### Off 1

#### States ought to establish or expand an international public trust obligation towards celestial protection.

#### Counterplan solves global space sustainability.

**Babcock ’19** — Hope M. Babcock, Professor of Law, Georgetown University Law Center, B.A., Smith College, L.L.B., Yale University; (2019; “ARTICLE: THE PUBLIC TRUST DOCTRINE, OUTER SPACE, AND THE GLOBAL COMMONS: TIME TO CALL HOME ET”; University of Michigan Libraries, Nexis Uni; *Syracuse University Law Review*, Vol. 69; //LFS—JCM)

[\*259] The doctrine also appears to be infinitely malleable. Original uses of the doctrine were restricted to only that "aspect of the public domain below the low-water mark on the margin of the sea and the great lakes, the waters over those lands, and the waters within rivers and streams of any consequence," 520and covered only traditional uses of those lands, like fishing and navigation. 521 Over time, the scope and application of the doctrine broadened to protect more public resources and different uses. 522 Thus, the doctrine expanded to protect new trust resources, such as dry sand beaches, inland lakes, groundwater, dry riverbeds, and wildlife, 523and passive uses of those resources, like scientific study. 524The original link to navigable water and tidelands disappeared. 525 Supporters of the [\*260] doctrine successfully advocated that it be applied to "wildlife, parks, cemeteries, and even works of fine art," 526 while arguing more recently its application to the atmosphere. 527

A doctrine that imposes a perpetual duty on the sovereign to preserve trust resources, prevents their alienation for private benefit, assures public access to them, and can be invoked by anyone seems particularly useful as a management tool in outer space. 528The fact that public access to trust resources is so central to the doctrine makes it reflective, not contradictory, of international space law's bar against appropriation of outer space and of the principle of space being the "province of all mankind." 529 It avoids the problems of alienation and exclusion associated with any of the management approaches associated with some form of private property and requires neither the creation of a new administrative authority nor the presence of a close-knit group of like-minded people. 530 Members of the public, both rich and poor, can invoke and enforce the doctrine as easily as the sovereign. 531 It is cost effective to the extent that no separate apparatus is required to implement it, and the doctrine has shown itself to be highly adaptable and innovative as different needs arise. 532 It could also fill the gap in international law with respect to managing celestial property. Therefore, of all the management approaches studied here, the PTD seems the most suited to keep order in space until a regulatory regime is imposed.

However, the doctrine provides no incentives for development of trust resources; rather, it might be used to limit or curtail that development, making it an imperfect, perhaps even counter-productive solution by itself to the extent that such development might be [\*261] beneficial. 533Modifying the doctrine to allow limited use of private property management approaches, like tradable development claims, might buffer that effect - a form of overlapping hybridity between one type of property, a commons, and a management regime from another, private property, enabled by application of the PTD.

Conclusion

"Only a legal system that accommodates both the human need for resources and the necessary preservation of mankind's common heritage can fulfill these criteria."534 The future is now with regard to the development of outer space and its resources - it is no longer a question of whether humans will engage in these activities, but how soon they will. Technically advanced countries and private commercial enterprises are probing outer space and preparing for landing on an asteroid or the moon to extract their resources. 535Speculators are selling deeds to the moon's surface and preparing to exploit the tourism potential that space offers. 536 But, the legal framework for managing these initiatives is almost nonexistent. 537International treaties came into being before all this activity began in earnest and national laws that might apply are stunted by jurisdictional quandaries like the absence of national boundaries in outer space. 538Thus, there is an urgency to figure out how to control what happens in outer space before its resources are irreparably damaged or permanently monopolized by powerful countries and individuals.

In the absence of regulation, much of the current debate centers on what property regime should be applied in outer space. 539The assumption is that by only allowing private property rights in space, countries and commercial enterprises will undertake the risks and costs of space development. 540However, unless international space law changes, it may prevent this from happening. If it changes, strong management controls will be necessary to prevent destruction or over-consumption of celestial resources, as well as monopolization and competitive behavior by participants, which could lead to hostilities and inequities.

[\*262] This Article examines various private property regimes, including those of less than full fee ownership, to see if any would avoid the conflict with the international prohibition on appropriation of outer space and its resources. It concludes that none will because each retains the right to exclude and each is insensitive to the treaties' equity concerns. In contrast, considering outer space to be common is consistent with international space law in both respects.

Hypothesizing that private property in outer space may yet prevail, this Article investigates different private property management approaches, such as the right of first possession, lotteries, and tradable development rights, to see if any would be cost effective, easy to implement and equitable, and would also prevent over-consumption, monopolization or the slide into rivalrous behavior. The Article concludes that each comes up short in some respect. Social norms as a management tool for property held in common, although compliant with international law, are also not up to the task. Instead, although ancient, the PTD, with its malleability, easy and cost-effective implementation and enforcement, non-consumption principle, and consistency with the goals that animate international space treaties, seems best suited to the task of protecting the public's interests in the global commons that is outer space as it has done for centuries in Earth-bound commons.

But, as its principal terrestrial use has been to protect trust resources from development, the doctrine needs some modification to encourage development of celestial resources. Hence, this Article suggests that modifying the PTD to allow the application of private property management tools, like tradable development rights, will not only allow development, but also will assure that when it happens, it will not be just profitable for a few, but will also be sustainable and equitable.

### Off 2

#### Innovation high now but aff trades off

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Every once in a while, a confluence of discoveries, events and initiatives results in a breakthrough so significant that it propels the entire world to a higher level, redefining what is possible in so many different fields. This breakthrough is taking centerstage now, as the new era of space exploration — catalyzed by increasing launch access — dawns upon us. The surge of innovation that comes with this will create new opportunities and inspire the next generation of doers. When this happens, boundaries between scientific and social impact are blurred. Innovation leading to scientific discovery can benefit society in the same way that social innovation can diversify and support scientific innovators, who can contribute to global progress. To ride this wave of progress, we must all participate and innovate in the new era of space exploration. The intersection of space exploration, innovation and impact isn’t a new phenomenon. In the past, technology developments and spin-offs from space research have consistently found their way into communities worldwide sometimes with lifesaving benefits. The International Space Station supports experiments that have led to discoveries and inventions in communication, water purification, and remote guidance for health procedures and robotic surgeries. Satellite-enabled Earth observation capabilities that monitor natural disasters, climate and crops often support early warnings for threats and mitigation strategies. Space exploration has always been relevant to everyone no matter the discipline or interest. Commercialization of space has been key in many ways to the current boost in “firsts” over the last few years. It has spurred innovation in launch vehicles and related technologies that led to firsts in vertical-takeoff-vertical landing rocket technology, reusability of rocket boosters and privately developed crewed missions to orbit. Concurrently, NASA has continued to captivate our imagination with the first flight of a helicopter in another world, a mission to return an asteroid sample to Earth and sending a probe to make the closest ever approach to the sun. While we celebrate the scientific progress, there is a vastly important question that we all need to focus on: How can we drive the surge in innovation offered by increased access to space, to benefit humankind? Access to low-Earth orbit, and eventually human exploration of space, is a portal to achieve many impactful outcomes. The numbers and completion rate of microgravity experiments conducted by scientists will be greatly increased as a range of offerings in suborbital flights provide more opportunities to advance critical research in health, agriculture, energy, and more. Lunar, planetary, and even asteroid exploration may lead to discoveries of new materials — busting the limitations now imposed on capabilities for energy, transportation, and infrastructure or creating new sensors and devices that enhance safety on Earth. Space tourism —one can hope — has the power to potentially create an awareness of our oneness that may lead to social change.

#### Commercial space innovation stops extinction

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We find ourselves still at the dawn of a new space century, mindful of the victories and setbacks of our past, eager to pass the torch to the next generation of space visionaries, scientists, engineers, and enthusiasts. We look to the future not just to see how much bigger, faster, or higher we can reach, but also how the United States, and specifically the U.S. space community, can again inspire the nations of the world to align with us, as it did in the 20th century. The SmallSat Alliance is an alliance of companies developing, producing, and operating in all segments of the ‘next generation’ space economy; championing renewed U.S. leadership in the burgeoning commercial space economy, and advocating for the transformation of government-led space capabilities. We are experienced space professionals who have chosen to join with others leveraging our decades of hard-won experience, to develop smarter ways to explore space in the 21st century. A wonderful outgrowth of the legacy space program is the commercial, entrepreneurial, and job-creating commercial space business that it bequeathed. These next-generation enterprises range from multi-million-dollar startups providing rideshare opportunities or components for small satellites to multi-billion-dollar space data-analytic platforms reinventing urban car service and agricultural production. The early returns of this economic revolution are already on our doorstep: space data capabilities are exponentially growing elements of the 21st century world economy. Beginning with the dreams and funding by successful tech entrepreneurs, enormous venture investments are already delivering wondrous benefits to the world. Commercial Space – Profit and Non-Profit There are really two major categories in the commercial sector, the profit driven and the non-profit. The classic for-profit companies include not only those designing, building, launching, and operating satellites but also the tech sector that is turning that raw space data into gold through machine-learning analytics. Since for-profit companies are no longer dependent upon the revenues generated by the Cold War space race culture of a bygone era, this new generation of space companies is able to more efficiently capitalize on Moore’s Law, the nonstop exponential growth in chip density, and the associated networking technology co-evolving with it. This new generation is building profitable businesses helping to clean up our oceans of garbage and debris with satellite surveillance, reconnoitering to assist in enforcing laws that protect our oceans from illegal, unregulated, unlicensed fishing, something that is rapidly depleting the world’s most valuable and essential lifeforms. It’s leading in the innovative use of low-cost satellite constellations to produce ubiquitous remote-sensing data, enabling small business owners to be more profitable and less wasteful. For example, precise timing signals from space are already optimizing transportation of people, goods, and services, with even further gains anticipated with the introduction of artificial intelligence to assist drivers, perhaps even someday replacing them entirely. The non-profit sector is the other side of commercial space, concerned more for the general welfare of society, but every bit as integral to this new space enterprise. Much like every century before it in human history, ours is not without its unique challenges, some of which have been a consequence of the last, and all of which the space data domain can be leveraged to help solve. Examples are endless, but one challenge that this new space community is uniquely well-adapted for is to further inform worldwide resource allocation for the 21st century and beyond. These two primary resources are sustainable water and the materials needed for adequate housing for an ever-increasing human population. As cities and urbanization continue to expand, governmental planning challenges such as transportation design optimization for goods and services are only the beginning. Additionally, through using inexpensive remote sensing technologies, some members are designing space data analytics to mitigate human suffering from plagues, contain outbreaks, and combating illegal poaching. Some are connecting with other non-profits to curtail human trafficking for the sex trade or forced labor for migrant debt repayment. Still others are helping non-governmental organizations in their work to expose the use of children as soldiers. Addressing these challenges has little to do with resuscitating dreams conceived by long deceased science-fiction writers and much more to do with turning “swords back into plowshares” to solve real threats to humanity. Other non-profit initiatives include pursuing an even more foundational understanding of who we are and how to be the best custodians of our environment. Much as exploring and monitoring the world’s oceans has advanced civilization through a better understanding of human life and the planet, so too does exploring and monitoring from space. Low Earth orbit (LEO) provides a unique vantage point to look back on the planet and understand what is happening, anticipate what might happen and prepare for the future. In addition to better understanding Earth, responsible and rapid exploitation of the low Earth orbit domain will enhance the understanding of the solar system and the rest of the universe. Small satellites already offer low-cost platforms to study and explore what lies beyond the Earth. Other members are pioneering the use of zero-carbon, hydrogen-based reusable propulsion systems to ensure we don’t worsen our atmosphere using kerosene-fueled rockets for the coming tsunami of satellite launches. Finally, a mission ensuring the general welfare and planet survival for the next thousand years is finally confronting the existential threat that asteroids and comets pose to humanity. These extra-terrestrial, deep-space threats are passing dangerously close to our planet, and today we have no solar map of them and no defense.

#### Privatized innovation key to increasing data collection

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Data Collection, Processing and SSA Products. Breaking up of the system has enabled each segment to evolve somewhat independently. On the data collection front, there is already an explosion of new sensors through the development of new sites. Countries and companies are also looking for “signals of opportunity” to repurpose existing sensors such as those used for astronomy and atmospheric science research and, for a small investment, utilize them for SSA. Newly added sensors include all types—optical, radar, and radiofrequency (RF). Expecting a growing market for SSA, many private companies have plans to add more radar, RF, and space-based sensors. The fact that the cost of these sensors and their operation is falling, primarily for optical but also potentially for radar, is beneficial for the private sector, which has to raise funds in private markets. However, the trade-off between cost and performance of radar may continue. When properly located, more sensors, even if they are not necessarily exquisite, allow for more persistence— ability to see assets more of the time. Over time, the expansion of sensors would allow data to become more of a commodity (the need for exquisite data for certain applications will always remain) with the value remaining in software systems.

On the processing front, there is growth in the number of systems for creating catalogs and producing more actionable SSA products. Some of the software is open source with the potential to enable faster rates of innovation, although most appears to be proprietary and owned by governments and individual private companies. While most of the development is in the United States, there are pockets of activity in France and Spain, among other countries.

Innovation is not limited just to the counts of sensors or software: there are qualitative changes under way that are likely to improve SSA capabilities. For example, on the sensor front, there are efforts to examine whether optical sensors, which are cheaper, easier to install, and more abundant, can be used to track objects in low Earth orbit (LEO), where most of the growth of space traffic is expected. On the processing front, machine learning and other techniques in the mainstream IT community are increasingly being applied to process data expected to come from the growing number and diverse phenomenologies of sensors (e.g., combining data from optical and radar sensors to create new insights not feasible with just one type of sensor). There is also effort to use large amounts of data to compensate for physics-based models in algorithms (e.g., effect of solar weather), and predict orbits at similar levels of accuracy as with more sophisticated models. As a result, both countries and companies are increasing capabilities.

In the coming years, this innovation—both on the quantity and quality front—would allow for increasingly more (e.g., including covariance information) and better (e.g., smaller error ellipses) SSA information. Given growing capabilities in the private sector, it is also likely that the cost of SSA products could substantially decrease. This innovation could allow other countries to follow different pathways (for example, by leveraging the private sector or developing international partnerships), and leap-frog closer to the expertise level of the United States without the same investment of time and funding. This in turn would allow them to become more equal partners as well as acquire capabilities that are closer to being on par with the United States, with the end result that while the U.S. Government may have the best SSA information in the world, it will not be the only source of SSA information in the world.

#### Satellite advancement and rules of the road stops warming wars from escalating

David Harary 19, Future Tense is a partnership of Slate, New America, and Arizona State University that examines emerging technologies, public policy, and society., 8-13-2019, "If Another Country Blows Up Our Satellites, We’re in Deep Trouble," Slate Magazine, https://slate.com/technology/2019/08/space-militarization-earth-observation-satellites.html

Every corner of our modern lives depends on environmental data from Earth observation satellites. They provide more than 90 percent of the data used by weather prediction models. The availability of much of our most basic resources, especially agriculture and water, now largely relies on meteorological and environmental forecasts made using this information. Today, remote sensing satellites are able to offer scientists data that range from sea surface height to soil moisture content. With this information, farmers can better plan for precipitation and temperature fluctuations, thereby increasing their yield. Businesses and regional planners can mitigate risks of flood zones. Ecologists can monitor the migration of invasive species. Knowing when and how long drought, flooding, extreme weather, or other natural disasters will occur is especially crucial. Timely access to global environmental data and information from satellites help federal, state, and local governments; businesses; nonprofits; and other organizations ensure the security of our property, resources, environment, economy, and lives. The array of instruments onboard the National Oceanic and Atmospheric Administration’s low-Earth orbiting and geostationary orbiting satellites, for example, provide meteorologists with measures of temperature, precipitation, wind speed, and other information they need to predict the strength of hurricanes. Without the dependable downlink and delivery of these data and forecasts, our national security would most certainly be severely hampered. Now, as we enter a new era of space militarization, these environmental satellites are also at risk. They’re clear targets for militaries across the globe. The ramp up for a new satellite arms race started in 2007 when China launched a missile that intentionally obliterated one of its own weather satellites. Since then, Russia and India have also developed, tested, and deployed technologies intended to hack, intercept, sabotage, shoot down, or even physically maneuver out of orbit satellites that provide a wide range of data. The United States and France have already claimed that Russia has spied on their satellites from space. Earth observation is becoming increasingly important as global security threats are more intertwined with deteriorating environmental conditions. So far, there have been no reports of anti-satellite weapons being used against a foreign country. But it seems like a matter of time. As a response to these capabilities, French President Emmanuel Macron recently announced the creation of a French space force that would be able to defend its satellites. It’s not the only one. Today, six countries operate specific military branches for space operations, including Russia’s Aerospace Forces and China’s People’s Liberation Army Strategic Support Force. President Donald Trump’s plan to create a so-called Space Force, which now seems increasingly likely to happen, comes at a period of heightened tension, capability, and risk beyond Earth’s atmosphere. Countries argue they need new military investments to defend assets in space that provide vital economic, environmental, geographic, telecommunications, or intelligence information. The development of these defenses foreshadows the space wars of tomorrow. Imaging satellites, in particular, offer huge advantages to their operators. All-seeing eyes from space are certainly an asset to any military. This makes Earth observation and environmental satellites high-value targets in the context of conflict and war. China’s successful shoot-down of its own weather satellite and attempted hacking of the U.S. weather satellite network in 2014 underscores the strategic importance these satellites have. Worse yet, the 1967 U.N. Outer Space Treaty, which governs the use of space through international law, is out of date. The treaty does not cover modern forms of space weaponization, including ones that threaten satellite infrastructure. Without comprehensive and modern governance and regulations in space, countries are largely free to do as they please without fear of legal repercussions. This is especially worrying when climate-driven insecurity is helping drive conflict and war across the globe. Consistent and timely observation of precipitation, temperature, and vegetation conditions, in particularly volatile and fragile states, can help to proactively manage and mitigate the potential rise of social and political tensions over scarce resources. For example, recent drought has already contributed to significant social and political tension in Central America. The drought has caused more than 2.8 million people in the region to go hungry. Such increased water and food insecurity has helped spark internal territorial conflicts, which have triggered greater migration toward Mexico and the United States. These challenges are only worsened by weak, corrupt, and ineffective governance in the region. The development of such unrest is particularly concerning, as these events can quickly turn deadly and bring about armed conflict. Satellites provide needed data at a scale, resolution, and timeline other data-capturing platforms simply cannot rival. Limiting or knocking out the capabilities these tools have means far worse forecasting abilities. Without this data, countries will be left with the significantly increased risk of improperly handling and managing resource shortages, natural disasters, and possible conflict and migration resulting from insecurity. Fortunately, there are a number of steps Earth observation platforms can take to adequately defend themselves against attacks in space. The most likely and gravest threat to satellite systems is through cyber hacking. Countries that bolster cyber defenses by embedding security in the design, architecture, and production of these systems are therefore best prepared for these risks. However, kinetic, physical and even laser defenses may also be needed as countries develop missiles, robotic arms, and other techniques specifically designed to subvert environmental intelligence gathering. As such, Earth observation satellites that append defensive maneuvering or interception capabilities would be best prepared. Another way to reduce potential physical security risk is to diversify and multiply the quantity of satellite platforms. With the new space race comes significant technological leaps. Most important is perhaps the development of CubesSats, or miniaturized satellites that often pack powerful technology into small cubes. Sensors are getting smaller and propulsion more compact, and with reusable rockets, the overall cost of launching into space is plummeting thanks to startups like Spire, Planet, and SpaceX. The result: exponentially more Earth observation platforms in space. Offensive targeting of many small satellites is much more challenging than targeting one large satellite. Lastly, we need strong multinational governance and greater diplomatic leadership to ensure that, as with the last space race, the international community sets out clear rules and fair practices for the emerging forms of space technology being utilized. Environmental and meteorological forecasting requires a global team effort. International laws and treaties that protect Earth observation assets in space can help provide the assurances they need going forward. In light of Chinese and Russian testing of maneuverable satellites in orbit, the U.S. and Japan have recently sought to develop joint space situational awareness capabilities. Such information-sharing pacts are significant first steps toward building multilateral networks that can defend assets in space. Earth observation is becoming increasingly important as global security threats are more intertwined with deteriorating environmental conditions. Opportunities for mass displacement, civil war, and even greater nuclear proliferation increase as a changing climate fundamentally shifts the geopolitical dynamics that govern countries and their resources. Environmental satellites provide the intelligence and acute warnings needed to mitigate these risks before they occur. Securing these signals in the sky is now more imperative than ever.

#### Climate change is inevitable---it causes nuclear wars that escalates only question is how we manage it

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President Donald Trump may not accept the scientific reality of climate change, but the nation’s senior military leaders recognize that climate disruption is already underway, and they are planning extraordinary measures to prevent it from spiraling into nuclear war. One particularly worrisome scenario is if extreme drought and abnormal monsoon rains devastate agriculture and unleash social chaos in Pakistan, potentially creating an opening for radical Islamists aligned with elements of the armed forces to seize some of the country’s 150 or so nuclear weapons. To avert such a potentially cataclysmic development, the US Joint Special Operations Command has conducted exercises for infiltrating Pakistan and locating the country’s nuclear munitions. Most of the necessary equipment for such raids is already in position at US bases in the region, according to a 2011 report from the nonprofit Nuclear Threat Initiative. “It’s safe to assume that planning for the worst-case scenario regarding Pakistan’s nukes has already taken place inside the US government,” said Roger Cressey, a former deputy director for counterterrorism in Bill Clinton’s and George W. Bush’s administrations in 2011. Such an attack by the United States would be an act of war and would entail enormous risks of escalation, especially since the Pakistani military—the country’s most powerful institution—views the nation’s nuclear arsenal as its most prized possession and would fiercely resist any US attempt to disable it. “These are assets which are the pride of Pakistan, assets which are…guarded by a corps of 18,000 soldiers,” former Pakistani president Pervez Musharraf told NBC News in 2011. The Pakistani military “is not an army which doesn’t know how to fight. This is an army that has fought three wars. Please understand that.” A potential US military incursion in nuclear-armed Pakistan is just one example of a crucial but little-​discussed aspect of international politics in the early 21st century: how the acceleration of climate change and nuclear war planning may make those threats to human survival harder to defuse. At present, the intersections between climate change and nuclear war might not seem obvious. But powerful forces are pushing both threats toward their most destructive outcomes. In the case of climate change, the unbridled emission of carbon dioxide and other greenhouse gases is raising global temperatures to unmistakably dangerous levels. Despite growing worldwide reliance on wind and solar power for energy generation, the global demand for oil and natural gas continues to rise, and carbon emissions are projected to remain on an upward trajectory for the foreseeable future. It is highly unlikely, then, that the increase in average global temperature can be limited to 1.5 degrees Celsius, the aspirational goal adopted by the world’s governments under the Paris Agreement in 2015, or even to 2°C, the actual goal. After that threshold is crossed, scientists agree, it will prove almost impossible to avert catastrophic outcomes, such as the collapse of the Greenland and Antarctic ice sheets and a resulting sea level rise of 6 feet or more. Climbing world temperatures and rising sea levels will diminish the supply of food and water in many resource-deprived areas, increasing the risk of widespread starvation, social unrest, and human flight. Global corn production, for example, is projected to fall by as much as 14 percent in a 2°C warmer world, according to research cited in a 2018 special report by the UN’s Intergovernmental Panel on Climate Change (IPCC). Food scarcity and crop failures risk pushing hundreds of millions of people into overcrowded cities, where the likelihood of pandemics, ethnic strife, and severe storm damage is bound to increase. All of this will impose an immense burden on human institutions. Some states may collapse or break up into a collection of warring chiefdoms—all fighting over sources of water and other vital resources. A similar momentum is now evident in the emerging nuclear arms race, with all three major powers—China, Russia, and the United States—rushing to deploy a host of new munitions. This dangerous process commenced a decade ago, when Russian and Chinese leaders sought improvements to their nuclear arsenals and President Barack Obama, in order to secure Senate approval of the New Strategic Arms Reduction Treaty of 2010, agreed to initial funding for the modernization of all three legs of America’s strategic triad, which encompasses submarines, intercontinental ballistic missiles, and bombers. (New START, which mandated significant reductions in US and Russian arsenals, will expire in February 2021 unless renewed by the two countries.) Although Obama initiated the modernization of the nuclear triad, the Trump administration has sought funds to proceed with their full-scale production, at an estimated initial installment of $500 billion over 10 years. Even during the initial modernization program of the Obama era, Russian and Chinese leaders were sufficiently alarmed to hasten their own nuclear acquisitions. Both countries were already in the process of modernizing their stockpiles—Russia to replace Cold War–era systems that had become unreliable, China to provide its relatively small arsenal with enhanced capabilities. Trump’s decision to acquire a whole new suite of ICBMs, nuclear-armed submarines, and bombers has added momentum to these efforts. And with all three major powers upgrading their arsenals, the other nuclear-weapon states—led by India, Pakistan, and North Korea—have been expanding their stockpiles as well. Moreover, with Trump’s recent decision to abandon the Intermediate-Range Nuclear Forces (INF) Treaty, all major powers are developing missile delivery systems for a regional nuclear war such as might erupt in Europe, South Asia, or the western Pacific. All things being equal, rising temperatures will increase the likelihood of nuclear war, largely because climate change will heighten the risk of social stress, the decay of nation-states, and armed violence in general, as I argue in my new book, All Hell Breaking Loose. As food and water supplies dwindle and governments come under ever-increasing pressure to meet the vital needs of their populations, disputes over critical resources are likely to become more heated and violent, whether the parties involved have nuclear arms or not. But this danger is compounded by the possibility that several nuclear-armed powers—notably India, Pakistan, and China—will break apart as a result of climate change and accompanying battles over disputed supplies of water. Together, these three countries are projected by the UN Population Division to number approximately 3.4 billion people in 2050, or 34 percent of the world’s population. Yet they possess a much smaller share of the world’s freshwater supplies, and climate change is destined to reduce what they have even further. Warmer temperatures are also expected to diminish crop yields in these countries, adding to the desperation of farmers and very likely resulting in widespread ethnic strife and population displacement. Under these circumstances, climate-related internal turmoil would increase the risk of nuclear war in two ways: by enabling the capture of nuclear arms by rogue elements of the military and their possible use against perceived enemies and by inciting wars between these states over vital supplies of water and other critical resources.

#### Independently, the commercial space industry spurs technological innovation

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The size of the space economy is far larger than many may think. In 2015 alone, the global market amounted to $323 billion. Commercial infrastructure and systems accounted for 76 percent of that 9 total, with satellite television the largest subsection at $95 billion. The global space launch market’s 10 11 share of that total came in at $6 billion dollars. It can be hard to disaggregate how space benefits 12 particular national economies, but in 2009 (the last available report), the Federal Aviation Administration (FAA) estimated that commercial space transportation and enabled industries generated $208.3 billion in economic activity in the United States alone. Space is not just about 13 satellite television and global transportation; while not commercial, GPS satellites also underpin personal navigation, such as smartphone GPS use, and timing data used for Internet coordination.14 Without that data, there could be problems for a range of Internet and cloud-based services.15

There is also room for growth. The FAA has noted that while the commercial launch sector has not grown dramatically in the last decade, there are indications that there is latent demand. This 16 demand may catalyze an increase in launches and growth of the wider space economy in the next decade. The Satellite Industry Association’s 2015 report highlighted that their section of the space economy outgrew both the American and global economies. The FAA anticipates that growth to 17 continue, with expectations that small payload launch will be a particular industry driver.18

In the future, emerging space industries may contribute even more the American economy. Space tourism and resource recovery—e.g., mining on planets, moons , and asteroids—in particular may become large parts of that industry. Of course, their viability rests on a range of factors, including costs, future regulation, international problems, and assumptions about technological development. However, there is increasing optimism in these areas of economic production. But the space economy is not just about what happens in orbit, or how that alters life on the ground. The growth of this economy can also contribute to new innovations across all walks of life.

Technological Innovation

Innovation is generally hard to predict; some new technologies seem to come out of nowhere and others only take off when paired with a new application. It is difficult to predict the future, but it is reasonable to expect that a growing space economy would open opportunities for technological and organizational innovation.

In terms of technology, the difficult environment of outer space helps incentivize progress along the margins. Because each object launched into orbit costs a significant amount of money—at the moment between $27,000 and $43,000 per pound, though that will likely drop in the future —each 19 reduction in payload size saves money or means more can be launched. At the same time, the ability to fit more capability into a smaller satellite opens outer space to actors that previously were priced out of the market. This is one of the reasons why small, affordable satellites are increasingly pursued by companies or organizations that cannot afford to launch larger traditional satellites. These small 20 satellites also provide non-traditional launchers, such as engineering students or prototypers, the opportunity to learn about satellite production and test new technologies before working on a full-sized satellite. That expansion of developers, experimenters, and testers cannot but help increase innovation opportunities.

Technological developments from outer space have been applied to terrestrial life since the earliest days of space exploration. The National Aeronautics and Space Administration (NASA) maintains a website that lists technologies that have spun off from such research projects. Lightweight 21 nanotubes, useful in protecting astronauts during space exploration, are now being tested for applications in emergency response gear and electrical insulation. The need for certainty about the resiliency of materials used in space led to the development of an analytics tool useful across a range of industries. Temper foam, the material used in memory-foam pillows, was developed for NASA for seat covers. As more companies pursue their own space goals, more innovations will likely come from the commercial sector.

Outer space is not just a catalyst for technological development. Satellite constellations and their unique line-of-sight vantage point can provide new perspectives to old industries. Deploying satellites into low-Earth orbit, as Facebook wants to do, can connect large, previously-unreached swathes of 22 humanity to the Internet. Remote sensing technology could change how whole industries operate, such as crop monitoring, herd management, crisis response, and land evaluation, among others. 23 While satellites cannot provide all essential information for some of these industries, they can fill in some useful gaps and work as part of a wider system of tools. Space infrastructure, in helping to change how people connect and perceive Earth, could help spark innovations on the ground as well. These innovations, changes to global networks, and new opportunities could lead to wider economic growth.

### Off 3

#### Current business sentiment promises a slow and steady recovery.

Dr. Mark Zandi 11/15, PhD from UPenn, economist, and director of economic research at Moody’s Analytics, 11/15/21, “Moody's Analytics Survey of Business Confidence,” <https://www.economy.com/economicview/indicator/usa_dsbc/5C438EAA-8AA1-484E-8931-62208FCACE22>, cc

Abstracting from the weekly ups and downs of responses to the global business survey, business sentiment remains stuck consistent with a slowly recovering global economy. Most encouraging, more than one-third of respondents to the survey say present business conditions are improving and more than half say their sales are strengthening. Hiring and investment intentions aren’t as strong, but they are much improved since the dark days of the pandemic. Demand for office space remains depressed, inventory accumulation is weak, and though financial conditions are good, they aren’t as good as they were prior to the pandemic.

#### **Consistent space regulations are key to business confidence**

Christensen ND [Ian Christensen is a Project Manager at Secure World Foundation, and has eight years of experience as a consultant and analyst focused on international and domestic commercial space, satellite, and aviation markets. "Building Confidence and Reducing Risk in Space Resources Policy," Room, The Space Journal, https://room.eu.com/article/building-confidence-and-reducing-risk-in-space-resources-policy]/ISEE

Like most areas of economic activity, space resource utilisation business plans are based upon the ability to access a resource, produce a product, service, or goods based from the resource, and produce revenue from that product based on established market activities. An economic system requires a level of regulation and oversight to ensure it functions. Regulation and governmental oversight is part of an overall market framework that provides stability and confidence in validity for commercial entities and those that invest in them. Just as the commercial companies are in the initial stages of developing and validating hardware, governments have begun to establish regulatory and policy frameworks.

#### Business confidence is tied to economic growth

Sarah Chaney Cambon 21, Reporter on The Wall Street Journal's Economics Team, BA in Business Journalism from the University of North Carolina-Chapel Hill, “Capital-Spending Surge Further Lifts Economic Recovery”, Wall Street Journal, 6/27/2021, https://www.wsj.com/articles/capital-spending-surge-further-lifts-economic-recovery-11624798800

Business investment is emerging as a powerful source of U.S. economic growth that will likely help sustain the recovery.

Companies are ramping up orders for computers, machinery and software as they grow more confident in the outlook.

Nonresidential fixed investment, a proxy for business spending, rose at a seasonally adjusted annual rate of 11.7% in the first quarter, led by growth in software and tech-equipment spending, according to the Commerce Department. Business investment also logged double-digit gains in the third and fourth quarters last year after falling during pandemic-related shutdowns. It is now higher than its pre-pandemic peak.

Orders for nondefense capital goods excluding aircraft, another measure for business investment, are near the highest levels for records tracing back to the 1990s, separate Commerce Department figures show.

“Business investment has really been an important engine powering the U.S. economic recovery,” said Robert Rosener, senior U.S. economist at Morgan Stanley. “In our outlook for the economy, it’s certainly one of the bright spots.”

Consumer spending, which accounts for about two-thirds of economic output, is driving the early stages of the recovery. Americans, flush with savings and government stimulus checks, are spending more on goods and services, which they shunned for much of the pandemic.

Robust capital investment will be key to ensuring that the recovery maintains strength after the spending boost from fiscal stimulus and business reopenings eventually fades, according to some economists.

Rising business investment helps fuel economic output. It also lifts worker productivity, or output per hour. That metric grew at a sluggish pace throughout the last economic expansion but is now showing signs of resurgence.

The recovery in business investment is shaping up to be much stronger than in the years following the 2007-09 recession. “The events especially in late ’08, early ’09 put a lot of businesses really close to the edge,” said Phil Suttle, founder of Suttle Economics. “I think a lot of them said, ‘We’ve just got to be really cautious for a long while.’”

Businesses appear to be less risk-averse now, he said.

After the financial crisis, businesses grew by adding workers, rather than investing in capital. Hiring was more attractive than capital spending because labor was abundant and relatively cheap. Now the supply of workers is tight. Companies are raising pay to lure employees. As a result, many firms have more incentive to grow by investing in capital.

Economists at Morgan Stanley predict that U.S. capital spending will rise to 116% of prerecession levels after three years. By comparison, investment took 10 years to reach those levels once the 2007-09 recession hit.

Company executives are increasingly confident in the economy’s trajectory. The Business Roundtable’s economic-outlook index—a composite of large companies’ plans for hiring and spending, as well as sales projections—increased by nine points in the second quarter to 116, just below 2018’s record high, according to a survey conducted between May 25 and June 9. In the second quarter, the share of companies planning to boost capital investment increased to 59% from 57% in the first.

“We’re seeing really strong reopening demand, and a lot of times capital investment follows that,” said Joe Song, senior U.S. economist at BofA Securities.

Mr. Song added that less uncertainty regarding trade tensions between the U.S. and China should further underpin business confidence and investment. “At the very least, businesses will understand the strategy that the Biden administration is trying to follow and will be able to plan around that,” he said.

#### Decline cascades---nuclear war

Dr. Mathew Maavak 21, PhD in Risk Foresight from the Universiti Teknologi Malaysia, External Researcher (PLATBIDAFO) at the Kazimieras Simonavicius University, Expert and Regular Commentator on Risk-Related Geostrategic Issues at the Russian International Affairs Council, “Horizon 2030: Will Emerging Risks Unravel Our Global Systems?”, Salus Journal – The Australian Journal for Law Enforcement, Security and Intelligence Professionals, Volume 9, Number 1, p. 2-8

Various scholars and institutions regard global social instability as the greatest threat facing this decade. The catalyst has been postulated to be a Second Great Depression which, in turn, will have profound implications for global security and national integrity. This paper, written from a broad systems perspective, illustrates how emerging risks are getting more complex and intertwined; blurring boundaries between the economic, environmental, geopolitical, societal and technological taxonomy used by the World Economic Forum for its annual global risk forecasts. Tight couplings in our global systems have also enabled risks accrued in one area to snowball into a full-blown crisis elsewhere. The COVID-19 pandemic and its socioeconomic fallouts exemplify this systemic chain-reaction. Onceinexorable forces of globalization are rupturing as the current global system can no longer be sustained due to poor governance and runaway wealth fractionation. The coronavirus pandemic is also enabling Big Tech to expropriate the levers of governments and mass communications worldwide. This paper concludes by highlighting how this development poses a dilemma for security professionals.

Key Words: Global Systems, Emergence, VUCA, COVID-9, Social Instability, Big Tech, Great Reset

INTRODUCTION

The new decade is witnessing rising volatility across global systems. Pick any random “system” today and chart out its trajectory: Are our education systems becoming more robust and affordable? What about food security? Are our healthcare systems improving? Are our pension systems sound? Wherever one looks, there are dark clouds gathering on a global horizon marked by volatility, uncertainty, complexity and ambiguity (VUCA).

But what exactly is a global system? Our planet itself is an autonomous and selfsustaining mega-system, marked by periodic cycles and elemental vagaries. Human activities within however are not system isolates as our banking, utility, farming, healthcare and retail sectors etc. are increasingly entwined. Risks accrued in one system may cascade into an unforeseen crisis within and/or without (Choo, Smith & McCusker, 2007). Scholars call this phenomenon “emergence”; one where the behaviour of intersecting systems is determined by complex and largely invisible interactions at the substratum (Goldstein, 1999; Holland, 1998).

The ongoing COVID-19 pandemic is a case in point. While experts remain divided over the source and morphology of the virus, the contagion has ramified into a global health crisis and supply chain nightmare. It is also tilting the geopolitical balance. China is the largest exporter of intermediate products, and had generated nearly 20% of global imports in 2015 alone (Cousin, 2020). The pharmaceutical sector is particularly vulnerable. Nearly “85% of medicines in the U.S. strategic national stockpile” sources components from China (Owens, 2020).

An initial run on respiratory masks has now been eclipsed by rowdy queues at supermarkets and the bankruptcy of small businesses. The entire global population – save for major pockets such as Sweden, Belarus, Taiwan and Japan – have been subjected to cyclical lockdowns and quarantines. Never before in history have humans faced such a systemic, borderless calamity.

COVID-19 represents a classic emergent crisis that necessitates real-time response and adaptivity in a real-time world, particularly since the global Just-in-Time (JIT) production and delivery system serves as both an enabler and vector for transboundary risks. From a systems thinking perspective, emerging risk management should therefore address a whole spectrum of activity across the economic, environmental, geopolitical, societal and technological (EEGST) taxonomy. Every emerging threat can be slotted into this taxonomy – a reason why it is used by the World Economic Forum (WEF) for its annual global risk exercises (Maavak, 2019a). As traditional forces of globalization unravel, security professionals should take cognizance of emerging threats through a systems thinking approach.

METHODOLOGY

An EEGST sectional breakdown was adopted to illustrate a sampling of extreme risks facing the world for the 2020-2030 decade. The transcendental quality of emerging risks, as outlined on Figure 1, below, was primarily informed by the following pillars of systems thinking (Rickards, 2020):

• Diminishing diversity (or increasing homogeneity) of actors in the global system (Boli & Thomas, 1997; Meyer, 2000; Young et al, 2006);

• Interconnections in the global system (Homer-Dixon et al, 2015; Lee & Preston, 2012);

• Interactions of actors, events and components in the global system (Buldyrev et al, 2010; Bashan et al, 2013; Homer-Dixon et al, 2015); and

• Adaptive qualities in particular systems (Bodin & Norberg, 2005; Scheffer et al, 2012) Since scholastic material on this topic remains somewhat inchoate, this paper buttresses many of its contentions through secondary (i.e. news/institutional) sources.

ECONOMY

According to Professor Stanislaw Drozdz (2018) of the Polish Academy of Sciences, “a global financial crash of a previously unprecedented scale is highly probable” by the mid- 2020s. This will lead to a trickle-down meltdown, impacting all areas of human activity.

The economist John Mauldin (2018) similarly warns that the “2020s might be the worst decade in US history” and may lead to a Second Great Depression. Other forecasts are equally alarming. According to the International Institute of Finance, global debt may have surpassed $255 trillion by 2020 (IIF, 2019). Yet another study revealed that global debts and liabilities amounted to a staggering $2.5 quadrillion (Ausman, 2018). The reader should note that these figures were tabulated before the COVID-19 outbreak.

The IMF singles out widening income inequality as the trigger for the next Great Depression (Georgieva, 2020). The wealthiest 1% now own more than twice as much wealth as 6.9 billion people (Coffey et al, 2020) and this chasm is widening with each passing month. COVID-19 had, in fact, boosted global billionaire wealth to an unprecedented $10.2 trillion by July 2020 (UBS-PWC, 2020). Global GDP, worth $88 trillion in 2019, may have contracted by 5.2% in 2020 (World Bank, 2020).

As the Greek historian Plutarch warned in the 1st century AD: “An imbalance between rich and poor is the oldest and most fatal ailment of all republics” (Mauldin, 2014). The stability of a society, as Aristotle argued even earlier, depends on a robust middle element or middle class. At the rate the global middle class is facing catastrophic debt and unemployment levels, widespread social disaffection may morph into outright anarchy (Maavak, 2012; DCDC, 2007).

Economic stressors, in transcendent VUCA fashion, may also induce radical geopolitical realignments. Bullions now carry more weight than NATO’s security guarantees in Eastern Europe. After Poland repatriated 100 tons of gold from the Bank of England in 2019, Slovakia, Serbia and Hungary quickly followed suit.

According to former Slovak Premier Robert Fico, this erosion in regional trust was based on historical precedents – in particular the 1938 Munich Agreement which ceded Czechoslovakia’s Sudetenland to Nazi Germany. As Fico reiterated (Dudik & Tomek, 2019):

“You can hardly trust even the closest allies after the Munich Agreement… I guarantee that if something happens, we won’t see a single gram of this (offshore-held) gold. Let’s do it (repatriation) as quickly as possible.” (Parenthesis added by author).

President Aleksandar Vucic of Serbia (a non-NATO nation) justified his central bank’s gold-repatriation program by hinting at economic headwinds ahead: “We see in which direction the crisis in the world is moving” (Dudik & Tomek, 2019). Indeed, with two global Titanics – the United States and China – set on a collision course with a quadrillions-denominated iceberg in the middle, and a viral outbreak on its tip, the seismic ripples will be felt far, wide and for a considerable period.

A reality check is nonetheless needed here: Can additional bullions realistically circumvallate the economies of 80 million plus peoples in these Eastern European nations, worth a collective $1.8 trillion by purchasing power parity? Gold however is a potent psychological symbol as it represents national sovereignty and economic reassurance in a potentially hyperinflationary world. The portents are clear: The current global economic system will be weakened by rising nationalism and autarkic demands. Much uncertainty remains ahead. Mauldin (2018) proposes the introduction of Old Testament-style debt jubilees to facilitate gradual national recoveries. The World Economic Forum, on the other hand, has long proposed a “Great Reset” by 2030; a socialist utopia where “you’ll own nothing and you’ll be happy” (WEF, 2016).

In the final analysis, COVID-19 is not the root cause of the current global economic turmoil; it is merely an accelerant to a burning house of cards that was left smouldering since the 2008 Great Recession (Maavak, 2020a). We also see how the four main pillars of systems thinking (diversity, interconnectivity, interactivity and “adaptivity”) form the mise en scene in a VUCA decade.

ENVIRONMENTAL

What happens to the environment when our economies implode? Think of a debt-laden workforce at sensitive nuclear and chemical plants, along with a concomitant surge in industrial accidents? Economic stressors, workforce demoralization and rampant profiteering – rather than manmade climate change – arguably pose the biggest threats to the environment. In a WEF report, Buehler et al (2017) made the following pre-COVID-19 observation:

The ILO estimates that the annual cost to the global economy from accidents and work-related diseases alone is a staggering $3 trillion. Moreover, a recent report suggests the world’s 3.2 billion workers are increasingly unwell, with the vast majority facing significant economic insecurity: 77% work in part-time, temporary, “vulnerable” or unpaid jobs.

Shouldn’t this phenomenon be better categorized as a societal or economic risk rather than an environmental one? In line with the systems thinking approach, however, global risks can no longer be boxed into a taxonomical silo. Frazzled workforces may precipitate another Bhopal (1984), Chernobyl (1986), Deepwater Horizon (2010) or Flint water crisis (2014). These disasters were notably not the result of manmade climate change. Neither was the Fukushima nuclear disaster (2011) nor the Indian Ocean tsunami (2004). Indeed, the combustion of a long-overlooked cargo of 2,750 tonnes of ammonium nitrate had nearly levelled the city of Beirut, Lebanon, on Aug 4 2020. The explosion left 204 dead; 7,500 injured; US$15 billion in property damages; and an estimated 300,000 people homeless (Urbina, 2020). The environmental costs have yet to be adequately tabulated.

Environmental disasters are more attributable to Black Swan events, systems breakdowns and corporate greed rather than to mundane human activity.

Our JIT world aggravates the cascading potential of risks (Korowicz, 2012). Production and delivery delays, caused by the COVID-19 outbreak, will eventually require industrial overcompensation. This will further stress senior executives, workers, machines and a variety of computerized systems. The trickle-down effects will likely include substandard products, contaminated food and a general lowering in health and safety standards (Maavak, 2019a). Unpaid or demoralized sanitation workers may also resort to indiscriminate waste dumping. Many cities across the United States (and elsewhere in the world) are no longer recycling wastes due to prohibitive costs in the global corona-economy (Liacko, 2021).

Even in good times, strict protocols on waste disposals were routinely ignored. While Sweden championed the global climate change narrative, its clothing flagship H&M was busy covering up toxic effluences disgorged by vendors along the Citarum River in Java, Indonesia. As a result, countless children among 14 million Indonesians straddling the “world’s most polluted river” began to suffer from dermatitis, intestinal problems, developmental disorders, renal failure, chronic bronchitis and cancer (DW, 2020). It is also in cauldrons like the Citarum River where pathogens may mutate with emergent ramifications.

On an equally alarming note, depressed economic conditions have traditionally provided a waste disposal boon for organized crime elements. Throughout 1980s, the Calabriabased ‘Ndrangheta mafia – in collusion with governments in Europe and North America – began to dump radioactive wastes along the coast of Somalia. Reeling from pollution and revenue loss, Somali fisherman eventually resorted to mass piracy (Knaup, 2008).

The coast of Somalia is now a maritime hotspot, and exemplifies an entwined form of economic-environmental-geopolitical-societal emergence. In a VUCA world, indiscriminate waste dumping can unexpectedly morph into a Black Hawk Down incident. The laws of unintended consequences are governed by actors, interconnections, interactions and adaptations in a system under study – as outlined in the methodology section.

Environmentally-devastating industrial sabotages – whether by disgruntled workers, industrial competitors, ideological maniacs or terrorist groups – cannot be discounted in a VUCA world. Immiserated societies, in stark defiance of climate change diktats, may resort to dirty coal plants and wood stoves for survival. Interlinked ecosystems, particularly water resources, may be hijacked by nationalist sentiments. The environmental fallouts of critical infrastructure (CI) breakdowns loom like a Sword of Damocles over this decade.

GEOPOLITICAL

The primary catalyst behind WWII was the Great Depression. Since history often repeats itself, expect familiar bogeymen to reappear in societies roiling with impoverishment and ideological clefts. Anti-Semitism – a societal risk on its own – may reach alarming proportions in the West (Reuters, 2019), possibly forcing Israel to undertake reprisal operations inside allied nations. If that happens, how will affected nations react? Will security resources be reallocated to protect certain minorities (or the Top 1%) while larger segments of society are exposed to restive forces? Balloon effects like these present a classic VUCA problematic.

Contemporary geopolitical risks include a possible Iran-Israel war; US-China military confrontation over Taiwan or the South China Sea; North Korean proliferation of nuclear and missile technologies; an India-Pakistan nuclear war; an Iranian closure of the Straits of Hormuz; fundamentalist-driven implosion in the Islamic world; or a nuclear confrontation between NATO and Russia. Fears that the Jan 3 2020 assassination of Iranian Maj. Gen. Qasem Soleimani might lead to WWIII were grossly overblown. From a systems perspective, the killing of Soleimani did not fundamentally change the actor-interconnection-interaction adaptivity equation in the Middle East. Soleimani was simply a cog who got replaced.

## Case

### Framing

#### Extinction categorically outweighs every other impact – we concede util

### Emissions Contention

#### Turn – private entities put geospatial satellite data collection in space which helps the environment

#### The notion that rockets are the root cause of warming is a bad model – like alt causes china, rmissions etc. all prove that rockets aren’t uqly key

#### No climate impact

Amber Kerr et al. 19 (Amber Kerr is an agroecologist with a PhD from UC Berkeley, and was the coordinator of the USDA California Climate Hub, based at the University of California, Davis, Daniel Swain is a Climate Scientist at UCLA, Andrew King is a lecturer in Climate Science and ARC DECRA fellow at the School of Earth Sciences and ARC Centre of Excellence for Climate Extremes, University of Melbourne, Peter Kalmus is an American climate scientist and data scientist at NASA's Jet Propulsion Laboratory, Richard Bettis is Chair in Climate Impacts at the University of Exeter and Head of Climate Impacts in the Met Office Hadley Centre, 6/4/19, accessed 11/17/21, “Claim that human civilization could end in 30 years is speculative, not supported with evidence”, https://climatefeedback.org/evaluation/iflscience-story-on-speculative-report-provides-little-scientific-context-james-felton/)AGabay

There is no scientific basis to suggest that climate **breakdown will** “annihilate intelligent **life**” (by which I assume the report authors mean **human** **extinction**) by 2050. However, climate breakdown does pose a grave threat to civilization as we know it, and the potential for mass suffering on a scale perhaps never before encountered by humankind. This should be enough reason for action without any need for exaggeration or misrepresentation! A “Hothouse Earth” scenario plays out that sees Earth’s temperatures doomed to rise by a further 1°C (1.8°F) even if we stopped emissions immediately. Peter Kalmus, Data Scientist, Jet Propulsion Laboratory This word choice perhaps reveals a bias on the part of the author of the article. A temperature can’t be doomed. And while I certainly do not encourage false optimism, assuming that humanity is doomed is **lazy** and counterproductive. Fifty-five percent of the global population are subject to more than 20 days a year of lethal heat conditions beyond that which humans can **survive** Richard Betts, Professor, Met Office Hadley Centre & University of Exeter: This is clearly from Mora et al (2017) although the report does not include a citation of the paper as the source of that statement. The way it is written here (and in the report) is misleading because it gives the impression that everyone dies in those conditions. That is not actually how Mora et al define “deadly heat” – they merely looked for heatwaves when somebody died (not everybody) and then used that as the definition of a “deadly” heatwave. North America suffers extreme weather events including wildfires, drought, and heatwaves. Monsoons in China fail, the great rivers of Asia virtually dry up, and rainfall in central America falls by half. Andrew King, Research fellow, University of Melbourne: Projections of extreme events such as these are very difficult to make and **vary greatly** between differentclimate **models**. Deadly heat conditions across West Africa persist for over **100 days a year** Peter Kalmus, Data Scientist, Jet Propulsion Laboratory: The deadly heat projections (this, and the one from the previous paragraph) come from Mora et al (2017)1. It should be clarified that “deadly heat” here means heat and humidity beyond a two-dimension threshold where at least one person in the region subject to that heat and humidity dies (i.e., not everyone instantly dies). That said, in my opinion, the projections in Mora et al are conservative and the methods of Mora et al are sound. I did not check the claims in this report against Mora et al but I have no reason to think they are in error. 1- Mora et al (2017) Global risk of deadly heat, Nature Climate Change The knock-on consequences affect national security, as the scale of the challenges involved, such as pandemic disease outbreaks, are overwhelming. Armed conflicts over resources may become a reality, and have the potential to escalate into nuclear war. In the worst case scenario, a scale of destruction the authors say is beyond their capacity to model, there is a ‘high likelihood of human civilization coming to an end’. Willem Huiskamp, Postdoctoral research fellow, Potsdam Institute for Climate Impact Research: This is a highly questionable conclusion. The reference provided in the report is for the “Global Catastrophic Risks 2018” report from the “Global Challenges Foundation” and not peer-reviewed literature. (It is worth noting that this latter report also provides no peer-reviewed evidence to support this claim). Furthermore, if it is apparently beyond our capability to model these impacts, how can they assign a ‘high likelihood’ to this outcome? While it is true that warming of this magnitude would be catastrophic, making claims such as this without evidence serves only to undermine the trust the public will have in the science. Daniel Swain, Climate Scientist, University of California, Los Angeles: It seems that the eye-catching headline-level claims in the report stem almost entirely from these **knock-on effects**, which the authors themselves admit are “beyond their **capacity** to **model**.” Thus, from a scientific perspective, the purported “high likelihood of civilization coming to an end by 2050” is essentially personal **speculation** on the part of the report’s authors, rather than a clear conclusion drawn from **rigorous assessment** of the available **evidence**.

### Space Capitalism

#### Counterplan solves – ptd establishes a stable space regulatory regime

#### Tech solves any impact- - space junk clean up, ssa etc. all prove

#### Cross apply from innovation --- space capitalism good k2 long term sustainability --- anything else cedes the use

This card is just in the context of the US