### Util Off

#### The standard is maximizing expected wellbeing. Prefer it:

#### No intent-foresight distinction – If we foresee a consequence, then it becomes part of our deliberation which makes it intrinsic to our action since we intend it to happen.

#### Extinction comes first – it’s the worst of all evils

Baum and Barrett 18 - Seth D. Baum & Anthony M. Barrett, Global Catastrophic Risk Institute. 2018. “Global Catastrophes: The Most Extreme Risks.” Risk in Extreme Environments: Preparing, Avoiding, Mitigating, and Managing, edited by Vicki Bier, Routledge, pp. 174–184.

What Is GCR And Why Is It Important? Taken literally, a global catastrophe can be any event that is in some way catastrophic across the globe. This suggests a rather low threshold for what counts as a global catastrophe. An event causing just one death on each continent (say, from a jet-setting assassin) could rate as a global catastrophe, because surely these deaths would be catastrophic for the deceased and their loved ones. However, in common usage, a global catastrophe would be catastrophic for a significant portion of the globe. Minimum thresholds have variously been set around ten thousand to ten million deaths or $10 billion to $10 trillion in damages (Bostrom and Ćirković 2008), or death of one quarter of the human population (Atkinson 1999; Hempsell 2004). Others have emphasized catastrophes that cause long-term declines in the trajectory of human civilization (Beckstead 2013), that human civilization does not recover from (Maher and Baum 2013), that drastically reduce humanity’s potential for future achievements (Bostrom 2002, using the term “existential risk”), or that result in human extinction (Matheny 2007; Posner 2004). A common theme across all these treatments of GCR is that some catastrophes are vastly more important than others. Carl Sagan was perhaps the first to recognize this, in his commentary on nuclear winter (Sagan 1983). Without nuclear winter, a global nuclear war might kill several hundred million people. This is obviously a major catastrophe, but humanity would presumably carry on. However, with nuclear winter, per Sagan, humanity could go extinct. The loss would be not just an additional four billion or so deaths, but the loss of all future generations. To paraphrase Sagan, the loss would be billions and billions of lives, or even more. Sagan estimated 500 trillion lives, assuming humanity would continue for ten million more years, which he cited as typical for a successful species. Sagan’s 500 trillion number may even be an underestimate. The analysis here takes an adventurous turn, hinging on the evolution of the human species and the long-term fate of the universe. On these long time scales, the descendants of contemporary humans may no longer be recognizably “human”. The issue then is whether the descendants are still worth caring about, whatever they are. If they are, then it begs the question of how many of them there will be. Barring major global catastrophe, Earth will remain habitable for about one billion more years 2 until the Sun gets too warm and large. The rest of the Solar System, Milky Way galaxy, universe, and (if it exists) the multiverse will remain habitable for a lot longer than that (Adams and Laughlin 1997), should our descendants gain the capacity to migrate there. An open question in astronomy is whether it is possible for the descendants of humanity to continue living for an infinite length of time or instead merely an astronomically large but finite length of time (see e.g. Ćirković 2002; Kaku 2005). Either way, the stakes with global catastrophes could be much larger than the loss of 500 trillion lives. Debates about the infinite vs. the merely astronomical are of theoretical interest (Ng 1991; Bossert et al. 2007), but they have limited practical significance. This can be seen when evaluating GCRs from a standard risk-equals-probability-times-magnitude framework. Using Sagan’s 500 trillion lives estimate, it follows that reducing the probability of global catastrophe by a mere one-in-500-trillion chance is of the same significance as saving one human life. Phrased differently, society should try 500 trillion times harder to prevent a global catastrophe than it should to save a person’s life. Or, preventing one million deaths is equivalent to a one-in500-million reduction in the probability of global catastrophe. This suggests society should make extremely large investment in GCR reduction, at the expense of virtually all other objectives. Judge and legal scholar Richard Posner made a similar point in monetary terms (Posner 2004). Posner used $50,000 as the value of a statistical human life (VSL) and 12 billion humans as the total loss of life (double the 2004 world population); he describes both figures as significant underestimates. Multiplying them gives $600 trillion as an underestimate of the value of preventing global catastrophe. For comparison, the United States government typically uses a VSL of around one to ten million dollars (Robinson 2007). Multiplying a $10 million VSL with 500 trillion lives gives $5x1021 as the value of preventing global catastrophe. But even using “just" $600 trillion, society should be willing to spend at least that much to prevent a global catastrophe, which converts to being willing to spend at least $1 million for a one-in-500-million reduction in the probability of global catastrophe. Thus while reasonable disagreement exists on how large of a VSL to use and how much to count future generations, even low-end positions suggest vast resource allocations should be redirected to reducing GCR. This conclusion is only strengthened when considering the astronomical size of the stakes, but the same point holds either way. The bottom line is that, as long as something along the lines of the standard riskequals-probability-times-magnitude framework is being used, then even tiny GCR reductions merit significant effort. This point holds especially strongly for risks of catastrophes that would cause permanent harm to global human civilization. The discussion thus far has assumed that all human lives are valued equally. This assumption is not universally held. People often value some people more than others, favoring themselves, their family and friends, their compatriots, their generation, or others whom they identify with. Great debates rage on across moral philosophy, economics, and other fields about how much people should value others who are distant in space, time, or social relation, as well as the unborn members of future generations. This debate is crucial for all valuations of risk, including GCR. Indeed, if each of us only cares about our immediate selves, then global catastrophes may not be especially important, and we probably have better things to do with our time than worry about them. While everyone has the right to their own views and feelings, we find that the strongest arguments are for the widely held position that all human lives should be valued equally. This position is succinctly stated in the United States Declaration of Independence, updated in the 1848 Declaration of Sentiments: “We hold these truths to be self-evident: that all men and 3 women are created equal”. Philosophers speak of an agent-neutral, objective “view from nowhere” (Nagel 1986) or a “veil of ignorance” (Rawls 1971) in which each person considers what is best for society irrespective of which member of society they happen to be. Such a perspective suggests valuing everyone equally, regardless of who they are or where or when they live. This in turn suggests a very high value for reducing GCR, or a high degree of priority for GCR reduction efforts.

#### Non util ethics are impossible

Greene 07 – Joshua, Associate Professor of Social science in the Department of Psychology at Harvard University (The Secret Joke of Kant’s Soul published in Moral Psychology: Historical and Contemporary Readings, accessed: <https://www.gwern.net/docs/philosophy/ethics/2007-greene.pdf>, pages 47-50)

**What turn-of-the-millennium science** **is telling us is that human moral judgment is not a pristine rational enterprise**, that our **moral judgments are driven by a hodgepodge of emotional dispositions, which themselves were shaped by a hodgepodge of evolutionary forces, both biological and cultural**. **Because of this, it is exceedingly unlikely that there is any rationally coherent normative moral theory that can accommodate our moral intuitions**. Moreover, **anyone who claims to have such a theory**, or even part of one, **almost certainly doesn't**. Instead, what that person probably has is a moral rationalization. It seems then, that we have somehow crossed the infamous "is"-"ought" divide. How did this happen? Didn't Hume (Hume, 1978) and Moore (Moore, 1966) warn us against trying to derive an "ought" from and "is?" How did we go from descriptive scientific theories concerning moral psychology to skepticism about a whole class of normative moral theories? The answer is that we did not, as Hume and Moore anticipated, attempt to derive an "ought" from and "is." That is, our method has been inductive rather than deductive. We have inferred on the basis of the available evidence that the phenomenon of rationalist deontological philosophy is best explained as a rationalization of evolved emotional intuition (Harman, 1977). Missing the Deontological Point I suspect that **rationalist deontologists will remain unmoved by the arguments presented here**. Instead, I suspect, **they** **will insist that I have simply misunderstood what** Kant and like-minded **deontologists are all about**. **Deontology, they will say, isn't about this intuition or that intuition**. It's not defined by its normative differences with consequentialism. **Rather, deontology is about taking humanity seriously**. Above all else, it's about respect for persons. It's about treating others as fellow rational creatures rather than as mere objects, about acting for reasons rational beings can share. And so on (Korsgaard, 1996a; Korsgaard, 1996b). **This is, no doubt, how many deontologists see deontology. But this insider's view**, as I've suggested, **may be misleading**. **The problem**, more specifically, **is that it defines deontology in terms of values that are not distinctively deontological**, though they may appear to be from the inside. **Consider the following analogy with religion. When one asks a religious person to explain the essence of his religion, one often gets an answer like this: "It's about love**, really. It's about looking out for other people, looking beyond oneself. It's about community, being part of something larger than oneself." **This sort of answer accurately captures the phenomenology of many people's religion, but it's nevertheless inadequate for distinguishing religion from other things**. This is because many, if not most, non-religious people aspire to love deeply, look out for other people, avoid self-absorption, have a sense of a community, and be connected to things larger than themselves. In other words, secular humanists and atheists can assent to most of what many religious people think religion is all about. From a secular humanist's point of view, in contrast, what's distinctive about religion is its commitment to the existence of supernatural entities as well as formal religious institutions and doctrines. And they're right. These things really do distinguish religious from non-religious practices, though they may appear to be secondary to many people operating from within a religious point of view. In the same way, I believe that most of **the standard deontological/Kantian self-characterizatons fail to distinguish deontology from other approaches to ethics**. (See also Kagan (Kagan, 1997, pp. 70-78.) on the difficulty of defining deontology.) It seems to me that **consequentialists**, as much as anyone else, **have respect for persons**, **are against treating people as mere objects,** **wish to act for reasons that rational creatures can share, etc**. **A consequentialist respects other persons, and refrains from treating them as mere objects, by counting every person's well-being in the decision-making process**. **Likewise, a consequentialist attempts to act according to reasons that rational creatures can share by acting according to principles that give equal weight to everyone's interests, i.e. that are impartial**. This is not to say that consequentialists and deontologists don't differ. They do. It's just that the real differences may not be what deontologists often take them to be. What, then, distinguishes deontology from other kinds of moral thought? A good strategy for answering this question is to start with concrete disagreements between deontologists and others (such as consequentialists) and then work backward in search of deeper principles. This is what I've attempted to do with the trolley and footbridge cases, and other instances in which deontologists and consequentialists disagree. **If you ask a deontologically-minded person why it's wrong to push someone in front of speeding trolley in order to save five others, you will get** characteristically deontological **answers**. Some **will be tautological**: **"Because it's murder!"** **Others will be more sophisticated: "The ends don't justify the means**." "You have to respect people's rights." **But**, as we know, **these answers don't really explain anything**, because **if you give the same people** (on different occasions) **the trolley case** or the loop case (See above), **they'll make the opposite judgment**, even though their initial explanation concerning the footbridge case applies equally well to one or both of these cases. **Talk about rights, respect for persons, and reasons we can share are natural attempts to explain, in "cognitive" terms, what we feel when we find ourselves having emotionally driven intuitions that are odds with the cold calculus of consequentialism**. Although these explanations are inevitably incomplete, **there seems to be "something deeply right" about them because they give voice to powerful moral emotions**. **But, as with many religious people's accounts of what's essential to religion, they don't really explain what's distinctive about the philosophy in question**.

### 1

#### [Adapt to aff plan text] except for appropriation for space-based solar power.

#### SSP is viable and requires privatization.

Oberhaus 8/18 [DANIEL OBERHAUS, “Space Solar Power: An Extraterrestrial Energy Resource For The U.S.,” Innovation Frontier Project, August 18, 2021. <https://innovationfrontier.org/space-solar-power-an-extraterrestrial-energy-resource-for-the-u-s/>] CT

FUTURE OF SSP

The United States’ reluctance to pursue SSP can be attributed to a number of causes. In the 1970s and 80s, the exorbitant projected costs of an SSP station guaranteed that the project would not be pursued by NASA, the DOE, or the DOD. At the same time, the agency’s emphasis on developing nuclear space technologies — a trend that continues to this day — undermined enthusiasm for other ambitious energy projects like SSP. Finally, the fact that SSP is a space project meant to provide commercial levels of electrical power on Earth meant that it wasn’t obvious whether it fell within the purview of NASA or the DOE, and so both agencies were reluctant to allocate a substantial portion of their budget for its development. Today, the low cost of natural gas and renewables like wind and solar makes it seem challenging to justify a space energy project of this scale. But SSP offers several unique benefits as an energy resource, including its resiliency, its ability to provide flexible baseload power to geographically distant locations, its capacity to accelerate decarbonization directly by providing clean energy and indirectly by expediting the transition to off-world heavy industry, and its strategic benefits as a tool for diplomacy and national security. Given SSP’s benefits and the interest in the technology from most other space agencies, it’s puzzling that policymakers in the United States have not prioritized SSP R&D. The development of key technologies such as reusable rockets and thin film solar panels has finally made SSP economically and technically viable. But there is still a lot of fundamental research on SSP that needs to be done and it is in the United States’ national interest to begin this research program as soon as possible. So far, the only glimmer of hope for an American SSP program has come from the DOD’s efforts. In 2019, the Air Force Research Lab awarded a $100 million contract to Northrop Grumman as part of the new Space Solar Power Incremental Demonstrations and Research (SSPIDR) Project, which aims to develop hardware for in-orbit SSP experiments based on the design developed at Caltech.105 This is by far the United States’ largest federal expenditure on SSP R&D, but it is only a fraction of what will be required to build a large-scale SSP station and the specific technologies included in the SSPIDR program will not result in a system that could ever provide commercial power to civilians. SSP is a key tool for ensuring the prosperity and security of the United States in the latter half of the 21st century. It is imperative that NASA and the DOE prioritize the development of SSP. We believe the federal government should earmark approximately $1 billion for SSP research over the next five years with a special emphasis on advancing emerging technologies and in-space hardware demonstrations. Congress must take the first step in establishing a civilian SSP platform by directing NASA and the DOE to collaborate on a public-private initiative similar to NASA’s commercial crew program or its more recent commercial lunar payload services program. The directive must clearly delineate responsibilities between the agencies in order to avoid leadership paralysis that has stymied domestic SSP research in the past. Furthermore, a public-private program must be structured so that there is competition among multiple private companies, which must hit key milestones in order to continue receiving contracts. These contracts should be awarded with a fixed-price structure to avoid the massive cost overruns and delays that are typical of cost-plus contracts in the aerospace and defense sector. This is also an approach likely to find support among new launch providers and spacecraft manufacturers that have demonstrated the innovation that occurs when operating within the relative constraints of fixed price contracts. In fact, the main trade group for the aerospace sector has advocated for the increased use of fixed-price contracts in the past.106 Alternatively, it may be more efficient to establish a focused research organization (FRO) dedicated to SSP technologies to avoid delays associated with collaboration between two federal agencies on multi-year—and perhaps multi-decade—projects. FROs are independent entities that exist outside of national laboratories and universities. They are effectively a startup for basic research and deep technological development that requires large-scale engineering collaboration on technologies that may not yet have a market or are not readily monetizable.107 Recently, the U.S. Congress created five FRO-like centers in the DOE’s national labs as part of the National Quantum Initiative Act, which can serve as a framework for the creation of similar FROs dedicated to space solar power.108 While there are several approaches to a large-scale SSP system, we believe the most fruitful pathway is to focus on cost reduction over energy efficiency. This would prioritize highly modular systems similar to ALPHA, which benefit from the substantially reduced costs of mass manufacturing standardized components. We believe that it is possible to conduct a civilian SSP demonstration in low-Earth orbit within three years of the program’s start with less than $250 million in funding. The first phase of this program would involve conducting a series of ground tests with prototype systems over the course of about 18 months. Based on the results of this program, a system could be selected for an in-space demonstration capable of generating up to 300kw of power in low-Earth orbit. After a successful LEO demonstration mission, the next step would be to build a larger SSP system in mid-Earth orbit capable of producing commercial amounts of power (e.g., 1-10 MW). While this orbital altitude is not sufficient for maintaining the SSP system over a fixed spot on the Earth, it would stay on a fixed path so that it always passed over the same spots on the Earth. While the power from this MEO demonstrator would not be competitive with terrestrial electricity prices — we expect a cost of about $1/kwh — it would be a critical step toward proving the system’s ability to provide commercial power. We expect that the MEO demonstrator could be built and launched for approximately $1 billion. The success of the MEO demonstrator would lay the foundation for an SSP system in geostationary orbit that would be large enough to provide meaningful amounts of baseload power. We expect the initial version of this SSP system to be capable of delivering around 2 GW of solar energy to the surface. We expect that a 2 GW SSP system in geostationary orbit could be built for about $10 billion. Here we start to see the cost savings of mass manufacturing modular SSP components. This system would be capable of delivering more than 200 times more power than the MEO demonstrator for only 10 times the cost. We believe that a public-private SSP program jointly led by NASA and the DOE could result in a commercially viable SSP platform in geostationary orbit by the end of the decade. In addition to providing a critical pathway for SSP, it also has the potential to lead to substantial advancements in solar power and wireless power transmission technologies that would be useful on Earth. If policymakers do not take action on advancing domestic SSP capabilities soon, the United States will find itself losing its leadership position in space and increasingly vulnerable to natural and human-made disasters on the ground.

#### SSP Constellations are coming now. SSP is technologically and economically feasible. Bests studies prove.

Patel 12/1 [Sonal Patel, “Space-Based Solar Power May Be Closer Than You Think,” POWER, 12/1/21. Accessed 2/16/22. <https://www.powermag.com/space-based-solar-power-may-be-closer-than-you-think/>] CT

The vision sounds far-fetched: If a kilometer-scale satellite could be outfitted with a hybrid array of photovoltaic (PV) and concentrating solar power (CSP) panels and launched into orbit 22,400 miles above Earth, it could continuously harvest 3.4 GW of solar power and beam it down to Earth via microwave radiation for grid consumption, potentially delivering 2 GW of dispatchable and baseload power. But according to a “whole systems” set of detailed engineering and economic feasibility studies conducted by systems, engineering, and technology-oriented Frazer-Nash Consultancy for the UK government, this concept of a typical space-based solar power (SBSP) system is both technically and economically feasible—and it can be achieved within the next 18 years.

While still at an early stage of technical maturity, SBSP systems research and development has progressed steadily since the 1970s, spearheaded by several government space programs, including in the U.S., Japan, China, South Korea, and the European Union. And while it has existed for more than a century—it derives from Nicolas Tesla’s grand vision for wireless power transfer (WPT)—the world’s white-knuckle fight against climate change in the context of energy security, affordability, and scalability is making SBSP an extraordinarily attractive pursuit, noted Martin Soltau, lead of Frazer-Nash’s Space business, and a lead developer of the report for the UK government.

UK Actively Exploring Space-Based Solar Power Systems

“It can provide baseload power but it can also provide this dispatchable power,” said Soltau, who notably also co-chairs the Space Energy Initiative, a UK-based alliance of research and commercial energy, space, materials, and manufacturing entities that are dedicated to space power delivery by 2050. “But then it’s got these other real exciting advantages,” Soltau told POWER at the end of September as the UK’s Department for Business, Energy, and Industrial Strategy (BEIS) endorsed the SBSP feasibility studies. “It doesn’t produce waste, it doesn’t have problems with fuel supply, it’s very environmentally clean, and the carbon payback is very short,” he said.

Also notable is that SBSP’s “extra-terrestrial” footprint—which essentially only requires a receiving antenna and a conversion facility—is also “much smaller, only a third of the size compared to terrestrial solar, and only about 3% of the size of an equivalent wind farm,” Soltau said. As uniquely, “it is possible to beam energy to other parts of the world,” opening up new international collaboration to net-zero, potentially helping developing nations to decarbonize, and even shaking up traditional power markets.

The Frazer-Nash Consultancy study is especially significant because it represents one of the world’s first “whole system” space power-based independent assessments. The UK’s interest in space power stems from an economic opportunity to establish a foothold in rapidly burgeoning civil and defense space activities around the world, essentially boosting private investment, and capitalize on its unique engineering and manufacturing strengths, like satellite manufacturing. But Soltau said the study, which stems from a government-sponsored innovation “competition,” could also offer international insight through its stakeholder-reviewed findings, which were gleaned over a six-month period and encapsulated two phases: one focused on technical opportunities and challenges, and the other on costs.

In its study, Frazer-Nash recommended that the SBSP system concept be established to define user and system requirements, which would ultimately align more focused research activities. The UK government told POWER that as a next step, it is already exploring how it can potentially support innovation in the development of these “dual-use” space power and terrestrial power systems.

A Gigawatt-Scale Baseload Solar Plant on a Satellite

Still, the undertaking is markedly broad. As part of its engineering study, Frazer-Nash proposed a “typical” SBSP system based on three leading concepts, which it chose as reference designs for its investigation. The typical system comprises a massive kilometer-scale satellite that would be launched to Geostationary Earth Orbit (GEO, about 36,000 kilometers above a point on the Earth) to enable gigawatt-scale generation.

“At this altitude, the Sun is visible over 99% of the time,” it noted. The satellite harvests solar power using large lightweight solar panels, often with a system of mirrors to reflect and concentrate sunlight onto the panels (Figure 2). That generated power is then converted into microwave radiation and beamed—in a “safe” frequency of 2.45 GHz and intensity 230 W per square meter (which is one-quarter of the intensity of midday sunlight)—to a rectifying antenna (or “rectenna”) on the ground. The ground rectenna then converts the electromagnetic energy into direct-current electricity, which can be converted and transformed to provide power to the grid with acceptable characteristics.

Significantly, the concept envisions a complete system that would comprise a “constellation” of such satellites with a combined 10 GW capacity. However, the study also embeds the core generating system into a larger power study that includes “enabling systems,” such as spacelift, control station construction, ground station maintenance, and even potential legislation, permits, international agreements, and standards.

According to Soltau, the study concluded that leading satellite power concepts do not require any substantial advance in materials’ technology or performance, but building them economically will require two principal capabilities that are today immature but rapidly developing: robotic in-orbit assembly, and a low-cost reusable space transportation infrastructure. This poses a “substantial undertaking,” he noted, given that the size of the system, and the need to assemble and integrate them in space, “would be an order of magnitude larger in mass and extent than any spacecraft currently in orbit.” Key to achieving the scale and ambition of the system will be to address the “considerable engineering risk” through a program of design and technology demonstration, he said.

Costs Competitive with Cheap Earth-Based Renewables

The study also identified an array of technical challenges, from maintaining the angle between the sun-pointing solar collector and the ground-pointing microwave transmitter, to the size and scaling of the microwave antenna. Optimizing the specific power of SBSP satellites—which have a mass of several thousand tons—and managing their components’ thermal aspects will also be crucial.

Finding an optimum choice of power beaming frequency will also “require a trade-off between the satellite orbit, satellite sizing, power level transmitted, power beaming efficiency, the transmitter diameter and receiver diameter, the thermal limits on the sandwich panel, and the upper safe limit of Radio Frequency (RF) intensity at the center of the received beam,” the study acknowledges. Keeping frequencies at 2.45 GHz for larger (2 GW) systems, and 5.8 GHz for lower-power, lower-mass systems, may be a good guideline, it concluded.

The given technical challenges (and scope of engineering risks), the relatively low technical maturity of several technologies, and the diversity of technical concepts that have been proposed pose a long list of methodology limitations when assessing SBSP costs, the study acknowledges. However, by developing a “bespoke cost model” that addresses uncertainty and focuses only on the CASSIOPeiA design, the study concludes that a typical SBSP could deliver a levelized cost of electricity (LCOE) of between £35 ($47)/MWh and £79 ($107)/MWh, assuming a successful development program.

The cost analysis included “end-to-end production, launch, assembly, operational service life, and decommissioning,” Soltau noted. “The LCOE we calculated is for the nth of a kind, which would be quickly reached in the fourth or fifth system,” given the modularity and repeatability of the design, he said. “Each solar power satellite is highly modular, so you reduce production costs when you’ve got high production runs,” he said.

Assuming a system is commissioned in 2040, the LCOE at the midpoint of £50/MWh “includes this very high hurdle rate of 20%” to account for estimated uncertainty as required by institutional investors, he noted. “And what you’d expect is as the development proceeded, and we matured the technology, and all the development risk was retired, that the hurdle rate is going to fall well under 10%. At a 10% hurdle rate, the LCOE is only £26/MWh—that’s cheaper than the cheapest renewable technology in the UK at the moment,” he said. “This is why our government is excited because it’s actually looking not only at the technology’s great characteristics, but it’s actually very affordable as well.”

Still, for now, to propel research and development, the UK government is looking at a net present value—a representation of overall development costs—of about £16.3 billion ($22.1 billion), the study suggests. Another £1 billion will also be necessary to support operating expenditure over the life of the system.

In its policy roadmap, however, Frazer-Nash suggests the public sector may only need to fully fund Phase 1, totaling £350 million ($474 million) over the first five years. “Thereafter the private sector could reasonably be expected to start investing an increasing proportion as shown,” it says. As an incrementally valuable benefit, the program would potentially provide “broader spillover economic benefits,” including in areas that span wireless power transmission, semiconductor technology, PV technology, space-grade electronics, robotics, space freight and transportation, and general skill development to support space activities, it said.

### 2

#### TEXT: The Outer Space Treaty ought to be amended to establish an international legal trust system governing outer space.

Finoa 21 [Ivan Finoa (Department of Law University of Turin), “Building a New Legal Model for Settlements on Mars,” A. Froehlich (ed.), Assessing a Mars Agreement Including Human Settlements, Studies in Space Policy 30, 2021. <https://doi.org/10.1007/978-3-030-65013-1_7>]CT

7.5 A Proposal for an International Legal Trust System

Since several legal and policy issues may arise from the actual legal framework, a new international legal regime for outer space shall: (a) Provide for property rights or a lease allocation system, both incentivising investments in the space sector. The system would be supervised and led by the United Nations (UN) through the United Nations Office for Outer Space Affairs (UNOOSA). (b) Establish the rule of law in outer space. A laissez faire system could turn into anarchy whereby countries and companies could race to grab as many resources as possible bringing considerable potential conflict. (c) Recognise outer space as common heritage of mankind, instead of res communis.24 (d) Provide a sustainable exploitation of celestial bodies, to avoid the uncontrolled production of space debris or to prevent the complete exhaustion of the celestial bodies’ masses or their natural orbits.25 The United Nations should manage the ordered and sustainable economic development in outer space for the present and future generations. (e) Prevent the militarisation of outer space and favours the international collaboration, which are the same aims of the Outer Space Treaty’ drafters. (f) Consider the weak points of the Moon Agreement which led to nations’ refusal to sign. Only a widely accepted agreement would have the power of law in the international context.

The abovementioned requirements could be met by establishing an international Legal Trust System (ILTS). A trust is an arrangement that assigns assets to one or more trustees that will manage them in the interest of one or more beneficiaries. The latter may include the trustee or the settlor.26 Translated in the ILTS, mankind would assume the role of settlor and beneficiary of the outer space resources. The UNOOSA would act as main trustee of outer space resources and trading property rights and leases to companies and countries. The rights over the celestial bodies or over its resources would depend on the nature of the celestial body itself. For example, property rights are preferable to a lease over asteroids, as they could just disappear after the exploitation. Both leases and property rights can be provided over lands and mining sites on Mars. Leases or defeasible titles are preferable for some land mass on those celestial bodies which could hypothetically be used by humankind pending an Earth disaster. In the case of lucrative activities, such as mining, companies will choose whether to get the exclusive use over the resource through payment of the lease or through annual payment linked to net proceeds or to production charges.

7.6 The Functioning of the International Legal Trust System

When a company is interested in leasing or buying an outer space resource, before starting any operations, it must send a plan of work to the United Nations. The plan of work shall include all the details of the activity that would be carried out; it shall be consistent with pre-established parameters of sustainability and shall not interfere with other space activities. If the UN approves the company plan of work, the country of the company assumes the role of co-trustee for the specific resource. Thus, as a cotrustee, countries must investigate whether all activities of their national companies are consistent with the plan of work authorised by the UN. These supervisory duties would be added to the responsibility of nations for all space objects that are launched within their territory.27 The UN, as main trustee, would oversee that countries are performing their duties. This model would be the ordinary one. There would be also an extraordinary model, in which the UN would be the only trustee. This model would be possible in two instances: when the country of the applicant for a private company is not technologically able to act as a trustee or when the applicant of the activity is a country itself. Furthermore, as stated previously, the beneficiaries of this trust are the countries of the world and their citizens; hence all mankind would take concrete profit from lease transactions and benefit sharing. The income from the sales, leases and benefit sharing can be distributed to mankind by financing international global goals, following a similar model of the 17 Sustainable Development Goals adopted by the United Nations in 2015, which addressed poverty, inequality, climate change, environmental degradation, and peace and justice. Finally, the International Legal Trust System would meet acceptance because every country would obtain benefit sharing to improve its living standard and space faring nations would rely on property rights.

#### The legal trust would incentivize investment in space while preventing conflict and ensuring sustainable development and the equitable distributions of resources.

Finoa ’20 – Ivan Finoa [Department of Law, University of Turin], “An international legal trust system to deal with the new space era,” 71st International Astronautical Congress (IAC) – The CyberSpace Edition, (12-14 October 2020). <<https://d1wqtxts1xzle7.cloudfront.net/66728932/_IAC_20_E7.VP.8.x58518_An_international_legal_trust_system_to_deal_with_the_new_space_era_BY_IVAN_FINO-with-cover-page-v2.pdf?Expires=1642044926&Signature=asvt6StaK5n9UnpXuJIlo4ziI839WzFYjDZy37bm70ObGy3vFJyHwWNGxhn2beze4QzYDPPX0pVEXAwYvDaINVNxN01Ify8YwG5loNRddlat-grf3iawic7KvwqPowxFe2GuemVvbB-KW8ZVBxigwS-gelSKIVy4KYR9UgiDrM6e6deEBnUTcULSwmsH-JdHNg13ytZ3vNVMMlxZW2MPOCRuB2WlOHdCLoC86VqafSoMwuec-d~Aisbgyt5F2vO-GjvI60bR7h2MSp0iT6P7apIDUUpHUsDGbvcdxp22HSxXdlvr7lSqtLnL5rKxujGDYq~R9B~WuGiorVL2hn74UQ__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA>>CT

Considering the worsening climate change, in the future outer space might be our last Noah’s Ark. Now, humans must look to space as an opportunity to support growing resource requirements. Asteroids are rich in metals, which could be transported back to Earth. Unfortunately, the existing international legal framework discourages investments in the space economy. Once an enterprise invests billions of dollars in discovering and developing a mining site, it cannot claim any ownership because of the non-appropriation principle stipulated in Article 2 of the Outer Space Treaty (OST). Thus, other entities could legally access and exploit the same resource without any participation in the initial financial investment, increasing the risk of potential conflict. Bearing this in mind, the question arises, which legal regime could ensure effective allocation of resources, avoiding a chaotic space race to acquire valuable assets? The aim of this research is to argue that the first two articles of OST should be amended, to set up an international legal trust system which would guarantee different kinds of rights, dependently on the nature of the celestial body. E.g., property rights could be preferable to a lease over asteroids, as they could be exploited to their disappearance. This proposed system would be led by the United Nations Office for Outer Space Affairs (UNOOSA), as the main trustee. The co-trustees would be the nations of the world. Prior to initiating any space activity, every entity would send a request to their national government. If all the legal parameters are respected, the nation would forward the operational request to the UNOOSA. In the case of acceptance, UNOOSA would record the permit on an international public registry. The country in which the company has been registered would investigate whether the activities of its national company are consistent with the permit. This would be the ordinary model. The extraordinary model would be when the applicant for the space activity is a state, then the trustee would be the UN. All lucrative activities would be subject to benefit-sharing. Finally, this research will demonstrate the valuable outcome of the International Legal Trust System and its advantages for all humankind. Private companies would rely on property rights, while the benefit-sharing could be used to finance the 17 Sustainable Development Goals adopted by the UN in 2015, which address peace, climate change, inequalities and poverty.

### 3

#### Current law is not a barrier to space settlement.

Gesl 18 [Paul M. Gesl (Maj, USAF JD), “PREPARING FOR THE NEXT SPACE RACE: Legislation and Policy Recommendations for Space Colonies,” A Research Report Submitted to the Faculty In Partial Fulfillment of the Graduation Requirements for the Degree of MASTER OF OPERATIONAL ARTS AND SCIENCES (April 2018). <https://apps.dtic.mil/sti/pdfs/AD1053024.pdf>] CT

Existing Legal Framework for Space Colonies

In 1967, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (OST) entered into force.43 This document, which is over 50 years old, was drafted when space issues were very different, yet it is still the primary binding international law on space activities. The OST places several limitations on potential colonization; however, it does not forbid the activity.

The first hurdle to a potential colony is Article II of the OST. “Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”44 One could argue that this would prevent any colonization. In fact, some do just that. Attorney Michael Listner, who founded Space Law and Policy Solutions, views this article as a non-starter for colonization efforts. “When a private citizen makes a claim to private, real property, basically, that’s saying the United States is making a claim as well, because of that continuing jurisdiction, the U.S. government always has.”45 The publication theoutline.com, relying on an interview with Listner,took this one step further, arguing that this means “any base or settlement on Mars would have to be free to use by anyone who can travel there. A person can’t just set up a colony, claim independence, and create rules that restrict access to it.”46 However, Lister’s interpretation is incorrect as it is too strict an interpretation of the language. Theoutline.com appears to take the interpretation to an untenable conclusion that is not supported by the evidence. Even though this position is not credible, it is important to discuss because as the United States moves towards colonization, it will face similar criticisms from opponents. Article II of the OST was not written to ban establishing a colony on a celestial body. Instead it was written to prevent a country from claiming a celestial body, such as the moon, as their own sovereign territory. This more permissive interpretation is supported by other provisions of the OST.

The OST contains language that supports establishing colonies. Article IV, while generally a prohibitive Article, states, “The use of any equipment or facility necessary for peaceful exploration of the Moon and other celestial bodies shall also not be prohibited.”47 If this leaves any doubt, Article XII likely clears up the confusion.

All stations, installations, equipment and space vehicles on the Moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity. Such representatives shall give reasonable advance notice of a projected visit, in order that appropriate consultations may be held and that maximum precautions may be taken to assure safety and to avoid interference with normal operations in the facility to be visited.48

This Article establishes two important facts under the treaty. First, space colonization is acceptable under the OST. A colony easily fits within the definition of a station or installation. Quite simply, if the drafters of the OST intended to prevent States from establishing colonies, they would have most certainly done so in uncertain terms. Second, a State can establish a colony either unilaterally, or with a selected group of international partners. The visits discussed in Article XII would not be necessary if every colony needed to be open to the international community. This also eviscerates claims like those cited by theoutline.com, discussed above. If any colony were open to any party that could reach it, the visits by representatives in Article XII would be nonsensical. Looking at these details in the language of the entire treaty is important, because without it, one could argue that Article I in the OST would prevent a State from establishing a colony. If a space colony established by a single State would deny other states free access to an area of a celestial body (namely the area where the colony is established), then facilities would be banned outright. However, Article XII directly undercuts this weak argument.

It is important to note that the OST equally applies to commercial entities. Private corporations are currently leading the way in planning for space colonization. A company that did not sign, or even exist when the OST was signed, is still bound by its provisions. Article VI establishes that these entities have to conform to the treaty, and more importantly that “the appropriate State Party to the Treaty” must both authorize and supervise these companies. 49 While not binding, the United Nations has spoken on the matter.

Space activities should require authorization by a competent national authority; such authority or authorities, as well as the conditions and procedures for granting, modifying, suspending and revoking the authorization, should be set out clearly within the regulatory framework; States might employ specific procedures for the licensing and/or for the authorization of different kinds of space activities.”50

These two citations together indicate that the United States must authorize and supervise the activities of commercial companies operating in space. If those activities include colonization, then legislation must appropriately supervise it.

#### But, non-appropriation makes space settlement impossible.

Kerkonian 17 [Aram Daniel Kerkonian (Institute of Air and Space Law Faculty of Law, McGill University Montréal, Quebec), “The Legal Aspects of Permanent Human Settlement on Celestial Bodies,” A thesis submitted to McGill University in partial fulfillment of the requirements of the degree of Masters of Laws (LLM) (Oct 2017). <https://escholarship.mcgill.ca/downloads/tq57nt396>] CT

Article II prohibits the appropriation of outer space, simultaneously limiting and preserving the rights afforded under Article I: States are limited from claiming ownership or securing property rights in space thereby preserving for all other States the general freedom to use and explore. As the “non-appropriation” principle, Article II prevents an entity from claiming ownership over a particular spot in space, a plot of land on a celestial body or even an orbit around a moon151; while exploration and use are permitted, ownership is prohibited. Therefore, regardless of the scope of use or degree of reliance on a particular phenomenon of outer space, an entity cannot claim an individual benefit permanently. As a result, the USSR could not claim the orbit in which Sputnik made its maiden voyage152, the USA could not claim the Sea of Tranquility as its territory after planting its flag on the Moon153 nor could the equatorial countries exclude others from using the geostationary orbit located approximately 36,000 km above their territories154.

Although the OST does not define “appropriation” 155, the prohibition outlined in Article II must be understood to limit not only explicit claims of property or ownership but also, what can be called, “appropriation by action” – an activity that, without ever claiming to do so, appropriates outer space through its indirect consequences. An appropriate understanding of appropriation, therefore, becomes vital when determining whether proposed new and emerging technologies (such as permanent human settlement or space mining) may appropriate outer space, in one way or another, without ever claiming to do so.156 Although a truly meaningful investigation into the definition of appropriation is outside the scope of this thesis, moving forward without a useful conceptualization would be imprudent; therefore, a brief investigation into the drafting parties’ motivations for including the non-appropriation principle is warranted.

During Article II’s deliberations, many State representatives announced their support of the non-appropriation principle as a way of ensuring space activities would not undermine the general objectives of the OST (that outer space serve the interest of all States and not just the State undertaking a particular activity). Specifically, there was a desire that outer space not devolve into another domain of exploitation and imperialism, as had the New World and Africa during the fifteenth through nineteenth centuries.157 As Judge Manfred Lachs reminds: “Need one recall how frequently the practices of dividing and disposing of lands and whole continents led to conflict and strife? The lesson should have been learnt.”158 Indeed, for many of the negotiating parties the lesson had been learned. Rather poignantly, the years in which such space-related discussions were taking place were also a period of great decolonization and independence, with States acutely aware and hyper-prescient of the consequences of imperialism.

Since there is no evidence that space harbours other life forms, some have argued that mimicking the imperialism of the past in space would not result in harm as it did on Earth. What must be remembered, however, is that imperialism generates great inequality aside from the fact that it often subjugates certain classes. Ambitious territorial landgrabs in space, currently only possible for developed space-faring States, would cement economic advantages far into the cosmos and further exacerbate the inequality amongst nations on Earth. This will be the case regardless of whether alien civilizations exist. There is no question that space affords humanity great opportunity – what is questionable is how such opportunity will be distributed.159 Prohibiting appropriation was one method chosen by the negotiating parties to ensure the satisfaction of the OST’s underlying objective that space activities benefit all of humanity and not simply those with exploitative capabilities.160

The appropriation of outer space, therefore, can be accomplished by an activity that results in the same kinds of consequences as private ownership – exclusive use, profiting, unilateral decision making, etc. While such characteristics are necessarily true of certain activities (such as orbital positions 161), they are temporary and often available for someone else to use nearly simultaneously. A human settlement, with its notable permanence in a particular location, is neither temporary nor can it be used by multiple users concurrently – once established, its location will be restricted to other users.162 The general argument that space is vast (and so a single settlement site will not reduce the available real estate or subsequent users can simply choose another suitable site) undercuts the reality that space, while expansive, offers certain irreplaceable advantages depending on location.163 Notwithstanding, any realistic permanent human settlement will necessarily require affixing its structures to the ground, thereby appropriating that specific area in favour of the structure’s owner. In discussing this position, Judge Lachs reiterates that all activities in space ought to be for the benefit of all countries and Dr. Nicolas Matte draws the conclusion that: “moveable objects ‘attached to celestial bodies become immovables’, which grants the State to which they belong a right to the ‘soil’ of celestial bodies or at least a right to the surface’. Thus it is contended that ‘we arrive at an ownership… by technical and industrial occupation, without giving it a name.”164 Both Judge Lachs and Dr. Matte warned against State appropriation of celestial bodies to avoid the ever-present conflicts on Earth caused by similar situations.

In an attempt to get around this prohibition on national appropriation, some private enterprise proponents developed a nuanced argument focussing on the inclusion of the word “national” to claim that private, non-governmental entities were not prohibited from appropriating outer space and celestial bodies.165 Indeed, a plain language, straightforward reading of Article II suggests that since only national sovereignty is listed as a prohibited ground, other forms of appropriation may be permitted. Notwithstanding that Article VI makes it clear that States are responsible for their private entities’ space activities (thus if a private entity claimed sovereignty, their State would be responsible and thereby violate Article II), most delegates participating in the negotiations of Article II were of the opinion that it prohibited both public and private appropriation.166 This remains the consensus today.167 Plainly, the appropriation of outer space by private entities would have similar consequences as State appropriation – imperialistic exploitation conducted by SpaceX is still imperialistic exploitation. Therefore, arguments that claim private entities can appropriate outer space are legally invalid.

The conclusion, therefore, seems to be that any permanent human settlement would necessarily appropriate the celestial body upon which it is located and therefore violate Article II. Although there is no denying that States or private entities can establish stations or installations in space, the intention and permanence of the structures may give rise to an activity that violates international law.168 However, if the settlement activity were undertaken in a particular manner (as will be explored more thoroughly in Chapter 165 “ 3, an interpretation of Article II, in light of the object and purpose of the overall treaty, may justify its violation.

#### AND, even if it’s theoretically possible, without private appropriation space settlement will not happen – no incentives, and would result in conflict.

Thomas 05 [Jonathan Thomas, “Privatization of Space Ventures: Proposing a Proven Regulatory Theory for Future Extraterrestral Appropriation,” 1 BYU Int'l L. & Mgmt. R. 191 (2005). https://digitalcommons.law.byu.edu/ilmr/vol1/iss1/7]CT

The current corpus juris spatialis based on res communis has received wide criticism by legal commentators, in part because of the practical limitations of its idealistic principles in application. For example, one commentator addressing the potential problems of future colonization of celestial bodies argued that the prohibition against private and national appropriation may cause deleterious effects when colonizers build settlements. Although these colonizers may occupy the property, they will have no legal control of their communities and could be uprooted for the purposes of putting that property to a better use for the benefit of common heritage. This risk may serve as a strong disincentive to the preservation of sectarian colonization in a res communis society.

Other commentators argue that the current corpus juris spatialis based on the idealistic res communis principle has actually slowed the development of outer space exploration because privately and publicly funded organizations cannot appropriate outer space.61 Under the corpus juris spatialis, there exists no probability or possibility of return on investments, which results in insufficient monetary incentive for businesses or private persons. Even with the daunting needs created by increasing population and consumption, and decreasing resources on earth, many states may not even attempt to exploit extraterrestrial resources because the current corpus juris spatialis does not guarantee that their own citizens will benefit from the investments made with their tax dollars. A future lack of resources, combined with a body of law that mandates common ownership of potential resources, may create a black market for extraterrestrial resources, or it may engender armed conflicts over the lack of supplies available to states.63

While there is little past precedent to justify it, and little present sentiment to support it, the current corpus juris spatialis clings to the idea that in the future, humans will be able to share the resources of space in common. One commentator illustrates these idealistic ideas and assumptions:

The articles of the various [outer space J treaties all predicate themselves upon the theory that mankind will work together for the common good with no real advantage to be gained other than the praise of his fellow man. It assumes that people are able to co-operate, and that they will indeed do so whenever dealing with outer space ventures. While the global effort in researching, developing and exploring space for the sheer joy of the information obtained, accomplished in the spirit of teamwork is a noble goal, it is clear that a world full of economic strife is ripe to intervene.64

These assumptions of the Outer Space Treaty and the Moon Treaty are unrealistic at present. Perhaps someday humankind will develop ideal characteristics that the Outer Space Treaty and Moon Treaty would like it to engender. In the meantime, it may be impractical to attempt to solve the dilemma of space appropriation based on characteristics yet to be consistently demonstrated.

Furthermore, res communis principles would become problematic as applied to space law due to the following problems: (1) the application of res communis theory in the Western world has been unsuccessful; and (2) scarcity of resources in res communis society is fatalistic to the society. It could be argued that the success of res communis ideology, albeit on a small scale, indicates that humankind should be able to implement the res communis ideology into corpus juris spatialis. While res communis ideology has seen some success in other societies, it is not prudent to assume that it will enjoy the same successful application in our increasingly capitalistic, modern society. Societies that have successfully implemented res communis ideology have had entirely different goals and values systems than those of the capitalist societies that are now developing the means for further space exploration. 65 While the isolated successes of communal societies in Africa and the Australian Outback are indeed admirable, they are certainly not the pioneers of space exploration and appropriation. Furthermore, it is difficult to posit that capitalistic nations can successfully switch to a res communis ideology. Groups that originated in capitalistic societies and subsequently switched to communal living have ultimately failed and reverted back to the individual ownership system from which they came. 66

The second problem with using res communis as a basis for property endowment in outer space law is the damaging effect of individual appropriation on the community when scarcity arises. Even in a res communis society where the community owns all property, individual members of the community nonetheless use certain parts of that property to the exclusion of the rest of the community. Such individual use and appropriation against the community is seen as permissible under res communis ideology supported by Lockean notions of property endowment; an individual may exclude the community from property if he or she mixes his or her labor with that property. This individual appropriation does not have a damaging impact on the community as long as there IS "'enough and as good left in common for others.71 However, when there IS scarcity, the rights of the community against the individual become increasingly hostile.

In outer space, scarcity will always be an Issue and thus will limit the utility of res communis based on Lockean principles of property endowment.72 The universe potentially may contain billions of solar systems and planets, but some celestial bodies may prove to be gold mines, while others prove to be "the Sahara."73 More important than the scarcity of limited resources, however, is the scarcity created by human lifespan and technological limitations. The time that space travel presently takes in comparison to the average human life span limits our ability to exploit celestial resources. Furthermore, technological limitations already have created issues of scarcity: such as the increasing problems of satellite positioning and traffic in geostationary orbit.

#### Space Settlement is coming now and prevents inevitable extinction. Settlement requires private industry and rule of law.

Gesl 18 [Paul M. Gesl (Maj, USAF JD), “PREPARING FOR THE NEXT SPACE RACE: Legislation and Policy Recommendations for Space Colonies,” A Research Report Submitted to the Faculty In Partial Fulfillment of the Graduation Requirements for the Degree of MASTER OF OPERATIONAL ARTS AND SCIENCES (April 2018). <https://apps.dtic.mil/sti/pdfs/AD1053024.pdf>] CT

Why the United States Needs to Think About Space Colonization Now

The United States’ space policies under the previous two Presidential administrations have not matched the ambition of the commercial sector. The author has criticized the National Space Policies of both President Obama and George W. Bush as being too “Earth-Centric.”6 Based on the current state of technologies, it is easy to dismiss space colonization as, at best, a problem to worry about tomorrow and, at worst, mere science fiction. This is irresponsible. Reaching space is difficult. Colonizing it will be even more difficult; however, we cannot overlook it as a likely possibility. NASA viewed space colonization as an endeavor within humanity’s reach in the 1970s.7 Now it is beginning to take shape as a reality. In 2015 at the Pioneering Space National Summit, policy makers, industry leaders and advocates agreed that “The long term goal of the human spaceflight and exploration program of the United States is to expand permanent human presence beyond low-Earth orbit in a way that will enable human settlement and a thriving space economy. This will be best achieved through public-private partnerships and international collaboration (emphasis in original).”8 Additionally, there have been several attempts in Congress to pursue space settlement.9 Private industry appears to be taking the lead in this race. Elon Musk, the CEO of SpaceX intends to establish a colony of a million settlers on the surface of Mars.10 SpaceX is targeting the first manned missions to make this a reality to launch in 2024.11 Mr. Musk envisions the full colonization to take 40-100 years.12 Even if this timeline misses its ambitious deadline by a decade, humanity will be a multi-planetary species in many readers’ lifetimes. It is important to note that Mr. Musk recently stated that SpaceX is “building the first Mars, or interplanetary ship, and I think we’ll be able to do short trips, flights by first half of next year.”13 Even though he joked that the company might miss their timeline, his comments highlight that colonization is an issue that is fast approaching.14 Another factor to consider is that a legal framework needs to be developed before a Martian colony is at its full capacity. Mr. Musk envisions using SpaceX’s BFR to send approximately 100 people per flight to Mars.15 Additionally, SpaceX appears to be planning for humans living on the lunar surface in their Moon Base Alpha.16 SpaceX is not alone in their ambitions. United Launch Alliance (ULA) published their plans to expand the population of humans living and working in space. Their Cis-lunar 1,000 framework is a 30-year plan to develop the cis-lunar economy and grow the population of humans living and working in space from six to 1,000.17 Space colonization is more important to our species than the economic benefits of a space economy and the conquests of exploration. The current world population is 7.4 billion people.18 According to the World Wildlife Foundation and the Global Footprint Network, “the equivalent of 1.7 planets would be needed to produce enough natural resources to match our consumption rates and a growing population.”19 The problem will likely grow worse as the population of the planet continues to grow. According to the United Nations, the Earth’s population will grow to over 11 billion people by 2100.20 Based partially on this, “Prof [Stephen] Hawking said it was only a matter of time before the Earth as we know it is destroyed by an asteroid strike, soaring temperatures or over-population.”21 Hawking further stated that, “When we have reached similar crisis in or (sic.) history there has usually been somewhere else to colonise (sic.). Columbus did it in 1492 when he discovered the new world. But now there is no new world. No Eutopia (sic.) around the corner. We are running out of space and the only places to go are other worlds.”22 The late Professor Hawking is not alone in his view, the National Space Society observed the benefits of expanding into space. “Outer space holds virtually limitless amounts of energy and raw materials, which can be harvested for use both on Earth and in space. Quality of life can be improved directly by utilization of these resources and also indirectly moving hazardous and polluting industries and/or their waste products off planet Earth.”23 These are just several of the many compelling reasons to colonize space advocated by groups such as the National Space Society and the Space Frontier Foundation.24 ULA appears to be taking steps to meet their ambitions for the future. ULA announced the first step towards making their Cis-lunar 1,000 vision a reality. In October 2017, they announced a partnership with Bigelow Aerospace to launch a habitat to low lunar orbit.25 The launch is expected to be completed before the end 2022.26 Some feel that colonization is going to happen, no matter what governments do.27 If colonization is going to happen, then it is in the United States’ best interest to develop a legal framework that supports the efforts and protects our citizens who will travel to and live in these habitats. This is important for several reasons. First, private corporations appear to have an interest in colonizing space, so it is in humanity’s future whether the government is involved nor not. However, governments can take actions that will accelerate things.28 Second, it is in the best interest of the United States’ economy to support commercial companies that are expanding into space. Third, if the United States does not create a favorable legal framework for space colonization, someone else will. Finally, as humanity expands away from the surface of the Earth, it is important to create a free society based on the principles of the Rule of Law rather than some other form of government, or an anarchistic company town.

#### An extinction event is inevitable, unpredictable, and the risk is growing. Space settlement is the only solution and it requires a thriving private space industry including orbital installations, mining, and tourism.

Hertzler and Rench 16 [Kevin Hertzler and Rebecca McCauley Rench (PhD), “GLOBAL EXTINCTION or a Space-Industrial Complex,” Potomac Institute for Policy Studies (2016). <https://www.potomacinstitute.org/steps/images/PDF/Articles/HertzlerSTEPS_2016Issue3.pdf>] CT

Yet, the bigger existential threat of annihilation of all humanity, by nuclear holocaust or natural forces, is currently considered too remote to be taken seriously. The geological record has preserved the rise and decline of many species throughout earth’s history, whether their extinctions were the result of asteroid impacts, volcanic activity, solar flares, or gamma ray bursts from distant star systems. To think humanity above the historical trends of the universe is conceited and illogical. Perhaps it is time to reconsider the annihilation threat and to entertain the need for an off-Earth sustainable colony.

Humanity might not get a second chance at survival. The idea of an extinction event has long been fuel for science fiction writers, and is exemplified in the novel by Neal Stephenson entitled Seveneves. 3 In Seveneves, humanity will be wiped out on Earth within two years unless nations collaborate to put a small group of astronauts and scientists on the International Space Station in hopes they survive and repopulate the planet. Science fiction has been known to become science fact, both in ways that are beneficial to society, and in ways that have negative consequences. A study of threats and a dystopian future is also inculcated into academia, with Niklas Bostrom, the founder of the “Future of Humanity Institute,” as a recognized leader. While the risk in any given year might be quite small, there is almost certainly an eventual global extinction event. With a growing population and the speed of destructive technological advancements, the annual risk of humanity’s downfall may be increasing. When the inevitable is presented as a certain future, or happens before we can react, what will be humanity’s last collective thought? Given our current technological prowess, perhaps the time to take action is now. During a Wall Street Journal All Things Digital conference,4 Elon Musk said:

Either we spread Earth to other planets, or we risk going extinct. An extinction event is inevitable and we’re increasingly doing ourselves in.

World renown physicist Steven Hawking agrees and recently told a gathering at the Big Think:5

I believe that the long-term future of the human race must be in space. It will be difficult enough to avoid disaster on planet Earth in the next hundred years, let alone the next thousand, or million. The human race shouldn’t have all its eggs in one basket, or on one planet. Let’s hope we can avoid dropping the basket until we have spread the load.

The timing and the nature of this event remains truly unknown. Predictions suggest an existential event may come from space or be the product of our own hand, but we will likely remain ignorant of the cause until its near arrival. What we do know is that if humanity is still inhabiting only one planet, our unique life stories will be tragically and permanently erased. Thus, we confront the realization of the likelihood of a global extinction event that we have absolutely no control over, that we currently have no defense for, and no plans to escape from. We are deluded into believing that since an extinction event is rare, it can not occur in our lifetime. Consider the attitude expressed in the Jet Propulsion Laboratory’s Near Earth Object program’s website6 which states:

On an average of every several hundred thousand years or so, asteroids larger than a kilometer could cause global disasters … No one should be overly concerned about an Earth impact of an asteroid or comet. The threat to any one person from auto accidents, disease, other natural disasters and a variety of other problems is much higher than the threat from [Near Earth Objects] NEOs. Over long periods of time, however, the chances of the Earth being impacted are not negligible so that some form of NEO insurance is warranted. At the moment, our best insurance rests with the NEO scientists and their efforts to first find these objects and then track their motions into the future. We need to first find them, then keep an eye on them.

However, what will our response be if we find an NEO larger than a kilometer that is on a collision course with Earth? A database is not an insurance policy and leaves open the issue of an appropriate response. Currently, our only real hope lies with mitigation strategies predicated on intercepting7 or redirecting8 NEO objects. The former suggests using a robotic spacecraft that is weighted or carries a nuclear explosive and the latter will redirect the NEO object with a robotic spacecraft. However, as NASA states in their “Asteroid and Comet Watch” website9 a response requires decades of warning time if the NEO object is larger that a few hundred meters.

We needed Sputnik to motivate our resolve for the domination of space. The mental contrast of one day dreaming about space travel through science fiction, and then seeing it live on television in the living room, stimulated our imaginations. President Kennedy’s speech inspired a nation and the decade-long pursuit that saw a surge in academic scholarship and technological advances. There are many technologies and spinoffs10 woven into the fabric of the world culture that owe their birth to that speech and subsequent technology development.

Can we expect the development of a humanity insurance policy before a crisis begins? It might require funding of NASA at levels similar to the 1960s, when we successfully landed men on the moon. It might require the development of a space-industrial complex that could help drive future economic growth. It might require that we spread out to other planets and achieve Earth independence to stave off global human extinction, even on our watch. It does require that we take the threat, and its inevitability, seriously and devote resources to preventing our extinction.

The ancient seafarers were motivated to take risks for the sake of curiosity and the desire for exploration and resources.11 The drive to leave the planet and set up colonies is similar: There is the allure, the curiosity, the adventure, and the insurance. It could, and should, be an international effort justified based on the purpose of planning for the preservation of humanity.

Certain plans are underway. Mars One is a nonprofit organization that promotes its plans for a Mars settlement within fifteen years.12 Elon Musk’s company SpaceX is reportedly developing plans to send large numbers of people to Mars.13 And NASA recently released a comprehensive strategy14 that leverages nearterm space activities with a comprehensive capability development culminating in an independent human presence on Mars. The NASA plan, at a minimum, would provide a future with a sustainable presence for humanity in deep space and provide an answer to many global extinction scenarios. Some of these plans are more logistically feasible than others, but all demonstrate the ambition of a select sect of humanity interested in pursuing off-Earth colonization. This strategy is well reasoned and has the potential to save humanity as well as provide a much needed economic boost by creating a space-industrial complex with the nascent private-public partnerships15 for mining asteroids, manufacturing propellant on the moon, creating fuel depots, and launching humans into space. The spinoff technologies would fuel real job growth as evidenced by the Apollo program of the 1960s. Rather than a short lived event to win a space race, this modern space age will be designed as a sustained effort in human space colonization. The current roadblocks preventing this strategy from moving forward are budgets, political priorities, and the changeable public interests; the exact same denouement of the moon landings over 40 years ago. An article posted on the Washington Post website by Joel Achenbach made the following observation:16

At the moment NASA can’t even get an astronaut to the International Space Station without buying a seat on a Russian rocket. A new NASA space capsule that was conceived in 2005 likely won’t be ready until 2023, according to NASA’s latest estimate, and it’s built for 21-day missions, not for trips to Mars.

The same article quotes Doug Cooke, a former NASA associate administrator as saying:

There needs to be more of a plan for actually getting there [Mars]. You can’t have a flatline budget indefinitely and think you’re going to put all of this together by 2030.

We must support the mission of human space exploration and colonization with both our interests as well as our national budget priorities if we want any hope of surviving the inevitable existential global extinction event.