendal, head of the geology department at Greenland’s Bureau of Minerals and Petroleum, a Dane who has worked in Greenland since 1970, told the U.K. Guardian in July: “We have shown that we have huge potential—it has been an eye-opener for the mining industry. The EU has shown a lot of interest and that’s been very good—we believe this could be very valuable for Greenland. There could be benefits for everyone—at present most of our income is from fishing and a little bit of tourism, so the government really wants another income.” In addition to oil and gas, and perhaps even more attractive to industry, are rare earth metals that lie beneath the ground in Greenland that are essential components in new technologies, including computer hard drives, cell phones and flat screen devices. The world is consuming these rare earth metals at a voracious rate. For instance, in the first weekend of sales, the 4G iPad mini sold four million units. Our appetite for these devices and the rare metals required seems unending. Rare earth metals are also essential elements to military guidance systems and other defense related technology. Most of the rare earth metals are currently sourced in China. Now, the world’s nations are considering Greenland’s resources not just from an economic point of view, but, perhaps more importantly, a strategic perspective. There is a national security imperative when looking at availability of these resources and who controls them. The New York Times reported in September: “Western nations have been particularly anxious about Chinese overtures to this poor and sparsely populated island, a self-governing state within the Kingdom of Denmark, because the retreat of its ice cap has unveiled coveted mineral deposits, including rare earth metals that are crucial for new technologies like cellphones and military guidance systems. A European Union vice president, Antonio Tajani, rushed here to Greenland’s capital in June, offering hundreds of millions in development aid in exchange for guarantees that Greenland would not give China exclusive access to its rare earth metals, calling his trip ‘raw mineral diplomacy.'” “In the past 18 months, Secretary of State Hillary Rodham Clinton and President Lee Myung-bak of South Korea have made debut visits here, and Greenland’s prime minister, Kuupik Kleist, was welcomed by President José Manuel Barroso of the European Commission in Brussels.”

#### Conflict over resources and energy in the near arctic cirucle goes nuclear

Cohen 10 Ariel [Senior Research Fellow for Russian and Eurasian Studies and International Energy Policy, The Kathryn and Shelby Cullom Davis Institute for International Studies] “From Russian Competition to Natural Resources Access: Recasting U.S. Arctic Policy” The Heritage Foundation 6/15/10 <http://www.heritage.org/research/reports/2010/06/from-russian-competition-to-natural-resources-access-recasting-us-arctic-policy>

To advance its position, Russia has undertaken a three-year mission to map the Arctic.[26] The Kremlin is also moving rapidly to establish a comprehensive sea, ground, and air presence. Under Putin, Russia focused on the Arctic as a major natural resources base. The Russian national leadership insists that the state, not the private sector, must take the lead in developing the vast region. The Kremlin published its Arctic doctrine in March 2009.[27] The main goal is to transform the Arctic into Russia’s strategic resource base and make Russia a leading Arctic power by 2020. Russian Militarization of the Arctic.The military is an important dimension of Moscow’s Arctic push. The policy calls for creating “general purpose military formations drawn from the Armed Forces of the Russian Federation” as well as “other troops and military formations [most importantly, border units] in the Arctic zone of the Russian Federation, capable of ensuring security under various military and political circumstances.”[28] These formations will be drawn from the armed forces and from the “power ministries” (e.g., the Federal Security Service, Border Guard Service, and Internal Ministry). Above all, the policy calls for a coast guard to patrol Russia’s Arctic waters and estuaries.Russia views the High North as a major staging area for a potential nuclear confrontationwith the United States and has steadily expanded its military presence in the Arctic since 2007. This has included resuming air patrols over the Arctic, including strategic bomber flights.[29] During 2007 alone, Russian bombers penetrated Alaska’s 12-mile air defense zone 18 times.[30] The Russian Navy is expanding its presence in the Arctic for the first time since the end of the Cold War, increasing the operational radius of the Northern Fleet’s submarines.Russia is also reorienting its military strategyto meet threats to the country’s interests in the Arctic, particularly with regard to its continental shelf.[31] Russia is also modernizing its Northern Fleet. During 2008 and 2009, Russian icebreakers regularly patrolled in the Arctic. Russia has the world’s largest polar-capable icebreaker flotilla, with 24 icebreakers. Seven are nuclear, including the 50 Years of Victory, the largest icebreaker in the world.[32] Russia plans to build new nuclear-powered icebreakers starting in 2015.[33] Moscow clearly views a strong icebreaker fleet as a key to the region’s economic development. Russia ’s Commercial Presence. Russia’s energy rush to the Arctic continues apace. On May 12, 2009, President Dmitry Medvedev approved Russia’s security strategy.[34] This document views Russia’s natural resources in the Arctic as a base for both economic development and geopolitical influence. Paragraph 11 identifies potential battlegrounds where conflicts over energy may occur: “The attention of international politics in the long-term will be concentrated on controlling the sources of energy resources in the Middle East, on the shelf of the Barents Sea and other parts of the Arctic, in the Caspian Basin and in Central Asia.” The document seriously considers the use of military force to resolve competition for energy near Russia’s borders or those of its allies: “In case of a competitive struggle for resources it is not impossible to discount that it might be resolved by a decision to use military might.The existing balance of forces on the borders of the Russian Federation and its allies can be changed.”[35] In August 2008, Medvedev signed a law that allows “the government to allocate strategic oil and gas deposits on the continental shelf without auctions.” The law restricts participation to companies with five years’ experience in a region’s continental shelf and in which the government controls at least a 50 percent stake. This effectively allows only state-controlled Gazprom and Rosneft to participate.[36] However, when the global financial crisis ensued, Russia backtracked and began to seek foreign investors for Arctic gas development.

#### 6] Moon basing key to China-Russia counterbalancing – guts US space dominance.

Goswami 21 “The Strategic Implications of the China-Russia Lunar Base Cooperation Agreement” [Dr. Namrata Goswami is an independent scholar on space policy, great power politics, and ethnic conflicts.] March 19, 2021 <https://thediplomat.com/2021/03/the-strategic-implications-of-the-china-russia-lunar-base-cooperation-agreement/> SM

The Strategic Implications of the China-Russia Lunar Base Cooperation Agreement

With their agreement, the partners are signalling an alternative to a U.S.-led order in space.

On March 9, 2021, the China National Space Administration (CNSA) and Russian Space Agency (ROSCOSMOS) signed a Memorandum of Understanding (MoU) for the joint construction of an autonomous lunar permanent research base. Employing the language of the Outer Space Treaty of 1967, China and Russia emphasized that the MoU is about scientific discovery as well as the use of lunar terrain. The agreement describes the planned International Lunar Research Station (ILRS) as “a comprehensive scientific experiment base with the capability of long-term autonomous operations, built on the lunar surface and/or on the lunar orbit that will carry out multi-disciplinary and multi-objective scientific research activities such as the lunar exploration and utilization, lunar-based observation, basic scientific experiment, and technical verification.”

These two major space faring nations have agreed to promote the ILRS to gain international partners for their joint lunar mission, especially by broadcasting China’s lunar South Pole environment and resource survey mission, the Chang’e 7 and Russia’s Luna-Resurs-1 Russian Orbital Spacecraft (OS) Mission.

That China and Russia would cooperate on exploration and utilization of lunar resources comes as no surprise. Both countries, especially Russia, keenly watched as the United States announced the Artemis Accords for creating an international mechanism for lunar development led by the U.S. and partner nations. ROSCOSMOS, in reaction to the Artemis Accords and especially former President Donald Trump’s April 6, 2020 executive order on the utilization of space resources for international partnerships stated, via its deputy director for international cooperation, Sergei Savelyev, that “attempts to expropriate outer space and aggressive plans to actually take over other planets” go against the principle of international cooperation. The Kremlin likened Trump’s executive order to the colonization of space, with Kremlin spokesman Dmitry Peskov coming out strong, stating that it would be “unacceptable” for the U.S. to privatize and colonize space.

While China officially did not respond to the Artemis Accords, the CNSA’s Space Law Center Deputy Director Guoyu Wang argued in an article in The Space Review that the accords cannot be viewed as an extension of the OST, but are instead an attempt to create norms outside of established international regulatory frameworks.

The Moon Is Strategic

The moon is no longer seen as a dead rock where humanity lands for a few days, shows off technology, and then journeys back to Earth. Today the discourse on the moon is about its resource potential, including the presence of water ice, solar power, and rare earth elements like platinum, titanium, scandium, and yttrium. Chinese space scientists and engineers have long recognized the economic potential of space resources to include a $10 trillion return on investments from the Earth-moon zone annually by 2050.

All the way back in 2002, Ouyang Ziyuan, lead scientist and founder of China Lunar Exploration Program (CLEP) specified that “China’s long-term aim and task is to set up a base on the moon to tap and make use of its rich resources.” His perspective was supported at the highest level of CNSA leadership. China’s subsequent demonstrations of lunar capacity include a far side lunar landing in 2019 and an autonomous lunar sample return mission in 2020.

Other benefits highlighted by Chinese scientists are the potential of lunar propellant made from water-ice lowering the cost of access and movement throughout the entire volume of cislunar space. Launching from the moon is 22 times more efficient than launching from Earth due to Earth’s gravity well. In order to access those lunar resources, a long-term permanent presence, first robotic, then human, will be necessary. This aspect of first mastering autonomous robotic lunar basing capacities is highlighted in the China-Russia MoU.

Similar to China’s long-term plans for a permanent presence on the moon and a lunar research base by 2036, Russia in 2018 announced its own lunar plan, which included resource extraction ambitions, backed by a three phase base construction plan between 2025 and 2040. The first stage is a lunar orbiter module (2025); the second phase will be the construction of a lunar base (2025-2034); and the third phase (2040) will involve the construction of an “integrated manned moon exploration system.” The former chief designer of Russia’s manned space programs, the late Yevgeny Mikrin, in an interview with state run RIA Novosti news in November 2018, specified that the construction of the moon colony was to begin in 2025.

The strategic recognition of the critical role of the Earth-moon economic zone for future space development and utilization is the first peg on which the China-Russia MoU stands. Besides that, there are two other specific geopolitical and regime constriction considerations at play here.

Geopolitical Considerations

The future of space is its economy, with possible returns in the trillions of dollars. And robust economic growth leads to military and other power projection capacities. Both China and Russia understand the impact of space on the future of global leadership. China wants to become the foremost space power by 2045, in time for the centenary of the establishment of the People’s Republic in 2049. President Xi Jinping has repeatedly highlighted the intrinsic contribution of space to Chinese global leadership. The idea behind China’s space philosophy is to demonstrate high-end technology, including human missions, lunar soft landings (near and far side), lunar sample returns, and Mars missions, to be followed by construction of a permanent space station, space-based solar power satellites, and deep space probes.

For China, the MoU with Russia came at the appropriate geopolitical moment, especially after it has successfully demonstrated high end indigenous space capacity like lunar far side landing, autonomous lunar sample return, and a Mars mission. China no longer has to worry about the age-old cliché that all Chinese space technology is reengineered Russian space technology.

For Russia, joining in with China’s lunar base goal, even as a junior partner, means that the two nations can pool their joint international resources to register opposition to a U.S.-led space order, something both sides are uncomfortable with. For Russia and especially President Vladimir Putin, it is about taking back the space leadership position it enjoyed as the erstwhile Soviet Union.

This lunar MoU is a continuation of the two nations’ geopolitical behavior on Earth, where China and Russia have established alternative security systems like the Shanghai Cooperation Organization and the Chinese-led Belt and Road Initiative (BRI), of which Russia is a participating country. By establishing an alternative lunar base development effort, China and Russia are questioning the legitimacy of the Artemis Accords and signaling that they do not view U.S. efforts, both public and private, as the only mechanism for cooperation in space

. Basically, this is clear indication that leadership in space is contested. Once they draw in enough partners and signatories to their lunar research base, China and Russia will have the power and influence to create an alternative state-centric preamble and lunar accord crafting the regulatory regime around lunar exploration and development. Both wield enormous clout internationally via their U.N. Security Council permanent memberships and veto power as well as advocacy in U.N. space bodies.

Signing an MoU for lunar development has several long-term strategic implications for both as well. First, Russia gets access to an international structure already in place under China’s BRI, in which nearly 140 countries are now participating. Both sides get access to launch sites, ground stations, and receiver stations in China and Russia, as well as access to a universal scientific talent pool, to include growing Chinese and Russian space expertise, and burgeoning employment opportunities in China where aerospace salaries are becoming globally competitive. They will also be able to divide the long-term costs of research and development. Finally, the MoU offers a rather flexible international partnership for countries. A decision on inclusion lies primarily with either Xi or Putin, unlike U.S. space partnerships, which have to pass through several interagency clearance processes and time-consuming bureaucratic procedures.

Strategic Regime Constriction

China and Russia have expressed opposition to the U.S. policy moves to enable the private sector and commercialization of space in Artemis Accords signatory countries, as well as national legislation like the U.S. Commercial Space Launch Competitive Act 2015 (CSLCA). Beijing and Moscow are especially worried by the prospect of the private space sector taking the lead in developing space technology breakthroughs. This implies fast enhancement of capability (think SpaceX and Blue Origin reusable rockets, lunar landers), truly democratizing space beyond just the state-owned institutions currently at the forefront of space policy, technology development, and missions. This has serious economic consequences in a globally competitive trillion-dollar space market. This aspect was evident in Kremlin spokesperson Dmitry Peskov’s vocal opposition to the U.S. focus on the privatization of space.

China, and to a larger extent Russia, do not yet have a vibrant private space sector capable of competing with the U.S. private sector globally, even though China under Xi has created enormous financial and ideological incentives for Chinese private space startups since 2014. China has, however, excelled in and utilized state-based policies to rein in its own private space sector under its strict Civil-Military Fusion Strategy and its new National Defense Law 2021.

The CSLCA, which supports U.S. private citizens’ ownership of space resources; the Artemis Accords’ emphasis on commercial activities on the moon, establishment of safety zones, and utilization of space resources; and the April 6, 2020 executive order calling for space resource utilization efforts based on international partnerships have galvanized the China-Russia MoU, an alternative lunar development mechanism led by authoritarian state-owned space agencies. Both China and Russia fear that with the Artemis Accords, the private space sector has been strengthened legally to invest in lunar breakthroughs that would take their own state-owned space agencies years to compete with or catch up to. They also fear that the Cold War-based space governance mechanisms that limit private development of space might be unraveling, especially if today’s leading space-faring states become flexible on the regulatory mechanisms set up during the Cold War that have stifled private innovation in space by creating incentives for state funded and owned space activities.

Innovation in technology will be a game changer in space going forward, and both China and Russia realize the impact of, say, SpaceX’s reusable heavy lift rocket, Starship, scheduled for launch by 2023, with plans for crewed missions to the moon and Mars (with orbital refueling). Starship will be the world’s most advanced reusable rocket, with a lift capacity of 100 metric tonnes to low earth orbit (LEO). In comparison, China has plans for a reusable Long March 8 rocket (with a lift capacity of 8.4 metric tonnes to LEO) designed by the state-owned China Academy of Launch Vehicle Technology (CALT), but this is clearly not in the same class of rockets like Starship.

Their vocal oppositions to the entry of the U.S. private space sector buys time for China and Russia to catch up over the next decade or so. By 2030, China has its own plans for a heavy lift rocket, the Long March 9, which will have a lift capacity of 140 metric tonnes to LEO, and also aspires to master reusability in the next 20 years. However, time is of the essence in space power projection and a single technology can change the game, as reusability has done for launch infrastructure.

A Changed Reality

China and Russia’s lunar base MoU has changed the alignment structures around space cooperation and sends a clear signal to the United States and the seven other Artemis Accords partners that space is contested. China and Russia are offering avenues for alternate partnership, especially to encourage countries like Saudi Arabia and Turkey to join, both of whom have aspirations to develop their space sector. Turkish President Recep Tayyip Erdogan recently announced Turkish ambitions to make first contact with the moon by 2023 (the 100th year celebration of the establishment of the Turkish republic) with the help of international partnerships.

Despite the U.S. private space sector advantages identified above, the U.S. suffers from a lack of continuity and emphasis in its space sector at the policy level due to changing space priorities across presidential administrations. We saw such uncertainty creep in with regard to its Artemis Accords (established under the Trump administration), the Space Force, and the reconstitution of the National Space Council after President Joe Biden was sworn in. Biden has offered little insight into his administration’s space priorities, including on critical concepts like space resource utilization and development. Such uncertainties can stifle international partnerships and technology development.

In contrast, despite lacking a similarly vibrant private sector, China’s clear articulation of its long-term steady lunar missions, and its ability to commit resources without having to worry about a change in missions with a change in administrations, showcases its long-term assurance that it can meet its goal of establishing a lunar base, now in partnership with Russia. While technology is a game changer, a nation cannot succeed in space without long-term strategic vision.

#### US space dominance prevents global war

**Zubrin 15** [(Robert Zubrin, president of Pioneer Energy, a senior fellow with the Center for Security Policy) “US Space Supremacy is Now Critical,” Space News, 1/22/15, https://spacenews.com/op-ed-u-s-space-supremacy-now-critical/] TDI

The United States needs a new national security policy. For the first time in more than 60 years, we face the real possibility of a large-scale conventional war, and we are woefully unprepared. Eastern and Central Europe is now so weakly defended as to virtually invite invasion. The United States is not about to go to nuclear war to defend any foreign country. So deterrence is dead, and, with the German army cut from 12 divisions to three, the British gone from the continent, and American forces down to a 30,000-troop tankless remnant, the only serious and committed ground force that stands between Russia and the Rhine is the Polish army. It’s not enough. Meanwhile, in Asia, the powerful growth of the Chinese economy promises that nation eventual overwhelming numerical force superiority in the region. How can we restore the balance, creating a sufficiently powerful conventional force to deter aggression? It won’t be by matching potential adversaries tank for tank, division for division, replacement for replacement. Rather, the United States must seek to totally outgun them by obtaining a radical technological advantage. This can be done by achieving space supremacy.To grasp the importance of space power, some historical perspective is required. Wars are fought for control of territory. Yet for thousands of years, victory on land has frequently been determined by dominance at sea. In the 20th century, victory on both land and sea almost invariably went to the power that controlled the air. In the 21st century, victory on land, sea or in the air will go to the power that controls space. The critical military importance of space has been obscured by the fact that in the period since the United States has had space assets, all of our wars have been fought against minor powers that we could have defeated without them. Desert Storm has been called the first space war, because the allied forces made extensive use of GPS navigation satellites. However, if they had no such technology at their disposal, the end result would have been just the same. This has given some the impression that space forces are just a frill to real military power — a useful and convenient frill perhaps, but a frill nevertheless. But consider how history might have changed had the Axis of World War II possessed reconnaissance satellites — merely one of many of today’s space-based assets — without the Allies having a matching capability. In that case, the Battle of the Atlantic would have gone to the U-boats, as they would have had infallible intelligence on the location of every convoy. Cut off from oil and other supplies, Britain would have fallen. On the Eastern front, every Soviet tank concentration would have been spotted in advance and wiped out by German air power, as would any surviving British ships or tanks in the Mediterranean and North Africa. In the Pacific, the battle of Midway would have gone very much the other way, as the Japanese would not have wasted their first deadly airstrike on the unsinkable island, but sunk the American carriers instead. With these gone, the remaining cruisers and destroyers in Adm. Frank Jack Fletcher’s fleet would have lacked air cover, and every one of them would have been hunted down and sunk by unopposed and omniscient Japanese air power. With the same certain fate awaiting any American ships that dared venture forth from the West Coast, Hawaii, Australia and New Zealand would then have fallen, and eventually China and India as well. With a monopoly of just one element of space power, the Axis would have won the war. But modern space power involves far more than just reconnaissance satellites. The use of space-based GPS can endow munitions with 100 times greater accuracy, while space-based communications provide an unmatched capability of command and control of forces. Knock out the enemy’s reconnaissance satellites and he is effectively blind. Knock out his comsats and he is deaf. Knock out his navsats and he loses his aim. In any serious future conventional conflict, even between opponents as mismatched as Japan was against the United States — or Poland (with 1,000 tanks) is currently against Russia (with 12,000) — it is space power that will prove decisive. Not only Europe, but the defense of the entire free world hangs upon this matter. For the past 70 years, U.S. Navy carrier task forces have controlled the world’s oceans, first making and then keeping the Pax Americana, which has done so much to secure and advance the human condition over the postwar period. But should there ever be another major conflict, an adversary possessing the ability to locate and target those carriers from space would be able to wipe them out with the push of a button. For this reason, it is imperative that the United States possess space capabilities that are so robust as to not only assure our own ability to operate in and through space, but also be able to comprehensively deny it to others. Space superiority means having better space assets than an opponent. Space supremacy means being able to assert a complete monopoly of such capabilities. The latter is what we must have. If the United States can gain space supremacy, then the capability of any American ally can be multiplied by orders of magnitude, and with the support of the similarly multiplied striking power of our own land- and sea-based air and missile forces be made so formidable as to render any conventional attack unthinkable. On the other hand, should we fail to do so, we will remain so vulnerable as to increasingly invite aggression by ever-more-emboldened revanchist powers. This battle for space supremacy is one we can win. Neither Russia nor China, nor any other potential adversary, can match us in this area if we put our minds to it. We can and must develop ever-more-advanced satellite systems, anti-satellite systems and truly robust space launch and logistics capabilities. Then the next time an aggressor commits an act of war against the United States or a country we are pledged to defend, instead of impotently threatening to limit his tourist visas, we can respond by taking out his satellites, effectively informing him in advance the certainty of defeat should he persist. If we desire peace on Earth, we need to prepare for war in space.