### 1AC---Framework

**The standard is maximizing expected well-being. – we will spec – Hedonistic act Utilitarianism**

**Prefer:**

**Pleasure and pain are intrinsic value and disvalue**

**Blum et al. 18**

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**Pleasure** is not only one of the three primary reward functions but it also **defines reward.** As homeostasis explains the functions of only a limited number of rewards, the principal reason why particular stimuli, objects, events, situations, and activities are rewarding may be due to pleasure. This applies first of all to sex and to the primary homeostatic rewards of food and liquid and extends to money, taste, beauty, social encounters and nonmaterial, internally set, and intrinsic rewards. Pleasure, as the primary effect of rewards, drives the prime reward functions of learning, approach behavior, and decision making and provides the **basis for hedonic theories** of reward function. We are attracted by most rewards and exert intense efforts to obtain them, just because they are enjoyable [10]. Pleasure is a passive reaction that derives from the experience or prediction of reward and may lead to a long-lasting state of happiness. The word happiness is difficult to define. In fact, just obtaining physical pleasure may not be enough. One key to happiness involves a network of good friends. However, it is not obvious how the higher forms of satisfaction and pleasure are related to an ice cream cone, or to your team winning a sporting event. Recent multidisciplinary research, using both humans and detailed invasive brain analysis of animals has discovered some critical ways that the brain processes pleasure [14]. Pleasure as a hallmark of reward is sufficient for defining a reward, but it may not be necessary. A reward may generate positive learning and approach behavior simply because it contains substances that are essential for body function. When we are hungry, we may eat bad and unpleasant meals. A monkey who receives hundreds of small drops of water every morning in the laboratory is unlikely to feel a rush of pleasure every time it gets the 0.1 ml. Nevertheless, with these precautions in mind, we may define any stimulus, object, event, activity, or situation that has the potential to produce pleasure as a reward. In the context of reward deficiency or for disorders of addiction, homeostasis pursues pharmacological treatments: drugs to treat drug addiction, obesity, and other compulsive behaviors. The theory of allostasis suggests broader approaches - such as re-expanding the range of possible pleasures and providing opportunities to expend effort in their pursuit. [15]. It is noteworthy, the first animal studies eliciting approach behavior by electrical brain stimulation interpreted their findings as a discovery of the brain’s pleasure centers [16] which were later partly associated with midbrain dopamine neurons [17–19] despite the notorious difficulties of identifying emotions in animals. Evolutionary theories of pleasure: The love connection BO:D Charles Darwin and other biological scientists that have examined the biological evolution and its basic principles found various mechanisms that steer behavior and biological development. Besides their theory on natural selection, it was particularly the sexual selection process that gained significance in the latter context over the last century, especially when it comes to the question of what makes us “what we are,” i.e., human. However, the capacity to sexually select and evolve is not at all a human accomplishment alone or a sign of our uniqueness; yet, we humans, as it seems, are ingenious in fooling ourselves and others–when we are in love or desperately search for it. It is well established that modern biological theory conjectures that **organisms are** the **result of evolutionary competition.** In fact, Richard Dawkins stresses gene survival and propagation as the basic mechanism of life [20]. Only genes that lead to the fittest phenotype will make it. It is noteworthy that the phenotype is selected based on behavior that maximizes gene propagation. To do so, the phenotype must survive and generate offspring, and be better at it than its competitors. Thus, the ultimate, distal function of rewards is to increase evolutionary fitness by ensuring the survival of the organism and reproduction. It is agreed that learning, approach, economic decisions, and positive emotions are the proximal functions through which phenotypes obtain other necessary nutrients for survival, mating, and care for offspring. Behavioral reward functions have evolved to help individuals to survive and propagate their genes. Apparently, people need to live well and long enough to reproduce. Most would agree that homo-sapiens do so by ingesting the substances that make their bodies function properly. For this reason, foods and drinks are rewards. Additional rewards, including those used for economic exchanges, ensure sufficient palatable food and drink supply. Mating and gene propagation is supported by powerful sexual attraction. Additional properties, like body form, augment the chance to mate and nourish and defend offspring and are therefore also rewards. Care for offspring until they can reproduce themselves helps gene propagation and is rewarding; otherwise, many believe mating is useless. According to David E Comings, as any small edge will ultimately result in evolutionary advantage [21], additional reward mechanisms like novelty seeking and exploration widen the spectrum of available rewards and thus enhance the chance for survival, reproduction, and ultimate gene propagation. These functions may help us to obtain the benefits of distant rewards that are determined by our own interests and not immediately available in the environment. Thus the distal reward function in gene propagation and evolutionary fitness defines the proximal reward functions that we see in everyday behavior. That is why foods, drinks, mates, and offspring are rewarding. There have been theories linking pleasure as a required component of health benefits salutogenesis, (salugenesis). In essence, under these terms, pleasure is described as a state or feeling of happiness and satisfaction resulting from an experience that one enjoys. Regarding pleasure, it is a double-edged sword, on the one hand, it promotes positive feelings (like mindfulness) and even better cognition, possibly through the release of dopamine [22]. But on the other hand, pleasure simultaneously encourages addiction and other negative behaviors, i.e., motivational toxicity. It is a complex neurobiological phenomenon, relying on reward circuitry or limbic activity. It is important to realize that through the “Brain Reward Cascade” (BRC) endorphin and endogenous morphinergic mechanisms may play a role [23]. While natural rewards are essential for survival and appetitive motivation leading to beneficial biological behaviors like eating, sex, and reproduction, crucial social interactions seem to further facilitate the positive effects exerted by pleasurable experiences. Indeed, experimentation with addictive drugs is capable of directly acting on reward pathways and causing deterioration of these systems promoting hypodopaminergia [24]. Most would agree that pleasurable activities can stimulate personal growth and may help to induce healthy behavioral changes, including stress management [25]. The work of Esch and Stefano [26] concerning the link between compassion and love implicate the brain reward system, and pleasure induction suggests that social contact in general, i.e., love, attachment, and compassion, can be highly effective in stress reduction, survival, and overall health. Understanding the role of neurotransmission and pleasurable states both positive and negative have been adequately studied over many decades [26–37], but comparative anatomical and neurobiological function between animals and homo sapiens appear to be required and seem to be in an infancy stage. Finding happiness is different between apes and humans As stated earlier in this expert opinion one key to happiness involves a network of good friends [38]. However, it is not entirely clear exactly how the higher forms of satisfaction and pleasure are related to a sugar rush, winning a sports event or even sky diving, all of which augment dopamine release at the reward brain site. Recent multidisciplinary research, using both humans and detailed invasive brain analysis of animals has discovered some critical ways that the brain processes pleasure. Remarkably, there are pathways for ordinary liking and pleasure, which are limited in scope as described above in this commentary. However, there are **many brain regions**, often termed hot and cold spots, that significantly **modulate** (increase or decrease) our **pleasure or** even **produce the opposite** of pleasure— that is disgust and fear [39]. One specific region of the nucleus accumbens is organized like a computer keyboard, with particular stimulus triggers in rows— producing an increase and decrease of pleasure and disgust. Moreover, the cortex has unique roles in the cognitive evaluation of our feelings of pleasure [40]. Importantly, the interplay of these multiple triggers and the higher brain centers in the prefrontal cortex are very intricate and are just being uncovered. Desire and reward centers It is surprising that many different sources of pleasure activate the same circuits between the mesocorticolimbic regions (Figure 1). Reward and desire are two aspects pleasure induction and have a very widespread, large circuit. Some part of this circuit distinguishes between desire and dread. The so-called pleasure circuitry called “REWARD” involves a well-known dopamine pathway in the mesolimbic system that can influence both pleasure and motivation. In simplest terms, the well-established mesolimbic system is a dopamine circuit for reward. It starts in the ventral tegmental area (VTA) of the midbrain and travels to the nucleus accumbens (Figure 2). It is the cornerstone target to all addictions. The VTA is encompassed with neurons using glutamate, GABA, and dopamine. The nucleus accumbens (NAc) is located within the ventral striatum and is divided into two sub-regions—the motor and limbic regions associated with its core and shell, respectively. The NAc has spiny neurons that receive dopamine from the VTA and glutamate (a dopamine driver) from the hippocampus, amygdala and medial prefrontal cortex. Subsequently, the NAc projects GABA signals to an area termed the ventral pallidum (VP). The region is a relay station in the limbic loop of the basal ganglia, critical for motivation, behavior, emotions and the “Feel Good” response. This defined system of the brain is involved in all addictions –substance, and non –substance related. In 1995, our laboratory coined the term “Reward Deficiency Syndrome” (RDS) to describe genetic and epigenetic induced hypodopaminergia in the “Brain Reward Cascade” that contribute to addiction and compulsive behaviors [3,6,41]. Furthermore, ordinary “liking” of something, or pure pleasure, is represented by small regions mainly in the limbic system (old reptilian part of the brain). These may be part of larger neural circuits. In Latin, hedus is the term for “sweet”; and in Greek, hodone is the term for “pleasure.” Thus, the word Hedonic is now referring to various subcomponents of pleasure: some associated with purely sensory and others with more complex emotions involving morals, aesthetics, and social interactions. The capacity to have pleasure is part of being healthy and may even extend life, especially if linked to optimism as a dopaminergic response [42]. Psychiatric illness often includes symptoms of an abnormal inability to experience pleasure, referred to as anhedonia. A negative feeling state is called dysphoria, which can consist of many emotions such as pain, depression, anxiety, fear, and disgust. Previously many scientists used animal research to uncover the complex mechanisms of pleasure, liking, motivation and even emotions like panic and fear, as discussed above [43]. However, as a significant amount of related research about the specific brain regions of pleasure/reward circuitry has been derived from invasive studies of animals, these cannot be directly compared with subjective states experienced by humans. In an attempt to resolve the controversy regarding the causal contributions of mesolimbic dopamine systems to reward, we have previously evaluated the three-main competing explanatory categories: “liking,” “learning,” and “wanting” [3]. That is, dopamine may mediate (a) liking: the hedonic impact of reward, (b) learning: learned predictions about rewarding effects, or (c) wanting: the pursuit of rewards by attributing incentive salience to reward-related stimuli [44]. We have evaluated these hypotheses, especially as they relate to the RDS, and we find that the incentive salience or “wanting” hypothesis of dopaminergic functioning is supported by a majority of the scientific evidence. Various neuroimaging studies have shown that anticipated behaviors such as sex and gaming, delicious foods and drugs of abuse all affect brain regions associated with reward networks, and may not be unidirectional. Drugs of abuse enhance dopamine signaling which sensitizes mesolimbic brain mechanisms that apparently evolved explicitly to attribute incentive salience to various rewards [45]. Addictive substances are voluntarily self-administered, and they enhance (directly or indirectly) dopaminergic synaptic function in the NAc. This activation of the brain reward networks (producing the ecstatic “high” that users seek). Although these circuits were initially thought to encode a set point of hedonic tone, it is now being considered to be far more complicated in function, also encoding attention, reward expectancy, disconfirmation of reward expectancy, and incentive motivation [46]. The argument about addiction as a disease may be confused with a predisposition to substance and nonsubstance rewards relative to the extreme effect of drugs of abuse on brain neurochemistry. The former sets up an individual to be at high risk through both genetic polymorphisms in reward genes as well as harmful epigenetic insult. Some Psychologists, even with all the data, still infer that addiction is not a disease [47]. Elevated stress levels, together with polymorphisms (genetic variations) of various dopaminergic genes and the genes related to other neurotransmitters (and their genetic variants), and may have an additive effect on vulnerability to various addictions [48]. In this regard, Vanyukov, et al. [48] suggested based on review that whereas the gateway hypothesis does not specify mechanistic connections between “stages,” and does not extend to the risks for addictions the concept of common liability to addictions may be more parsimonious. The latter theory is grounded in genetic theory and supported by data identifying common sources of variation in the risk for specific addictions (e.g., RDS). This commonality has identifiable neurobiological substrate and plausible evolutionary explanations. Over many years the controversy of dopamine involvement in especially “pleasure” has led to confusion concerning separating motivation from actual pleasure (wanting versus liking) [49]. We take the position that animal studies cannot provide real clinical information as described by self-reports in humans. As mentioned earlier and in the abstract, on November 23rd, 2017, evidence for our concerns was discovered [50] In essence, although nonhuman primate brains are similar to our own, the disparity between other primates and those of human cognitive abilities tells us that surface similarity is not the whole story. Sousa et al. [50] small case found various differentially expressed genes, to associate with pleasure related systems. Furthermore, the dopaminergic interneurons located in the human neocortex were absent from the neocortex of nonhuman African apes. Such differences in neuronal transcriptional programs may underlie a variety of neurodevelopmental disorders. In simpler terms, the system controls the production of dopamine, a chemical messenger that plays a significant role in pleasure and rewards. The senior author, Dr. Nenad Sestan from Yale, stated: “Humans have evolved a dopamine system that is different than the one in chimpanzees.” This may explain why the behavior of humans is so unique from that of non-human primates, even though our brains are so surprisingly similar, Sestan said: “It might also shed light on why people are vulnerable to mental disorders such as autism (possibly even addiction).” Remarkably, this research finding emerged from an extensive, multicenter collaboration to compare the brains across several species. These researchers examined 247 specimens of neural tissue from six humans, five chimpanzees, and five macaque monkeys. Moreover, these investigators analyzed which genes were turned on or off in 16 regions of the brain. While the differences among species were subtle, **there was** a **remarkable contrast in** the **neocortices**, specifically in an area of the brain that is much more developed in humans than in chimpanzees. In fact, these researchers found that a gene called tyrosine hydroxylase (TH) for the enzyme, responsible for the production of dopamine, was expressed in the neocortex of humans, but not chimpanzees. As discussed earlier, dopamine is best known for its essential role within the brain’s reward system; the very system that responds to everything from sex, to gambling, to food, and to addictive drugs. However, dopamine also assists in regulating emotional responses, memory, and movement. Notably, abnormal dopamine levels have been linked to disorders including Parkinson’s, schizophrenia and spectrum disorders such as autism and addiction or RDS. Nora Volkow, the director of NIDA, pointed out that one alluring possibility is that the neurotransmitter dopamine plays a substantial role in humans’ ability to pursue various rewards that are perhaps months or even years away in the future. This same idea has been suggested by Dr. Robert Sapolsky, a professor of biology and neurology at Stanford University. Dr. Sapolsky cited evidence that dopamine levels rise dramatically in humans when we anticipate potential rewards that are uncertain and even far off in our futures, such as retirement or even the possible alterlife. This may explain what often motivates people to work for things that have no apparent short-term benefit [51]. In similar work, Volkow and Bale [52] proposed a model in which dopamine can favor NOW processes through phasic signaling in reward circuits or LATER processes through tonic signaling in control circuits. Specifically, they suggest that through its modulation of the orbitofrontal cortex, which processes salience attribution, dopamine also enables shilting from NOW to LATER, while its modulation of the insula, which processes interoceptive information, influences the probability of selecting NOW versus LATER actions based on an individual’s physiological state. This hypothesis further supports the concept that disruptions along these circuits contribute to diverse pathologies, including obesity and addiction or RDS.

**Extinction first –**

**1 – Forecloses future improvement – we can never improve society because our impact is irreversible**

**2 – Turns suffering – mass death causes suffering because people can’t get access to resources and basic necessities**

**3 – Moral obligation – allowing people to die is unethical and should be prevented because it creates ethics towards other people**

**4 – Objectivity – body count is the most objective way to calculate impacts because comparing suffering is unethical**

**5 – Moral uncertainty – if we’re unsure about which interpretation of the world is true – we ought to preserve the world to keep debating about it**

### C1) Public Private Partnership

#### Public Private Partnerships increasing in squo

**Beckers and Steggeman 21** [https://www.mckinsey.com/business-functions/risk-and-resilience/our-insights/a-smarter-way-to-think-about-public-private-partnerships] //VRao

**Public–private partnerships (PPPs) have become** an **increasingly popular** way to get major infrastructure projects built. Compared with traditional procurement solutions, these arrangements show a **significantly increased level of private-sector participatio**n, with the goal of **boost**ing the **efficiency** and **effectiveness** of the project through its entire life cycle, from development to the end of the operating phase**. PPPs can also** spread a project’s cost over a more extended period and can thus **free up public funds for investment in sectors in which private investment is impossible** or otherwise inappropriate. However, PPPs should not be seen as an instrument to solve public-sector budget constraints or financing gaps, but rather a tool to deliver effective, cost-efficient projects and associated services.

#### Voting aff removes resource appropriation incentives in space for private companies, which is key for the private space sector, and causes PPPs to stop

**Basulto 15**[Basulto, Dominic. “How Property Rights in Outer Space May Lead to a Scramble to Exploit the Moon's Resources.” *The Washington Post*, WP Company, 18 Nov. 2015, <https://www.washingtonpost.com/news/innovations/wp/2015/11/18/how-property-rights-in-outer-space-may-lead-to-a-scramble-to-exploit-the-moons-resources/>.] //Varun Rao

This week the U.S. House of Representatives passed legislation known as the SPACE Act of 2015 ([The U.S. Commercial Space Launch Competitiveness Act](https://www.congress.gov/bill/114th-congress/house-bill/2262/text)), which recognizes and promotes the rights of U.S. companies to engage in the exploration and extraction of space resources from asteroids and other celestial bodies.

That’s a huge win for private space exploration companies, especially for companies with upcoming plans to tap into the economic potential of the moon. That’s because the legislation, in its definition of “space resources,” is sufficiently broad to include resources found on the lunar surface. In short, **the moon could now be in play for some of America’s most innovative space exploration companies.**

One of those companies is [Moon Express](http://moonexpress.com/), a privately funded commercial space company with[an audacious plan to mine the surface of the moon](https://www.washingtonpost.com/news/innovations/wp/2015/03/19/an-audacious-plan-to-mine-the-surface-of-the-moon/?itid=lk_inline_manual_5). As Bob Richards, co-founder and CEO of Moon Express, told me, minerals and water found on the moon would be technically classified as a “space resource” according to Title IV of the SPACE Act, which defines “space resource” simply as “an abiotic resource in situ in outer space.”

“**The key to unlocking the economic potential of the moon is the water on the moon**,” Richards said. “Water is the ‘oil of the solar system,’ and can be used to create rocket fuel that changes the economics of space resources, not just on the moon, but throughout the solar system. So our initial goal is to locate and learn how to mine and stockpile the water on the moon. We’re effectively after our first gusher.”

And it’s **not just Moon Express interested in finding water on the moon. Mining the moon for water has attracted the attention of**[**Shackleton Energy Resources**](http://www.shackletonenergy.com/overview/#goingbacktothemoon)**,** which suggests that [there are billions of tons of water ice on the poles of the moon](http://www.shackletonenergy.com/overview/#goingbacktothemoon) that might be converted into rocket fuel. Moreover, **NASA has**[**two different mission concepts for extracting water from the lunar surface**](http://www.space.com/27388-nasa-moon-mining-missions-water.html)**.** If there’s ever going to be human lunar colony, then finding water on the moon is going to be a priority. It’s just cheaper and easier to have a source of water on the moon than it is to bring water to the moon.

[In introducing the SPACE Act legislation for a vote Monday night](http://www.majorityleader.gov/2015/11/16/the-future-of-space-exploration-is-now/), House Majority Leader (R-Calif.) Kevin McCarthy invoked the inspiring examples of both Kitty Hawk and Chuck Yeager breaking the sound barrier and cited the **extraordinary innovation already happening around commercial space exploration**:

When it comes to outer space, however, there’s the matter of a pesky little document known as the [Outer Space Treaty of 1967](http://www.unoosa.org/oosa/SpaceLaw/outerspt.html), to which the United States is a signatory. The Outer Space Treaty indirectly suggests that commercial space companies don’t own the rights to any resources they find in outer space. The treaty states that no “celestial body” is subject to “national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”

The SPACE Act of 2015 carefully skirts this issue by specifically making a disclaimer that the United States “does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body.” Clever, right? If there’s no U.S. sovereign claim, then the Outer Space Treaty can’t be applicable to private U.S. companies that assert a similar type of claim.

When asked about a hypothetical example in which a Chinese company or even the Chinese government might contest the rights of a U.S. company to space resources, Richards suggests that the SPACE Act would provide a sufficient legal basis. “It’s hard to imagine what challenge China or any other country could mount against this **U.S. legislation**, which **is about rights to materials obtained**, not territory, and is really just codifying principles and rights already in the 1967 Outer Space Treaty that have been demonstrated by **multinational activities on the moon as applicable to the private sector.”**

Nearly 50 years ago, of course, we didn’t know anything about the economic potential of space and nobody was seriously talking about humans as an interplanetary species. Certainly, there were not any private companies angling for a piece of the action. Space exploration was solely the preserve of sovereign governments and [we referred to astronauts as the “envoys of mankind.”](http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html)The prevailing sentiment, [as expressed in the Outer Space Treaty](http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html), was that outer space should belong to all of humanity, not just the first nation to venture into space and plant a flag on the surface of a celestial body.

**What’s happening now**, in essence**, is**[**a sea change in how we think about outer space**](https://www.washingtonpost.com/news/innovations/wp/2015/02/12/one-small-step-for-man-one-giant-step-for-the-commercialization-of-the-moon/?itid=lk_inline_manual_23)**. To convince private commercial space exploration companies to invest millions of dollars, there have to be economic incentives involved.** In short, financial backers of these companies **have to be able to realize a profit from their investments if innovation is going to happen**. That’s the reality.

Richards cites the rights of fishing boats in international waters as an economic template for the SPACE Act, “The ships are owned by companies flying flags of nations under which laws they are bound: they have a right to peacefully fish in international waters that they don’t own; but they have a right of ownership of the fish once obtained.”

The fishing analogy is a useful one. It suggests that we’re simply extending the same economic principles used on Earth to the moon and beyond, not creating new principles. Seafaring nations are now spacefaring nations. [Moon Express even refers to the moon as “the eighth continent,”](http://moonexpress.com/) suggesting that people should think about the moon the same way they think about the other seven continents on the planet. And Planetary Resources, an asteroid mining company, refers to the [“off-planet economy.”](http://www.planetaryresources.com/2015/11/planetary-resources-applauds-u-s-congress-in-recognizing-asteroid-resource-property-rights/)

**Throughout the annals of exploration, there have always been commercial incentive**s. Would the untapped economic potential of America have been possible without similar types of incentives? [One example cited by backers of the SPACE Act is the Homestead Act of 1862](http://www.planetaryresources.com/2015/11/planetary-resources-applauds-u-s-congress-in-recognizing-asteroid-resource-property-rights/), which paved the way for Americans to search for gold and timber. **Governments** they say, **have an important role to play here by passing legislation that catalyzes, rather than stifles, growth and innovation.**

#### Scenario 1 – Innovation

#### Public private partnerships spur massive tech innovations in space, but Outer Space Treaty rules against companies prevents space colonization

Chaben 20 [Jack B. Chaben, educator at George Washington University, 2020, "Extending Humanity’s Reach: A Public-Private Framework for Space Exploration." Journal of Strategic Security, https://digitalcommons.usf.edu/cgi/viewcontent.cgi?article=1811&context=jss]/Kankee

Exploring the Commercial Alternative The initiation of the construction of the International Space Station (ISS) in 1998 emphasized the increasingly international nature of space. Russia launched the first segment of the ISS, the Zarya control module, using one of the nation’s own rockets.24 The first U.S.-built segment of the ISS met the Russian module that same year, riding to orbit on the Space Shuttle.25 The collaboration between these two once-competing countries resulted in an unprecedented accomplishment in space, enabling sustainable access to and long-term experiments within the still-mysterious environment. Humans have lived on the ISS since the first crew arrived on November 2, 2000, providing insight into the long-term effects of the adverse conditions of space on the human body.26 By sustaining a human presence on the ISS, the international partners have also gained valuable experience in maintaining a spacecraft for long-term human use, a foundational component of missions to deep space. Since humans began inhabiting the Station, the European Space Agency and its Japanese counterpart have launched additional laboratory modules to facilitate research in space.27 While the Space Shuttle enabled this phase of international cooperation, its retirement in 2011 marked another structural change in the relationship between the United States, Russia, and each countries’ efforts in space. The end of the Space Shuttle program in 2011 initially resulted in a new dependence on Russian space capabilities, as the country’s Soyuz rocket became the only method to send American astronauts to the ISS. While this reliance strengthened international cooperation in space, it further exasperated the gap left by the end of the space race. The United States consequently lacked the capability to send its own astronauts to the ISS and to conduct future missions into deep space. NASA realized this eventual lack of capability during the construction of the ISS. In 2006, the agency began to contract its ISS resupply missions to private space companies through the Commercial Resupply Services (CRS) program, one of two strategies managed by the Commercial Crew and Cargo Program Office (C3PO).28 This decision to utilize the technologies of the commercial space industry to fulfill the nation’s obligations to the ISS initiated a new relationship between NASA and private space companies that ushered in a new phase of space travel. In addition to providing an alternative to dependence on Russian rockets, this widening cooperation between NASA and the commercial space industry displayed the dynamic capabilities of private companies to support the agency’s goal of maintaining a proactive presence in space. Inherently, the commercial space sector focused on cost-effective and innovative products to develop the most efficient technologies possible for space travel. While this natural profit-driven tendency of private industry may have revealed a failure of NASA to use its resources effectively, profitability became a powerful source of motivation to innovate. Innovation in the private space sector not only sustained resupply missions to the ISS but also catalyzed an entire space economy fueled largely by the burgeoning commercial space industry. By 2011, driven by the growth of commercial opportunities in space, this global space economy grew to nearly $290 million and instilled a strong sense of confidence in future commercial activity in the expansive environment. 29 The partnerships between NASA and private companies, beginning with the CRS program, introduced a new model for advancing the presence of humans in space. These Space Act Agreements (SAAs) became the main form of collaboration between NASA and commercial organizations.30 The National Aeronautics and Space Act of 1958 granted NASA the authority to enter into SAAs at its creation and enabled the agency to harness the innovations of private organizations to fulfill its mandated goals in space. Increased efficiency of routine missions to the ISS became the primary goal of the privatization of activities in space through these SAAs. Consequently, through the natural competition of the commercial space industry, NASA began awarding its contracts to the companies developing the most cost-effective capabilities. The CRS program utilized a costs-plus model in which NASA entered into binding agreements to purchase the hardware and services of its private partners no matter the cost, as it did in the Apollo era. A new form of SAAs emerged through the Commercial Orbital Transportation Services (COTS) program. 31 This new public-private strategy enabled NASA to set the objectives of its partnerships and made private companies responsible for reaching these goals in the most efficient manner possible, with NASA a primary investor and customer. Moreover, because companies are paid only for their achievements, NASA effectively spurs competition throughout the industry as companies strive to create the most efficient and effective technologies to attract the agency’s contracts. This system of progressive payments has encouraged unprecedented innovation and efficiency. SpaceX, for example, under a contract through the COTS program, built its Falcon 9 rocket and Dragon capsule for less than onethird the cost of NASA’s estimate.32 This tremendous efficiency has revealed the benefit of pursuing public-private partnerships following the model of the COTS program. As a customer of private space companies, NASA not only gains the ability to maintain the American presence in space but can also dedicate its limited resources to the development of novel missions to deeper space, specifically missions to Mars. The retirement of the Space Shuttle program reinforced this seminal transition to a commercial-network model, for private companies will provide the hardware necessary to send American astronauts to space on American rockets once again. Collaboration between NASA and the commercial space sector allows the agency to target its efforts on the extension of humanity’s reach throughout the solar system while reinforcing its previous accomplishments in space. As a result, publicprivate partnerships spurred by the COTS program have not only laid the foundation of the current phase of American space travel but have become the stepping-stones to human missions to Mars. Harnessing Commercial Opportunities As SpaceX successfully demonstrated its evolving and increasingly powerful capabilities with the launch of its Falcon Heavy rocket in 2017, excitement for space travel surged. This renewed enthusiasm for space, however, differed fundamentally from the triumph of Apollo 11; it came at the hands of a private company, not a national agency that served as a proxy for the entire country in an international battle. Despite this operational shift of NASA’s role, new SAAs are allowing the agency to benefit from the relatively rapid pace of innovation in the private sector, while still creating a new sense of possibility in space. In a major act in this public-private phase of space travel, a foundational step in the journey to Mars, NASA partnered with SpaceX to successfully launch astronauts to the ISS in the company’s Crew Dragon capsule on May 30, 2020. The National Aeronautics and Space Administration’s SpaceX Demo-2 mission marked not only the first commercially constructed and operated manned space flight, but the first time since the Space Shuttle’s retirement that astronauts launched from American soil.33 The agency plans to continue to send humans back to the ISS using commercial vehicles from SpaceX and, eventually, Boeing. Conducted under the mandate of the C3PO, these privately flown missions, purchased by NASA, can end the dependence on Russia to launch American astronauts and spur competition in the commercial space sector as companies strive to win NASA’s lucrative business.34 In addition to demonstrating the feasibility of public-private partnerships in space, the ability of private companies to conduct these routinized missions to the ISS becomes a crucial step in the development of the capabilities necessary for missions to Mars. Engaging in repeatable missions to the ISS allows private companies to simulate the launch, travel, and landing processes that will be crucial as manned missions into deep space transition from proof-of-concept missions to cost-effective routine transportation. Sustained travel to LEO alone, though, will not stimulate the innovation necessary for missions to Mars. Rather, to prepare for this ultimate goal, private companies should conduct progressively complex missions through contracts with NASA to fill the gaps the agency opens as it dedicates its resources to novel missions into deeper space. Through this supplementary relationship, private space companies gain the opportunity to build upon their technologies and refine their processes to ensure the transition from wholly public agencybased missions to routine public-private trips is as seamless as possible. The Global Exploration Roadmap (GER), a coordinated international framework to advance human exploration of the solar system, expresses the importance of an “evolution of critical capabilities which are necessary for executing increasingly complex missions to multiple destinations,” culminating with Mars.35 While the GER of 2013, along with its 2018 refinements, underestimates the role of public-private partnerships in the development of manned missions to Mars, it establishes a functional path to reach the red planet through international collaboration between space agencies. The integration of public-private partnerships into this proposed itinerary, however, will unlock increased flexibility in the efforts of public space agencies. In its three-phase plan, the GER identifies potential commercial opportunities only in missions to the Moon and its vicinity.36 The GER recognizes the existing role of commercial actors in LEO, especially in the continued use of the ISS, but cites only the technologies of participating space agencies as the potential means to conduct human missions into deep space.37 Each phase of the GER identifies a key step in the development of the capabilities to conduct missions to Mars, each building upon another in complexity to gain crucial knowledge and experience. While international collaboration will remain an essential precursor to sustainable human missions to the red planet, public-private partnerships will offer innovative solutions to support this sustained human presence. In its first phase, the GER aims to preserve the ISS as an environment for research and technology testing. This phase of the plan remains consistent with many of its internationally defined goals, notably the development of exploration technologies that promote the advancement of earth and space science, and extend understanding of the effects of space on human health.38 As the only currently operational phase of the GER, the ISS enables its visitors to gain unique insights into the current capabilities of humans in space. The Station has become a platform upon which various actors in space can conduct research and simulate long-term travel through space.39 Consequently, sustained operation of the ISS has revealed the benefit of maintaining common objectives between international collaborators; its construction and continual evolution as a preparatory environment for deep space travel materialized through integrated international efforts. Since 2011, however, NASA has relied on contracts with private space companies to sustain its scientific presence on the ISS. Through new SAAs, NASA has revealed the importance of the private sector in space, as its partnerships have spurred a continuous cycle of innovation that can meet the GER’s plans for continued use of the ISS. This new network of public-private partnerships will facilitate NASA’s efforts to send humans to the ISS while enabling the agency to pursue the progressively complex goals of the GER. Ultimately, the commercial space sector, with NASA as its main customer, is becoming the foundation of this international plan to reach Mars, as it assumes increasing responsibility for U.S. missions to the ISS. Public-private partnerships remain similarly important in the subsequent phases of the GER. The international plan advocates for an expansion of the synergy between human and robotic missions to “increase the unique contribution of each to achieving exploration goals.” 40 Robotic missions will therefore continue the pursuit of knowledge about the solar system before humans reach uncharted destinations. Gaining access to space through robotic missions can generate fundamental knowledge of the future locations of human space flight. This knowledge-generation facilitates the safety of human explorers while providing key preparatory insight to help guide formulation of future human missions to new destinations. Findings from these robotic missions can significantly affect the confidence with which public-private networks conduct future missions to the lunar surface, and eventually to Mars. When paired with the experience of sustaining a human presence on the ISS, robotic missions around and upon the Moon may become the next foundational step towards manned missions to Mars. With a variety of robotic missions planned for the lunar surface in the coming decade, the role of maturing private space companies grows in importance. The cost-effective and innovative developments of the United States’ commercial space sector have revealed the benefit of shifting responsibility from NASA and assigning routine missions to private companies. This planned proliferation of unmanned reconnaissance missions, that provide a constant stream of information about future destinations for humans, can serve as a model for the robotic exploration phase of the GER. The repeatability of these robotic missions is highly compatible with the efficient efforts of private companies, and enables public space agencies to conduct these foundational operations at a lower cost. While these partnerships enhance the flexibility of space agencies to act within limited budgets, they also enable private companies to gain the hands-on experience that will be essential to conducting missions to Mars. As a result, robotic missions not only advance the readiness of space agencies, as the GER projects, but also prepare private partners for their transition to conducting increasingly complex routinized missions. Empowering Exploration into Deep Space The knowledge gained through robotic missions facilitates the next phase of the GER and the next step on the journey to Mars: Human exploration beyond LEO. Similar to the integrated international effort to develop the capabilities to sustain a human presence on the Moon, NASA’s Moon to Mars plan considers a robust human transport system to the lunar surface a precursor to missions to Mars. NASA’s Artemis program aims to return humans to the Moon by 2024 through the development of a lunar station in orbit, Gateway, followed by sustainable human missions to the lunar surface.41 This goal of establishing a permanent presence on the Moon, a potential model for future missions to Mars, depends upon the continued partnership between NASA and private companies. Without the efficient services of the commercial space sector, NASA’s commitment to sustain the human presence on the ISS restrains the agency from exploring beyond LEO. By shifting its LEO responsibilities to private companies through new SAAs, NASA gains the freedom necessary to pursue its goals on the Moon and further into deep space. Consequently, as NASA leads the international effort to sustain humanity on the Moon and develop the capabilities to reach Mars, the efficiency and flexibility of private space companies will become a central part of the journey to the red planet. The GER defers the definition of missions to deeper space to the future, citing the importance of new discoveries and sustainable technologies to reach Mars.42 Private space companies will come to define these deep space missions as they efficiently routinize the tasks previously reserved for public agencies and prepare to assume the eventual role of sustaining a human presence on Mars. Artemis marks significant progress along the GER, as it supports the plan for robotic exploration of the Moon, followed by manned-missions to the lunar surface. The program harnesses widespread international collaboration to create a safe, sustainable, and efficient system for lunar exploration. At the crux of Artemis, NASA’s Space Launch System (SLS) and Orion capsule will provide the power to carry astronauts and essential cargo beyond LEO and, with future upgrades, to Mars.43 SLS, according to NASA, is the only rocket capable of carrying astronauts and large cargo to the Moon on a single mission.44 Built by the United Launch Alliance, a collaborative partnership between Boeing and Lockheed Martin, SLS is a product of traditional costs-plus agreements.45 Its increasing budget and slipping first launch date reveal the potential disadvantages of these limiting contracts, especially without the competitive pressures inherent in new SAAs. SLS, however, is not the only heavy-lift rocket currently in development; SpaceX and Blue Origin, for example, are each constructing systems to compete with SLS. SpaceX’s Starship is a fully reusable transportation system set to carry crew and cargo to earth orbit, the Moon, and Mars.46 Blue Origin is developing New Glenn, a semi-reusable rocket that will conduct routine missions to LEO and beyond.47 The National Aeronautics and Space Administration’s efforts to build the capability to explore further into space are followed closely by private companies that match, if not supersede, the power and efficiency of SLS. This step outside public-private partnerships through SAAs back into the traditional model of cooperation may enable NASA to exert greater control over its initial flights to the Moon and Mars, but reveals the efficiency with which private companies can operate. While NASA may refrain from entering new SAAs with companies like SpaceX or Blue Origin for its flagship missions beyond LEO, the presence and continued efforts of private space companies will become essential to sustaining the presence established by SLS. The efforts of the commercial space industry are not contradictory to, but complementary of NASA. Despite its inefficiency and relative lack of reusability, SLS has stimulated an internationally collaborative building process that will serve as the foundation of a human presence in space, sustained by public-private partnerships. In addition to facilitating the realization of the GER, NASA’s efforts also continue to advance United States National Space Policy, as amended by Space Policy Directive 1 of December 2017. Under this presidential directive, NASA will “Lead an innovative and sustainable program of exploration with commercial and international partners to enable human expansion across the solar system.” 48 Space Launch System will certainly provide the future capability for the United States to extend its presence beyond LEO, but the confluence of the accomplishments of private companies with the pioneering missions of NASA through new SAAs is similarly essential. In addition to its recent launch of NASA astronauts to the ISS, SpaceX, since 2012, has flown eighteen resupply missions to the ISS for NASA under the C3PO.49 The company’s costeffective services, bolstered by the reusability of its rockets, have enabled NASA to maintain its research efforts in space by reducing its spending on missions to the ISS. Boeing is currently testing its CST-100 Starliner spacecraft, competing directly with SpaceX to send astronauts to the ISS.50 Despite the vehicle’s failed orbital flight test in December 2019, its eventual operation will not only provide NASA another vehicle to power its efforts to maintain the American presence in space, but will spark competition with SpaceX that propels innovation.51 These efforts will continue to transform the United States space program as it regains the ability to launch humans and cargo to the ISS. Crucially, as private companies assume responsibility for missions to the ISS and other locations within LEO, NASA can dedicate a larger part of its budget to SLS and deep space exploration to continue along the GER. This model of commercial reinvigoration of the United States space program provides a seminal framework for exploration beyond LEO that applies to NASA’s current mandate and the GER. As the commercial space sector continues to sustain NASA’s presence on the ISS, the agency can dedicate its efforts to preparing SLS for missions to the Moon. By extension, once Gateway and manned missions to the lunar surface prove feasible, NASA can shift these missions to the private sector whose vehicles will provide a routine, affordable manner to sustain a human presence on and around the Moon. The significantly reduced cost of public-private missions to the Moon through new SAAs will enable NASA to pivot its resources to preparing SLS for travel to Mars. Meanwhile, private space companies can continue to build upon their experience conducting routine flights to the ISS with insight into the effects of prolonged travel through space on both vehicles and human passengers. First with its pioneering experience returning humans to the ISS and the Moon, then with the increased flexibility for development of SLS afforded to it by the innovation of private companies, NASA will conduct the first manned missions to Mars. Moreover, as private companies begin to conduct routine missions to the Moon as NASA invests in Mars, the allure of efficiency will allow the commercial sector to apply its accumulated experience in space to sustaining humanity on the red planet. Reaching New Heights Together Predicated upon tightly integrated international cooperation and agreements with the commercial space sector, NASA can follow the GER and United States space policy to extend the reach of humanity. When paired with the push for collaboration among national space agencies by current United States space policy, however, the international nature of the GER reinforces the characterization of space as a place for nationstates. While this nation-based cast remains consistent with the terms of the OST, it consequently questions the legitimacy of private companies acting in space. Article IX of the OST holds that actors in space should “conduct all their activities in outer space… with due regard to the corresponding interests of all other states.” 52 Some states party to the agreement may neglect to recognize private entities as legal actors in space, thereby threatening the practicability of conducting progressively complex and expensive missions on behalf of national space agencies. The commercial space industry will necessarily seek dedicated support from sponsoring governments, as it prepares to launch missions deeper into space, to ensure protection for its activities from states less receptive to the growing role of private companies. By establishing a pattern of public proof-of-concept missions followed by a shift to the private sector to sustain an extended human presence in space, public-private partnerships enable companies to gain the experience necessary for progressively complex missions. This cooperative succession will progressively construct the sense of confidence sought by space companies as they interact in a traditionally state-dominated environment. By conducting the first missions beyond LEO and eventually to Mars, public space agencies may dilute some of the uncertainty with which the commercial space industry would have to cope as it attempts to transition into its leading role.53 The reinforcing relationship between public space agencies and private space companies, furthered by the cooperation between such agencies along the GER, will confirm the commercial space industry’s integrity as it works to extend humanity throughout the solar system. By signaling the importance of international collaboration on the journey to Mars, the GER can serve as a stable foundation of the confidence the commercial space industry seeks before dedicating its resources to sustaining a human presence in space. Public-private partnerships will further support the efforts of the space sector, as space agencies become a liaison for private companies operating in the traditionally state-run environment. The tight integration between the commercial space industry and NASA, for example, will enable companies to act on behalf of the United States as a proxy for the efforts of the agency. States can increase the efficiency of their activities, private companies can protect their profits, and humans will explore unprecedented distances because of this cooperation. Ultimately, public-private partnerships through new SAAs allow private companies to become an extension of the state. Through the innovative technologies of the commercial space industry that increase the efficiency of space travel, these partnerships will enable sponsoring state agencies to further the internationally shared goal of creating a sustained human presence in deep space. Protecting Public-Private Progress The importance of public-private partnerships to reaching Mars, through the ISS and the Moon, will prevent a return to the dualistic nature of space that prompted the first missions to the lunar surface. A globally shared excitement for exploration has supplanted the competitive race to space, and private companies have become the key to this transformation, revealing innovative technologies that paint a view of a future where humanity is multiplanetary. Public-private partnerships capture this excitement; space agencies are recognizing the revolutionary role of private companies that are creating cost-effective and capable vehicles to reach unprecedented distances. While space agencies may still choose to conduct the pioneering missions to new locations alone, they can do so knowing the rapid efforts of private companies will readily make these flagship missions repeatable and efficient. National space agencies will find the freedom to devote their limited resources to developing these novel missions because private companies can quickly fill the gap with routinized missions to previously established destinations. It is through this pattern of succession that private companies will gain the experience required to take on the challenge of sustaining humanity on Mars. Public-private partnerships, consequently, inhibit the characterization of space as a conquerable territory for one nation over all others. They promote a global sense of exploration, represented by the GER, in which the efforts of states and companies alike are mutually dependent. In fact, private missions to the Moon and Mars may further ameliorate concerns of a return to a competitive space race mentality by effectively preventing countries from pursuing sovereignty in space and ignoring the terms of the OST. This multifaceted view of space, however, presents some difficulty in the application of the OST, for the era of publicprivate exploration of the Moon and Mars remains unprecedented. By maintaining the state as the primary actor in space, the OST presents various obstacles to the successful realization of the GER and the exploration goals of the United States. Consistent with its effort to curb the militarization of space, the OST prohibits states from claiming sovereignty of any celestial body, including the Moon and Mars. While the OST recognizes the activities of non-governmental entities as legitimate if granted “authorization and continuing supervision by the appropriate State Party,” it falls short of protecting the public-private partnerships that will enable sustainable exploration into deep space.54 A sense of security, as discussed above, in the tumultuous environment of outer space becomes increasingly salient as private companies assume greater responsibility for the tasks proven feasible by public space agencies. Private companies will seek a semblance of protection for their efforts and the significant costs they require, a safety net that the OST does not provide. Will companies claim the territory they explore and the resources they uncover on Mars to sustain its growing human population? Alternatively, will celestial bodies remain intangible destinations, benchmarks for the state of technology? The answers to these fundamental questions remain absent from the OST, but the model of public-private partnerships presented herein may guide the interested parties to a solution. Conclusion: Preparing for a Multiplanetary Future

#### Space Commercialization drives Tech Innovation in the Status Quo – it provides a unique impetus.

Hampson 17 Joshua Hampson 1-25-2017 “The Future of Space Commercialization” <https://republicans-science.house.gov/sites/republicans.science.house.gov/files/documents/TheFutureofSpaceCommercializationFinal.pdf> (Security Studies Fellow at the Niskanen Center)//Elmer

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.

#### PPPs Create competitive markets and has the net benefit of increasing the amount of research we can do

**ISS National Lab** [International Space Station National Laboratory – Center for the Advancement of Science in Space, “Research on the ISS, No Date, <https://www.issnationallab.org/research-on-the-iss/public-private-partnerships-in-space/>] //neth

Commercial Services Providers – A Competitive Marketplace for Space Services As the demand for space research and development projects increases, the supply of access to space and research and development facilities will need to be augmented. In space, private-sector commercial research and development facility operators are on the forefront of a new era of space research on the ISS and future space platforms. These organizations operate their facilities internally and externally on the ISS. They provide users with more choices to address unique research needs and are the pathfinders for a marketplace in low Earth orbit. Many of these companies have used their own resources to invest in in-orbit research and development facilities, reducing the risk for the federal sector to develop these facilities and services. In its first five years, the ISS National Lab has supported growth in the number of these research and development facility operators from one in FY12 to five in FY16—with four additional facilities expected to begin in-orbit operations by FY18. The ISS National Lab fosters healthy competition between these supply partners by allowing them to bid on each commercial customer project, seeking the best solution for the customer. The current commercial facility operators are: NanoRacks – Since 2009, NanoRacks has provided hardware and services for the International Space Station National Laboratory. Three internal research platforms can house plug-and-play NanoLabs and provide critical capabilities such as centrifugation and microscopy. Additionally, the NanoRacks External Platform was launched in FY15 and provides capabilities for Earth and deep space observation, sensor development, and testing for advanced electronics and materials. BioServe – In-orbit offerings from BioServe include multiple life sciences facilities and kits, including the multi-purpose Space Automated Bioproduct Laboratory (SABL), launched in FY15. SABL supports myriad initiatives for commercial life sciences research as well as physical and material science experiments. TechShot – Launched in FY15, the TechShot Bone Densitometer is a commercial bone-density scanner for use in spaceflight rodent research. In just one year, the successful operation of this facility has already demonstrated its utility as a catalyst for disease modeling research and commercial biomedical initiatives in space. Made In Space – In FY16, the Additive Manufacturing Facility developed by Made In Space launched to the International Space Station, enabling 3D printing projects from commercial, educational, and government entities interested in the development of objects for experiments and technology demonstrations. These objects will be produced onboard the International Space Station in a fraction of the time currently required to have such objects manifested and delivered to the station using traditional ground preparation and launch. Space Tango – TangoLab-1 is a general research platform launched in FY16. This facility from Space Tango allows multiple automated experiments in the life and physical sciences to run simultaneously. This architecture minimizes crew member interaction and reduces complexity while increasing scalability, enabling improved throughput for users. In addition to currently available capabilities, a growing pipeline of commercial ISS National Lab facilities in preparation (from Teledyne Brown, AlphaSpace, STaArS, and HNu Photonics) will advance research in remote sensing, materials testing, molecular biology, and tissue culture. Companies are exploring how these capabilities might transition onto future low Earth orbit platforms, from free-flying spacecraft to expandable modules. Through support of such companies, the ISS National Lab and NASA are enabling the International Space Station National Laboratory to serve as an incubator for the low Earth orbit market and U.S. private sector spaceflight interests, and are using public-private partnership funding models to share the risk and benefits of these emerging human space flight activities.

#### Strong Innovation solves Extinction.

Matthews 18 Dylan Matthews 10-26-2018 “How to help people millions of years from now” <https://www.vox.com/future-perfect/2018/10/26/18023366/far-future-effective-altruism-existential-risk-doing-good> (Co-founder of Vox, citing Nick Beckstead @ Rutgers University)//Re-cut by Elmer

If you care about improving human lives, you should overwhelmingly care about those quadrillions of lives rather than the comparatively small number of people alive today. The 7.6 billion people now living, after all, amount to less than 0.003 percent of the population that will live in the future. It’s reasonable to suggest that those quadrillions of future people have, accordingly, hundreds of thousands of times more moral weight than those of us living here today do. That’s the basic argument behind Nick Beckstead’s 2013 Rutgers philosophy dissertation, “On the overwhelming importance of shaping the far future.” It’s a glorious mindfuck of a thesis, not least because Beckstead shows very convincingly that this is a conclusion any plausible moral view would reach. It’s not just something that weird utilitarians have to deal with. And Beckstead, to his considerable credit, walks the walk on this. He works at the Open Philanthropy Project on grants relating to the far future and runs a charitable fund for donors who want to prioritize the far future. And arguments from him and others have turned “long-termism” into a very vibrant, important strand of the effective altruism community. But what does prioritizing the far future even mean? The most literal thing it could mean is preventing human extinction, to ensure that the species persists as long as possible. For the long-term-focused effective altruists I know, that typically means identifying concrete threats to humanity’s continued existence — like unfriendly artificial intelligence, or a pandemic, or global warming/out of control geoengineering — and engaging in activities to prevent that specific eventuality. But in a set of slides he made in 2013, Beckstead makes a compelling case that while that’s certainly part of what caring about the far future entails, approaches that address specific threats to humanity (which he calls “targeted” approaches to the far future) have to complement “broad” approaches, where instead of trying to predict what’s going to kill us all, you just generally try to keep civilization running as best it can, so that it is, as a whole, well-equipped to deal with potential extinction events in the future, not just in 2030 or 2040 but in 3500 or 95000 or even 37 million. In other words, caring about the far future doesn’t mean just paying attention to low-probability risks of total annihilation; it also means acting on pressing needs now. For example: We’re going to be better prepared to prevent extinction from AI or a supervirus or global warming if society as a whole makes a lot of scientific progress. And a significant bottleneck there is that the vast majority of humanity doesn’t get high-enough-quality education to engage in scientific research, if they want to, which reduces the **odds that we have enough trained scientists to come up with the breakthroughs** we need as a civilization to survive and thrive. So maybe one of the best things we can do for the far future is to improve school systems — here and now — to harness the group economist Raj Chetty calls “lost Einsteins” (potential innovators who are thwarted by poverty and inequality in rich countries) and, more importantly, the hundreds of millions of kids in developing countries dealing with even worse education systems than those in depressed communities in the rich world. What if living ethically for the far future means living ethically now? Beckstead mentions some other broad, or very broad, ideas (these are all his descriptions): Help make computers faster so that people everywhere can work more efficiently Change intellectual property law so that technological innovation can happen more quickly Advocate for open borders so that people from poorly governed countries can move to better-governed countries and be more productive Meta-research: improve incentives and norms in academic work to better advance human knowledge Improve education Advocate for political party X to make future people have values more like political party X ”If you look at these areas (economic growth and technological progress, access to information, individual capability, social coordination, motives) a lot of everyday good works contribute,” Beckstead writes. “An implication of this is that a lot of everyday good works are good from a broad perspective, even though hardly anyone thinks explicitly in terms of far future standards.” Look at those examples again: It’s just a list of what normal altruistically motivated people, not effective altruism folks, generally do. Charities in the US love talking about the lost opportunities for innovation that poverty creates. Lots of smart people who want to make a difference become scientists, or try to work as teachers or on improving education policy, and lord knows there are plenty of people who become political party operatives out of a conviction that the moral consequences of the party’s platform are good. All of which is to say: Maybe effective altruists aren’t that special, or at least maybe we don’t have access to that many specific and weird conclusions about how best to help the world. If the far future is what matters, and generally trying to make the world work better is among the

#### Scenario 2 – Space Debris

#### Space Junk inevitable from military satellites, banning private entities in space doesn’t solve, only PPP solves

**Minter 21**[Minter, Adam. “Space Junk, Long Feared, Is Now an Imminent Threat.” *Bloomberg.com*, Bloomberg, <https://www.bloomberg.com/opinion/articles/2021-09-01/space-junk-long-feared-is-now-an-imminent-threat>.] // Varun Rao

**In March, a Chinese military satellite appeared to**[**spontaneously disintegrate**](https://twitter.com/18SPCS/status/1374067474111500290)**in orbit, leaving a trail of debris high above the Earth.** If China knew anything, it wasn’t saying. Did the propulsion system explode? Was there a collision with some of the space junk that’s accumulating in orbit? Or did something [a bit more conspiratorial](https://www.china-arms.com/2021/03/us-military-destroy-china-satellite/) happen? The mystery persisted until last month, when an astronomer at the Center for Astrophysics [announced the answer](https://www.space.com/space-junk-collision-chinese-satellite-yunhai-1-02). Yunhai 1-02, as the satellite is known, collided with a piece of junk leftover from a 1996 Russian rocket launch.  
  
It was the first major smash-up in Earth orbit since 2009**. It won’t be the last. Thanks to cost-saving advances in rocket and satellite technologies, more countries and companies are preparing to launch more stuff into orbit than ever before**. As they do, the risk of collisions will only rise. The good news is that space junk is one of the rare problems where geopolitical adversaries and corporate rivals should find common cause. At least, that’s the hope.  
  
Scientists and policy makers have been worrying about space junk — the dead and unwanted craft left behind in the finite space of Earth orbit — for decades. A paper [published](https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/JA083iA06p02637) in 1978 posited one grim scenario**. As satellites proliferated, so too would collisions; each collision would in turn produce debris that made further collisions more likely. The result could be a belt of space junk so dense that it would make certain low-Earth orbits unusable.** The study generated intense interest at NASA, which set up an [Orbital Debris Program Office](https://www.orbitaldebris.jsc.nasa.gov/) to deal with the problem.  
  
In 1995, the agency issued the world’s first set of debris-mitigation guidelines. Among other things, it proposed that satellites be designed to re-enter Earth’s atmosphere within 25 years of mission completion. Other spacefaring countries and the United Nations followed with their own guidelines. But urgency and compliance were lacking, partly because the world hadn’t yet experienced a destructive collision between spacecraft and debris.  
  
That would soon change. In 2007, China [launched a ballistic missile](https://www.cfr.org/backgrounder/chinas-anti-satellite-test) at one of its old weather satellites, producing the largest cloud of space debris ever tracked. Two years later, a nonfunctional Russian communications orbiter [collided](https://swfound.org/media/6575/swf_iridium_cosmos_collision_fact_sheet_updated_2012.pdf) with a functioning one operated by Iridium Satellite LLC, producing almost 2,000 pieces of debris measuring at least 4 inches in diameter. Any of those fragments could inflict potentially catastrophic damage in a collision.  
  
Since then, the situation has only gotten more precarious. More than 100 million pieces of space junk are [now orbiting the Earth](https://oig.nasa.gov/docs/IG-21-011.pdf). Although the vast majority are the size of sand grains or smaller, at least 26,000 hunks are big enough to destroy a satellite. As more entities seek to access orbit for scientific and commercial purposes, the likelihood of a collision is growing fast. About 4,000 operational satellites are [now in orbit](https://www.ucsusa.org/resources/satellite-database); in the years ahead, that number could rise to [more than 100,000](https://aas.org/sites/default/files/2020-08/SATCON1-Report.pdf).  
  
None of this is news to the world’s spacefaring nations, which are well aware of how space junk could affect their research operations (including the threat posed to astronauts aboard the International Space Station). Companies including SpaceX are building constellations of new satellites that will be vulnerable to debris of all sorts. As Earth orbit becomes an increasingly important arena for military competition, there’s also the risk that collisions could be misinterpreted as something other than an accident.  
  
So what can be done?  
  
For one thing, some old-fashioned bridge-building between spacefaring nations would help. The 1967 [Outer Space Treaty](https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html), negotiated during an earlier space race with little input from China, is badly in need of an update. In particular, provisions that grant countries permanent property rights to their objects in space may complicate efforts to clean up debris. Could China unilaterally remove a defunct Russian satellite —  potentially containing valuable intellectual property — if its own equipment was at imminent risk? Greater clarity on such questions could help boost trust and cooperation.  
  
Next, **NASA should fund research into debris-removal technologies** — those recently [demonstrated](https://spacenews.com/astroscale-complete-first-test-of-satellite-capture-technology/) by Astroscale, a Japanese startup, offer a promising example — **and consider partnerships with companies developing them.** The U.S. should also seek to expand the Artemis Accords, a framework for space cooperation that includes (so far) 11 other countries. As more nations join, debris-mitigation protocols, such as a requirement to specify which country has responsibility for end-of-mission planning, should become routine.  
  
None of these steps can be taken soon enough to prevent the next satellite smash up. But over time, they should help to make space a place where countries and companies collaborate, not collide

#### PPPs improve satellite servicing which can solve for space debris

NASA 14 (“Public-Private Partnerships for Space Capability Development.” *Nasa.gov*, National Aeronautics and Space Administration, Apr. 2014, <https://www.nasa.gov/sites/default/files/files/NASA_Partnership_Report_LR_20140429.pdf>.) //Varun Rao

Satellite servicing involves the robotic or human capability to rescue, reposition, repair, inspect, or refuel satellites. **Satellite servicing capabilities also offer the potential to mitigate and remove orbital debris** . As humans venture farther from Earth, crews will need to be more self-reliant . The ability to perform servicing on spacecraft is thus likely to increase in importance. Satellite servicing has the potential to increase the service life of on-orbit assets and save costs by reducing mission risk. NASA is currently advancing this industry by testing technologies for servicing spacecraft. **Public-private partnerships could help close the business case for U .S . companies, allowing the U .S . to become the world leader in satellite servicing while providing NASA capabilities for fixing or extending the life of its spacecraft.**

Commercial satellite servicing applications involve using autonomous servicing spacecraft for a variety of scenarios including: rescuing satellites in stranded orbits; repositioning satellites into orbital slots or graveyard orbits; refueling satellites; inspecting satellites; assisting with the deployment of jammed solar arrays and antennas; moving out-of-place thermal blankets and cables; and transplanting components from retired satellites into operating ones . Satellite servicing systems can also be used as a proxy upper stage to deliver satellites with less propellant, which could translate into lower launch costs**. Once deployed by the launch vehicle, the onorbit servicing spacecraft would pick up the satellite and transport it to its destination . Satellite servicing may also provide an option to identify and remove orbital debris.** Some geosynchronous satellite telecommunication operators like Intelsat welcome the opportunity to launch satellites featuring greater transponder capacity in lieu of propellant mass . More capable satellites could improve the competitive advantage for satellite telecommunication providers over competitors providing terrestrial services .

NASA deployed and successfully tested a satellite refueling demonstrator during the 2011-2013 Robotic Refueling Mission aboard the International Space Station (ISS) . This mission demonstrated that satellites not specifically designed for refueling could in fact be refueled using a remote control robot . However, NASA crewmembers have serviced and repaired satellites

and spacecraft on orbit for the past 30 years . NASA’s first servicing mission was the 1973 Skylab mission to affix a new thermal shield lost during launch and to deploy a stuck solar panel . The shield, which also served as protection from micrometeroids had to be replaced to ensure Skylab did not overheat . Other onorbit repair missions include the 1984 rescue mission of the Solar Maximum Mission, the 1984 rescue and refurbishment of Palapa B2 and Westar 6, and five Hubble Space Telescope servicing missions since 1993 . General maintenance and servicing of the ISS also strengthens satellite servicing capabilities . The Defense Advanced Research Projects Agency (DARPA), with participation by NASA engineers, conducted the successful Orbital Express satellite servicing demonstration mission in 2007

#### Space Debris collapses critical infra

Massimo Pellegrino 16, Researcher at the European Union Institute for Security Studies, Master’s Degree in Space Studies from the International Space University, Master’s Degree in Accounting and Financial Management, and Master’s and Bachelor’s Degree in Industrial Engineering from the University of Naples Federico II, and Gerald Stang, Senior Associate Analyst at the European Union Institute for Security Studies, BSc and MSc Degrees in Chemical Engineering from the University of Saskatchewan and MA in International Affairs from the School of International and Public Affairs at Columbia University, “Space Security for Europe”, EUISS Reports, Number 29, July 2016, p. 21-22 https://www.iss.europa.eu/sites/default/files/EUISSFiles/Report\_29\_0.pdf

II. SPACE SYSTEMS AND CRITICAL INFRASTRUCTURE

Modern societies are highly dependent **on the continuous operation of critical infrastructure** to ensure the provision of basic goods and services. They consist of assets, systems or parts thereof which are so vital, that their disruption would significantly impact the economy, national security, public health, safety, or social well-being. Examples of critical infrastructure include energy, water, food supply, communication, transportation, and waste processing systems.

Space assets are so deeply embedded in developed economies that a day **without fully functioning space capabilities would** severely restrict or even endanger our lives. Space systems are critical for running energy grids and telecommunication networks, border and maritime surveillance, crisis management and humanitarian operations, environmental and climate monitoring, verification of international treaties and arms control agreements, and the fight against organised crime and terrorism. **Space assets** also provide the technological backbone for other critical infrastructures. The synchronisation of power grids and telecommunication networks, for example, is heavily dependent on GNSS timing signals and any disruption would create a domino effect on other critical infrastructures (see Figure 5).

Satellites also play a central role in supporting defence systems and military operations. They are force multipliers that provide intelligence, surveillance, and reconnaissance (ISR) capabilities, as well as communication, navigation, positioning and timing signals. Armed forces do not only use their own space systems, but are also significant consumers of space services provided by private operators. In fact, about 90% of US military communications traffic passes through civilian satellites, many of which privately owned, rather than through dedicated systems designed to withstand attempted interruptions. 1 The reliance of both civilian and military users on space systems therefore places them firmly in the area of critical infrastructure.

Some critical space systems, such as the American GPS, are under foreign control, and the governments controlling those systems retain the authority to disrupt services, even for allies, in case of a national emergency. While the United States announced that it has no intention of ever intentionally degrading public GPS signals (also known as ‘Selective Availability’) and that the next generation of GPS satellites will not include this feature, other governments might still do so.2 These dependences engender new and growing vulnerabilities.

Reliance on space is likely to increase further as space capabilities and services improve in diversity, quality and affordability. Close to 1,500 satellites with a launch mass of over 50 kg are expected to be launched over the next decade; an increase of 50% compared to 2005-2014. This estimate excludes both the expected proliferation of smaller satellites (such as CubeSats), but also the planned OneWeb and Steam mega-constellations for global internet broadband service. Advances in small satellite capabilities and in launch technology (e.g. SpaceX’s Falcon rocket family) have already lowered the cost of access to space. About 45% more CubeSats were launched in 2014 than in 2013 (130 vs. 91), accounting for 63% of all satellites launched3. However, just as the reliance on space increases, so too do threats and vulnerabilities. Therefore, in order to realise the full potential of investments in space, critical space systems need to be adequately protected and the space environment properly managed.

#### Collapse of Infra leads to Extinction

Dennis **Pamlin 15** & Stuart Armstrong. Dennis Pamlin, Executive Project Manager Global Risks, Global Challenges Foundation, and Stuart Armstrong, James Martin Research Fellow, Future of Humanity Institute, Oxford Martin School, University of Oxford. February 2015. “Global Challenges: 12 Risks that threaten human civilization: The case for a new risk category,” Global Challenges Foundation, https://api.globalchallenges.org/static/wp-content/uploads/12-Risks-with-infinite-impact.pdf

Global Challenges – Twelve risks that threaten human civilisation – The case for a new category of risks 89 3.1 Current risks System Collapse 3.1.5 Global Global system collapse is defined here as either an economic or societal collapse on the global scale. There is no precise definition of a system collapse. The term has been used to describe a broad range of bad economic conditions, ranging from a severe, prolonged depression with high bankruptcy rates and high unemployment, to a breakdown in normal commerce caused by hyperinflation, or even an economically-caused sharp increase in the death rate and perhaps even a decline in population. 310 Often economic collapse is accompanied by social chaos, civil unrest and sometimes a breakdown of law and order. Societal collapse usually refers to the fall or disintegration of human societies, often along with their life support systems. It broadly includes both quite abrupt societal failures typified by collapses, and more extended gradual declines of superpowers. Here only the former is included. 3.1.5.1 Expected impact The world economic and political system is made up of many actors with many objectives and many links between them. Such intricate, interconnected systems are subject to unexpected system-wide failures due to the structure of the network311 – even if each component of the network is reliable. This gives rise to systemic risk: systemic risk occurs when parts that individually may function well become vulnerable when connected as a system to a self-reinforcing joint risk that can spread from part to part (contagion), potentially affecting the entire system and possibly spilling over to related outside systems.312 Such effects have been observed in such diverse areas as ecology,313 finance314 and critical infrastructure315 (such as power grids). They are characterised by the possibility that a small internal or external disruption could cause a highly non-linear effect,316 including a cascading failure that infects the whole system,317 as in the 2008-2009 financial crisis. The possibility of collapse becomes more acute when several independent networks depend on each other, as is increasingly the case (water supply, transport, fuel and power stations are strongly coupled, for instance).318 This dependence links social and technological systems as well.319 This trend is likely to be intensified by continuing globalisation,320 while global governance and regulatory mechanisms seem inadequate to address the issue.321 This is possibly because the tension between resilience and efficiency322 can even exacerbate the problem.323 Many triggers could start such a failure cascade, such as the infrastructure damage wrought by a coronal mass ejection,324 an ongoing cyber conflict, or a milder form of some of the risks presented in the rest of the paper. Indeed the main risk factor with global systems collapse is as something which may exacerbate some of the other risks in this paper, or as a trigger. But a simple global systems collapse still poses risks on its own. The productivity of modern societies is largely dependent on the careful matching of different types of capital325 (social, technological, natural...) with each other. If this matching is disrupted, this could trigger a “social collapse” far out of proportion to the initial disruption.326 States and institutions have collapsed in the past for seemingly minor systemic reasons.327 And institutional collapses can create knock-on effects, such as the descent of formerly prosperous states to much more impoverished and destabilising entities.328 Such processes could trigger damage on a large scale if they weaken global political and economic systems to such an extent that secondary effects (such as conflict or starvation) could cause great death and suffering.

### C2) Economy

#### Long term econ collapse is coming.

Conerly 11-2 (, B., 2021. No Recession In 2022—But Watch Out In 2023. [online] Forbes. Available at: <https://www.forbes.com/sites/billconerly/2021/11/02/no-recession-in-2022-but-watch-out-in-2023/?sh=5e3b27d33555> [Accessed 24 December 2021] Dr. Bill Conerly connects the dots between the economy and business decisions. He has the unique combination of a Ph.D. in economics from Duke University and over 30 years’ experience helping companies adapt to changing economic conditions. He was formerly Senior Vice President at a major bank and held positions in economics and corporate planning at two Fortune 500 corporations. Dr. Conerly has earned the Chartered Financial Analyst designation.)-rahulpenu

No Recession In 2022—But Watch Out In 2023

A **recession** **will** **come** to the United States economy, but not in 2022. Federal Reserve policy will lead to more business cycles, which many businesses are not well prepared for. The downturn won’t come in 2022, but could arrive as early as 2023. If the Fed avoids recession in 2023, then look for a more severe slump in 2024 or 2025.

Recessions usually come from demand weakness, but **supply** **problems** can also trigger a downturn. In 2022 demand for goods and services will be strong. Consumers have plenty of money, thanks to past earnings, stimulus payments and extra unemployment insurance. They have paid down their credit card balances. Even though they also increased their car loans outstanding as they upgraded their rides, their general condition is good. Employment will increase thanks to the spending, reinforcing the income gains that enable expenditures.

Businesses, too, have plenty of cash on hand. Not only have profits been good, but the Paycheck Protection Program gave nearly $800 billion to businesses. Companies want to buy computers, equipment and machinery to substitute for the workers they cannot find, and this spending will help manufacturers of the equipment.

Homebuilders will construct as many homes as they can, though that will be limited by buildable lots, skilled labor and building materials. Non-residential construction will slowly gain ground, especially in warehouse space and suburban offices.

The government will spend, not only at the federal level but also among state and local entities. The federal government has no worries about deficits, while state and local governments are flush with federal money.

Exports should grow slowly, thanks to improving world economies.

The **spending** side of the economy has **little** **risk** of recession in 2022, but could supply problems trigger a recession?

Supply chain problems can have negative impacts when factories have to shut down for lack of parts, as happened in the **automobile** industry. Recently Ford Europe’s Gunnar Herrmann told CNBC, “It’s not only semiconductors. You find shortages or constraints all over the place,” mentioning **lithium**, **plastics** and **steel** in particular. The automobile industry has laid off workers at multiple plants, mostly for a few weeks, but some long term. When workers are laid off for lack of materials to assemble, then the economy suffers. Most of the shortages under discussion, however, are **limiting** **growth** rather than cutting back on current production.

So the supply challenge we have is not an actual reduction in materials available, just **insufficient** **materials** to meet the stronger demand. Despite the snarls at the ports of Long Beach and Los Angeles, more inbound containers are hitting the docks than in 2019. Mostly we are seeing supply as a limit on growth rather than a cause of recession.

Much of the supply limitation prevents growth, but does not push spending downward. Businesses are cutting back on variety. A shirt in a particular size may only be available in a few colors, not 16. That is unfortunate, and may discourage a few shoppers, but for the most part we’ll still be buying goods.

**Job** **losses** from vaccine mandate layoffs could push the economy toward recession, given that 31% of people over age 18 are not fully vaccinated. The various mandates cover about 100 million workers. Some of those 31 million unvaccinated workers subject to mandates will get their shots, but others certainly won’t. In the worst of the pandemic recession, the country lost 22 million jobs. Losing 31 million jobs because of vaccine mandates—or even half that number—would be disastrous. And because it would be disastrous, it will not happen. The Biden administration almost certainly will pull back the mandate before accepting such a harsh result rise in unemployment.

Though 2022 is unlikely to host a recession, 2023 and 2024 are extremely risky. The Federal Reserve will start tapering its quantitative stimulus soon, and sometime in mid-2022 it will begin raising short-term interest rates. The economy reacts with a **time** **lag** of about one year, plus or minus. The **greatest** **risk** in the near term is that the Fed realizes that much of the recent inflation is long-lasting rather than transitory. They will then hit the brakes. Because of the time lag, the Fed may decide to stomp down harder on the brakes, triggering a recession.

If the Fed avoids an over-reaction recession, it risks not bringing inflation down at all. The longer the Fed waits, the more work they will need to do later. We’ll still have massive fiscal stimulus plus the lagged effects of past monetary stimulus. Public anger over inflation will provoke a stronger Fed response by 2025 at the latest, but probably earlier.

Can a recession be completely avoided in the next few years? Theoretically it’s possible. The Fed would have to tighten at just the right time, in just the right magnitude, then return to neutral at just the right time. It could happen, but the odds are very, very slim. The people at the Fed are smart and knowledgeable, but the task is too difficult for mere mortals. So businesses should enjoy their gains in 2022 while developing contingency plans to be ready for the nearly-inevitable recession.

#### Private appropriation saves econ growth and innovation in the long run---the plan flips it and saps resources that spills over.

Clark 20 (, S., 2020. Opinion: Space is our new economic frontier. The US can't afford to lose out. [online] CNN. Available at: <https://www.cnn.com/2020/03/02/perspectives/space-economic-frontier/index.html> [Accessed 24 December 2021] Suzanne Clark is president and chief executive officer of the U.S. Chamber of Commerce, a director on two corporate boards, a former business owner, and an entrepreneur at heart. With a global perspective and a fierce commitment to free enterprise, Clark’s experience in the private sector deeply informs her leadership of the U.S. Chamber—the world’s largest business organization representing employers of every size and sector in Washington, D.C., across the country, and around the globe. Clark has led a multiyear effort to strengthen the Chamber’s well-known influence, advocacy, and impact, while modernizing its work and attracting new members from the fastest-growing and most innovative sectors of the U.S. economy. These efforts to invest in the Chamber’s future proved prescient when the COVID-19 pandemic hit in 2020, enabling the organization to quickly pivot to new ways of working and successfully advocate for businesses in the midst of the worst economic downturn since the Great Depression. Clark has also helped drive the national conversation on issues central to managing and recovering from the pandemic through the U.S. Chamber Foundation’s Path Forward program. In interviews with dozens of thought leaders and experts such as Dr. Anthony Fauci, former CDC Director Dr. Robert Redfield, Bill and Melinda Gates, Carlyle Group Founder David Rubenstein, and former U.S. Surgeon General Jerome Adams, Path Forward has reached an audience of millions of viewers with practical information, insightful guidance, and forward-looking strategies.)-rahulpenu

**Space** is our **new** economic **frontier**. The US can't afford to lose out

President Trump's budget, which was released last month, outlines several moonshots that are unlikely to pass a divided Congress. But there's one in particular that both Republicans and Democrats should support wholeheartedly: the $25.2 billion request to fund NASA, a 12% boost over the prior year.

The **future** **of** our **economy** **depends** **on** the **vigorous** **pursuit** **of** **space** exploration. And with NASA leading the way, the potential for **growth** — like space itself — **has** **no** **limits**.

Since NASA's launch, American space exploration has always been a bipartisan venture. It was President Kennedy who announced our goal of going to the moon, but it was President Nixon who brought that goal to fruition. Reaching the next milestone in interplanetary travel requires a commitment from our leaders that spans political parties and administrations. And with a new space race getting underway — one that could prove even more consequential than the last — NASA needs bipartisan support from Congress today more than ever.

**Space** is the **most** **promising** **industry** to arise since the birth of the tech sector, with **growth** projected to **skyrocket** in the coming years **led** **by** companies such as **Boeing** and **Northrop** **Grumman**, and new entrants, such as Virgin **Galactic**, **SpaceX** and **Blue** **Origin**. According to US Chamber of Commerce economists, the industry will be worth at least $1.5 trillion by 2040. While no one can fully grasp what our economy will look like 20 years from now, one thing is certain: the **private** **sector** space **industry** will **transform** how societies across the **globe** **live**, **communicate** and do **business**. In fact, it already has.

Nearly **every** **company** **depends** **on** **space**-enabled **tech**nologies **for** **day**-**to**-**day** **op**eration**s** — whether they use satellite **communications**, **remote** **sensing** or **location**-based **services**. **Businesses** across multiple sectors are **leveraging** these and other **tech**nologies to **stake** their **claim** **in** this new economic **frontier**.

Pharmaceutical companies such as Merck and Sanofi, for example, are conducting experiments in low-Earth orbit aboard the International Space Station to evaluate the potential advantages of microgravity in developing new drug treatments that will help people live longer, healthier lives. Companies, such as Bigelow, are committed to making off-Earth habitation a reality. Even retailers are getting in on the action, with companies like Target funding research on the International Space Station to produce more sustainable forms of cotton.

Lunar colonies, asteroid mining and interplanetary travel — once the stuff of science fiction — could become a reality. But for any of that to happen, we need sustained and meaningful action from members of Congress.

They can start by meeting the president's request for NASA funding. Included in the White House budget is $12.4 billion specifically for lunar exploration that would include landing systems, continued development of the Space Launch System (SLS) and the Orion crew module. These spacecraft will allow us to shuttle people and equipment to the moon and back. They will take us not only beyond Earth's orbit but also into the **next** **phase** **of** **commercial** **space** **development**. Most importantly, they will **ensure** that the **U**nited **S**tates continues to **outpace** **competitors** like China and Russia in the space race. Our country must be the vanguard in exploring these new economic frontiers. **Planting** the **American** **flag** **in** the **private** **sector** space **industry** will help **create** the **jobs** of the future and **allow** the **U**nited **S**tates **to** **lead** the **formation** of best practices **that** **will** **govern** the **industry** for decades to come.

Some might ask if returning to the moon is worth the expense. The answer is undeniably yes. Providing NASA with the resources it needs to succeed is a small investment that will yield tremendous dividends over time.

To start, it would help **secure** American **commercial** **dominance** in a fast-growing industry. It also would be a **catalyst** **for** **innovation** and scientific discovery, with **salutary** **effects** that would **benefit** the **entire** **economy**.

#### This is critical, as borgen project 13 quantifies that

**Borgen Project**--900m Borgen Project. IMF Study Shows Possible Consequences of Economic Recession, 4-11-20**13**. 1-14-2021. https://borgenproject.org/imf-study-shows-possible-consequences-of-economic-recession/ The International Monetary Fund (IMF) released the results of a new study, showing that **another global economic recession could throw nearly 900 million people back into poverty**. Although global poverty within the last decade has improved, over 1.2 billion people worldwide still live on $1.25 a day, and the IMF warns that the global economy that initially brought millions out of poverty is still extremely unsteady and at risk of failing. The report cites global unemployment numbers, which are at a 20-year high, that shows unemployment around the world is now at 40 percent. The report goes on to state that an economic event, such as the recession of 2007-2009, could have significant negative effects on the world’s poorest people. Experts are alarmed with the recent economic woes in Cyprus that caused “eurozone chaos,” and also cite that the U.S. and Europe are close to another economic downturn. Doubts in the U.S. economy have been exacerbated by the recent sequester, in which spending cuts could lead to hundreds of thousands of job furloughs and losses.

## On Case

#### They’re arg at cap leading to war is wrong – the Williams 10 evi says nothing about nuke war specifically

#### We’ve had inequality and strucutural violence for a long time, not lead to a nuke war, space doesn’t lead to a nuke war

#### Neg d3ecreases tenions

#### Cap Good

#### Tech Innovation drives dematerialization that makes Cap Sustainable

McAfee 19, Andrew. More from Less: The Surprising Story of How We Learned to Prosper Using Fewer Resources—and What Happens Next. Scribner, 2019. <https://drive.google.com/file/d/1SdXDFeq9gbuG7zVAP-vzCXgbALIm9W9d/view?usp=sharing> (Cofounder and codirector of the MIT Initiative on the Digital Economy at the MIT Sloan School of Management, former professor at Harvard Business School)//Elmer

Partial excludability is a beautiful thing. It provides strong incentives for companies to create useful, profit-enhancing new technologies that they alone can benefit from for a time, yet it also ensures that the **new techs will eventually "spill over**"—that with time they’ll diffuse and get adopted by more and more companies, even if that's not what their originators want. Romer equated tech progress to the production by companies of nonrivalrous, partially excludable ideas and showed that these ideas cause an economy to grow. What's more, he also demonstrated that this **idea-fueled growth** doesn't have to slow down with time. It's **not constrained by** the size of the **labor** force, the amount of natural **resources**, or other such factors. Instead, economic growth is limited only by the idea-generating capacity of the people within a market. Romer called this capacity "human capital" and said at the end of his 1990 paper, "The most interesting positive implication of the model is that an economy with a larger total stock of human capital will experience faster growth." This notion, which has come to be called "increasing returns to scale," is as powerful as it is counterintuitive. Most formal models of economic growth, as well as the informal mental ones most of us walk around with, feature decreasing returns—growth slows down as the overall economy gets bigger. This makes intuitive sense; it just feels like it would be easier to experience 5 percent growth in a $1 billion economy than a $1 trillion one. But Romer showed that as long as that economy continued to add to its human capital—the overall ability of its people to come up with new technologies and put them to use—it could actually grow faster even as it grew bigger. This is because the stock of useful, nonrivalrous, nonexcludable ideas would keep growing. As Romer convincingly showed, economies run and grow on ideas. The Machinery of Prosperity Romer's ideas should leave us optimistic about the planetary benefits of digital tools—hardware, software, and networks—for three main reasons. First, countless examples show us how good these tools are at fulfilling the central role of technology, which is to provide "instructions that we follow for combining raw materials." Since raw materials cost money, profit-maximizing companies are particularly keen to find ways to use fewer of them. So they use digital tools to come up with beer cans that use less aluminum, car engines that use less steel and less gas, mapping software that removes the need for paper atlases, and so on and so on. None of this is done solely for the good of the earth—it's done for the pursuit of profit that's at the heart of capitalism—yet it benefits the planet by, as we've seen, causing us to take less from it. Digital tools are technologies for creating technologies, the most prolific and versatile ones we've ever come up with. They're machines for coming up with ideas. Lots of them. The same piece of computer-aided design software can be used to create a thinner aluminum can or a lighter and more fuel-efficient engine. A drone can be used to scan farmland to see if more irrigation is needed, or to substitute for a helicopter when filming a movie. A smartphone can be used to read the news, listen to music, and pay for things, all without consuming a single extra molecule. In the Second Machine Age, the global stock of digital tools is increasing much more quickly than ever before. It's being used in countless ways by profit-hungry companies to combine raw materials in ways that use fewer of them. In advanced economies such as America's, the cumulative impact of this combination of capitalism and tech progress is clear: **absolute dematerialization** of the economy and society, **and thus a smaller footprint on our planet**.

#### 2] Cap solves dehumanization and the environment

Rhonheimer 20 Martin Rhonheimer 2-7-2020 “Capitalism is Good for the Poor – and for the Environment” <https://austrian-institute.org/en/subjects-en/catholic-social-doctrine-2/capitalism-is-good-for-the-poor-and-for-the-environment/> (professor at the Pontifical University of the Holy Cross)//Elmer

It is not social policy but capitalism that has created today’s prosperity. What is important is that what made today’s mass prosperity possible – a phenomenon unprecedented in history – was not social policy or social legislation, organised trade union pressure, or corrective interventions in the capitalist economy, but rather market capitalism itself, due to its enormous potential for innovation and the ever-increasing productivity of human labour that resulted from it. Increasing prosperity and quality of life are always the result of increasing labour productivity. Only increased productivity enabled higher social standards, better working conditions, the overcoming of child labour, a higher level of education, and the emergence of human capital. This process of increasing triumph over poverty and the constantly rising living standards of the general masses is taking place on a global scale – but only where the market economy and capitalist entrepreneurship are able to spread. From industrial overexploitation of nature to ecological awareness The first phase of industrialisation and capitalism was characterised by an enormous consumption of resources and frequent overexploitation of nature, which soon gave the impression that this process could not be sustainable. Since the end of the 19th century, disaster and doom scenarios have repeatedly been put forward, but in retrospect they have proved to be wrong: The combination of technological innovation, market competition, and entrepreneurial profit-seeking (with the compulsion to constantly minimise costs) have meant that these scenarios never occurred. The ever-increasing population has been increasingly better supplied thanks to innovative technologies, ever-increasing output with lower consumption of resources less harmful to the environment

t – e.g. less arable land in agriculture, or oil and electricity instead of coal for rapidly increasing mobility. More recent disaster scenarios, such as those spread by reputable scientists since the late 1960s and in the 1970s, have also proved to be inaccurate. The reason things developed differently was the always underestimated innovative dynamism of the capitalist market economy, a growing ecological awareness and, as a result, legislative intervention that took advantage of the logic of market capitalism: As a result of the ecological movement that had come out of the United States since 1970, wise legislation began to use the price mechanism to apply market incentives to internalize negative externalities. Environmental pollution was given a price-tag. This led to an enormous decrease in air pollution and other ecological consequences of growth, which is only possible in free, market-based societies, because the production process here is characterized by competition and constant pressure to reduce costs, i.e. to the most profitable use of resources. On the other hand, all forms of socialism, i.e. a state-controlled economy, have proved to be ecological disasters and have left behind destruction of gigantic proportions, without providing the population with anything that is near comparable in prosperity, often even by destroying existing prosperity, such as happened in Venezuela.

#### Unmitigated warming will cause extinction.

Xu 17 Yangyang Xu 9-6-2017 “Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes”; https://www.pnas.org/content/114/39/10315 (Assistant Professor of Atmospheric Sciences at Texas A&M University; and Veerabhadran Ramanathan, Distinguished Professor of Atmospheric and Climate Sciences at the Scripps Institution of Oceanography)//Elmer

From the IPCC burning embers diagram and from the language of the Paris Agreement, we infer that the DAI begins at warming greater than 1.5 °C. Our criteria for extending the risk category beyond DAI include the potential risks of climate change to the physical climate system, the ecosystem, human health, and species extinction. Let us first consider the category of catastrophic (3 to 5 °C warming). The first major concern is the issue of tipping points. Several studies (48, 49) have concluded that 3 to 5 °C global warming is likely to be the threshold for tipping points such as the collapse of the western Antarctic ice sheet, shutdown of deep water circulation in the North Atlantic, dieback of Amazon rainforests as well as boreal forests, and collapse of the West African monsoon, among others. While natural scientists refer to these as abrupt and irreversible climate changes, economists refer to them as catastrophic events (49). Warming of such magnitudes also has catastrophic human health effects. Many recent studies (50, 51) have focused on the direct influence of extreme events such as heat waves on public health by evaluating exposure to heat stress and hyperthermia. It has been estimated that the likelihood of extreme events (defined as 3-sigma events), including heat waves, has increased 10-fold in the recent decades (52). Human beings are extremely sensitive to heat stress. For example, the 2013 European heat wave led to about 70,000 premature mortalities (53). The major finding of a recent study (51) is that, currently, about 13.6% of land area with a population of 30.6% is exposed to deadly heat. The authors of that study defined deadly heat as exceeding a threshold of temperature as well as humidity. The thresholds were determined from numerous heat wave events and data for mortalities attributed to heat waves. According to this study, a 2 °C warming would double the land area subject to deadly heat and expose 48% of the population. A 4 °C warming by 2100 would subject 47% of the land area and almost 74% of the world population to deadly heat, which could pose existential risks to humans.

#### weaponization decreases great power wars – speed and deterrence ensure quick conflict resolution – arms control fails

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Critics question whether the benefits of space weapons are worth the possibility of strategic instability. They argue that only arms control agreements and international institutions can head off a disastrous military race in space. But space will become an arena for pre-emptive deterrence. Every environment—land, air, water, and now space—has become an arena for combat. The US could deter destabilizing space threats from rivals by advancing its defensive capabilities. Some realist strategists argue not just in favor of protecting US space assets, but seeking US space supremacy. Because great power competition has already spread to space, the United States should capitalize on its early lead to control the ultimate high ground, that of outer space.

Criticisms of space weapons overlook the place of force in international politics. Advances in space technology can have greater humanitarian outcomes that outweigh concerns with space weapons themselves. Rather than increase the likelihood of war, space-based systems reduce the probability of destructive conflicts and limit both combatant and civilian casualties. Reconnaissance satellites reduce the chances that war will break out due to misunderstanding of a rival’s deployments or misperception of another nation’s intentions. Space-based communications support the location of targets for smart weapons on the battlefield, which lower harm to combatants and civilians. Space-based weapons may bring unparalleled speed and precision to the strategic use of force that could reduce the need for more harmful, less discriminate conventional weapons that spread greater destruction across a broader area. New weapons might bring war to a timely conclusion or even help nations avoid armed conflict in the first place. We do not argue that one nation’s overwhelming superiority in arms will prevent war from breaking out, though deterrence can have this effect. At the very least, space weapons, like other advanced military technologies, could help nations settle their disputes without resort to wider armed conflict, and hence bolster, rather than undermine, international security.