# 1AC – Space Mining

## 1AC

### Fwk – Util

#### I affirm the resolution: The appropriation of outer space by private entities is unjust.

#### The value is justice.

#### The value criterion is utilitarianism.

#### 1] Pleasure and pain are intrinsic value and disvalue – everything else regresses – robust neuroscience proves

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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.

#### 2] Extinction outweighs under any framework

Pummer 15 [Theron, Junior Research Fellow in Philosophy at St. Anne's College, University of Oxford. “Moral Agreement on Saving the World” Practical Ethics, University of Oxford. May 18, 2015] AT

There appears to be lot of disagreement in moral philosophy. Whether these many apparent disagreements are deep and irresolvable, I believe there is at least one thing it is reasonable to agree on right now, whatever general moral view we adopt: that it is very important to reduce the risk that all intelligent beings on this planet are eliminated by an enormous catastrophe, such as a nuclear war. How we might in fact try to reduce such existential risks is discussed elsewhere. My claim here is only that we – whether we’re consequentialists, deontologists, or virtue ethicists – should all agree that we should try to save the world. According to consequentialism, we should maximize the good, where this is taken to be the goodness, from an impartial perspective, of outcomes. Clearly one thing that makes an outcome good is that the people in it are doing well. There is little disagreement here. If the happiness or well-being of possible future people is just as important as that of people who already exist, and if they would have good lives, it is not hard to see how reducing existential risk is easily the most important thing in the whole world. This is for the familiar reason that there are so many people who could exist in the future – there are trillions upon trillions… upon trillions. There are so many possible future people that reducing existential risk is arguably the most important thing in the world, even if the well-being of these possible people were given only 0.001% as much weight as that of existing people. Even on a wholly person-affecting view – according to which there’s nothing (apart from effects on existing people) to be said in favor of creating happy people – the case for reducing existential risk is very strong. As noted in this seminal paper, this case is strengthened by the fact that there’s a good chance that many existing people will, with the aid of life-extension technology, live very long and very high quality lives. You might think what I have just argued applies to consequentialists only. There is a tendency to assume that, if an argument appeals to consequentialist considerations (the goodness of outcomes), it is irrelevant to non-consequentialists. But that is a huge mistake. Non-consequentialism is the view that there’s more that determines rightness than the goodness of consequences or outcomes; it is not the view that the latter don’t matter. Even John Rawls wrote, “All ethical doctrines worth our attention take consequences into account in judging rightness. One which did not would simply be irrational, crazy.” Minimally plausible versions of deontology and virtue ethics must be concerned in part with promoting the good, from an impartial point of view. They’d thus imply very strong reasons to reduce existential risk, at least when this doesn’t significantly involve doing harm to others or damaging one’s character. What’s even more surprising, perhaps, is that even if our own good (or that of those near and dear to us) has much greater weight than goodness from the impartial “point of view of the universe,” indeed even if the latter is entirely morally irrelevant, we may nonetheless have very strong reasons to reduce existential risk. Even egoism, the view that each agent should maximize her own good, might imply strong reasons to reduce existential risk. It will depend, among other things, on what one’s own good consists in. If well-being consisted in pleasure only, it is somewhat harder to argue that egoism would imply strong reasons to reduce existential risk – perhaps we could argue that one would maximize her expected hedonic well-being by funding life extension technology or by having herself cryogenically frozen at the time of her bodily death as well as giving money to reduce existential risk (so that there is a world for her to live in!). I am not sure, however, how strong the reasons to do this would be. But views which imply that, if I don’t care about other people, I have no or very little reason to help them are not even minimally plausible views (in addition to hedonistic egoism, I here have in mind views that imply that one has no reason to perform an act unless one actually desires to do that act). To be minimally plausible, egoism will need to be paired with a more sophisticated account of well-being. To see this, it is enough to consider, as Plato did, the possibility of a ring of invisibility – suppose that, while wearing it, Ayn could derive some pleasure by helping the poor, but instead could derive just a bit more by severely harming them. Hedonistic egoism would absurdly imply she should do the latter. To avoid this implication, egoists would need to build something like the meaningfulness of a life into well-being, in some robust way, where this would to a significant extent be a function of other-regarding concerns (see chapter 12 of this classic intro to ethics). But once these elements are included, we can (roughly, as above) argue that this sort of egoism will imply strong reasons to reduce existential risk. Add to all of this Samuel Scheffler’s recent intriguing arguments (quick podcast version available here) that most of what makes our lives go well would be undermined if there were no future generations of intelligent persons. On his view, my life would contain vastly less well-being if (say) a year after my death the world came to an end. So obviously if Scheffler were right I’d have very strong reason to reduce existential risk. We should also take into account moral uncertainty. What is it reasonable for one to do, when one is uncertain not (only) about the empirical facts, but also about the moral facts? I’ve just argued that there’s agreement among minimally plausible ethical views that we have strong reason to reduce existential risk – not only consequentialists, but also deontologists, virtue ethicists, and sophisticated egoists should agree. But even those (hedonistic egoists) who disagree should have a significant level of confidence that they are mistaken, and that one of the above views is correct. Even if they were 90% sure that their view is the correct one (and 10% sure that one of these other ones is correct), they would have pretty strong reason, from the standpoint of moral uncertainty, to reduce existential risk. Perhaps most disturbingly still, even if we are only 1% sure that the well-being of possible future people matters, it is at least arguable that, from the standpoint of moral uncertainty, reducing existential risk is the most important thing in the world. Again, this is largely for the reason that there are so many people who could exist in the future – there are trillions upon trillions… upon trillions. (For more on this and other related issues, see this excellent dissertation). Of course, it is uncertain whether these untold trillions would, in general, have good lives. It’s possible they’ll be miserable. It is enough for my claim that there is moral agreement in the relevant sense if, at least given certain empirical claims about what future lives would most likely be like, all minimally plausible moral views would converge on the conclusion that we should try to save the world. While there are some non-crazy views that place significantly greater moral weight on avoiding suffering than on promoting happiness, for reasons others have offered (and for independent reasons I won’t get into here unless requested to), they nonetheless seem to be fairly implausible views. And even if things did not go well for our ancestors, I am optimistic that they will overall go fantastically well for our descendants, if we allow them to. I suspect that most of us alive today – at least those of us not suffering from extreme illness or poverty – have lives that are well worth living, and that things will continue to improve. Derek Parfit, whose work has emphasized future generations as well as agreement in ethics, described our situation clearly and accurately: “We live during the hinge of history. Given the scientific and technological discoveries of the last two centuries, the world has never changed as fast. We shall soon have even greater powers to transform, not only our surroundings, but ourselves and our successors. If we act wisely in the next few centuries, humanity will survive its most dangerous and decisive period. Our descendants could, if necessary, go elsewhere, spreading through this galaxy…. Our descendants might, I believe, make the further future very good. But that good future may also depend in part on us. If our selfish recklessness ends human history, we would be acting very wrongly.” (From chapter 36 of On What Matters)

#### 3] Only consequentialism explains degrees of wrongness—if I break a promise to meet up for lunch, that is not as bad as breaking a promise to take a dying person to the hospital. Only the consequences of breaking the promise explain why the second one is much worse than the first. Intuitions outweigh—they’re the foundational basis for any argument and theories that contradict our intuitions are most likely false even if we can’t deductively determine why

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

#### 5] Governments must aggregate because their policies benefit some and harm others so the only non-arbitrary way to prioritize is by helping the most amount of people. o/w since different agents have different ethical obligations

Mack 4 [(Peter, MBBS, FRCS(Ed), FRCS (Glasg), PhD, MBA, MHlthEcon) “Utilitarian Ethics in Healthcare.” International Journal of the Computer, the Internet, and Management Vol. 12, No.3. 2004. Department of Surgery. Singapore General Hospital.] SJDI

Medicine is a costly science, but of greater concern to the health economist is that it is also a limitless art. Every medical advance created new needs that did not exist until the means of meeting them came into existence. Physicians are reputed to have an infinite capacity to do ever more things, and perform ever more expensive interventions for their patients so long as any of their patients’ health needs remain unfulfilled. The traditional stance of the physician is that each patient is an isolated universe. When confronted with a situation in which his duty involves a competition for scarce medications or treatments, he would plead the patient’s cause by all methods, short of deceit. However, when the physician’s decision involves more than just his own patient, or has some commitment to public health, other issues have to be considered. He then has to recognise that the unbridled advocacy of the patient may not square with what the economist perceives to be the most advantageous policy to society as a whole. Medical professionals characteristically deplore scarcities. Many of them are simply not prepared to modify their intransigent principle of unwavering duty to their patients’ individual interest. However, in decisions involving multiple patients, making available more medication, labour or expenses for one patient will mean leaving less for another. The physician is then compelled by his competing loyalties to enter into a decision mode of one versus many, where the underlying constraint is one of finiteness of the commodities. Although the medical treatment may be simple and inexpensive in many instances, there are situations such as in renal dialysis, where prioritisation of treatment poses a moral dilemma because some patients will be denied the treatment and perish. Ethics and economics share areas of overlap. They both deal with how people should behave, what policies the state should pursue and what obligations citizens owe to their governments. The centrality of the human person in both normative economics and normative ethics is pertinent to this discussion. Economics is the study of human action in the marketplace whereas ethics deals with the “rightness” or “wrongness” of human action in general. Both disciplines are rooted in human reason and human nature and the two disciplines intersect at the human person and the analysis of human action. From the economist’s perspective, ethics is identified with the investigation of rationally justifiable bases for resolving conflict among persons with divergent aims and who share a common world. Because of the scarcity of resources, one’s success is another person’s failure. Therefore ethics search for rationally justifiable standards for the resolution of interpersonal conflict. While the realities of human life have given rise to the concepts of property, justice and scarcity, the management of scarcity requires the exercise of choice, since having more of some goods means having less of others. Exercising choice in turn involves comparisons, and comparisons are based on principles. As ethicists, the meaning of these principles must be sought in the moral basis that implementing them would require. For instance, if the implementation of distributive justice in healthcare is founded on the basis of welfare-based principles, as opposed to say resource-based principles, it means that the health system is motivated by the idea that what is of primary moral importance is the level of welfare of the people. This means that all distributive questions should be settled according to which distribution maximises welfare. Utilitarianism is fundamentally welfarist in its philosophy. Application of the principle to healthcare requires a prior understanding of the welfarist theory as expounded by the economist. Conceptually, welfarist theory is built on four tenets: utility maximisation, consumer sovereignty, consequentialism and welfarism. Utility maximisation embodies the behavioural proposition that individuals choose rationally, but it does not address the morality of rational choice. Consumer sovereignty is the maxim that individuals are the best judge of their own welfare. Consequentialism holds that any action or choice must be judged exclusively in terms of outcomes. Welfarism is the proposition that the “goodness” of the resource allocation be judged solely on the welfare or utility levels in that situation. Taken together these four tenets require that a policy be judged solely in terms of the resulting utilities achieved by individuals as assessed by the individuals themselves. Issues of who receives the utility, the source of the utility and any non-utility aspects of the situation are ignored.

#### 6] Psychological evidence proves we don’t identify with our future selves.

Opar 14. Alisa Opar (articles editor at Audubon magazine; cites Hal Hershfield, an assistant professor at New York University’s Stern School of Business; and Emily Pronin, a psychologist at Princeton) “Why We Procrastinate” Nautilus January 2014

“The British philosopher Derek Parfit espoused a severely reductionist view of personal identity in his seminal book, Reasons and Persons: It does not exist, at least not in the way we usually consider it. We humans, Parfit argued, are not a consistent identity moving through time, but a chain of successive selves, each tangentially linked to, and yet distinct from, the previous and subsequent ones. The boy who begins to smoke despite knowing that he may suffer from the habit decades later should not be judged harshly: “This boy does not identify with his future self,” Parfit wrote. “His attitude towards this future self is in some ways like his attitude to other people.” Parfit’s view was controversial even among philosophers. But psychologists are beginning to understand that it may accurately describe our attitudes towards our own decision-making: It turns out that we see our future selves as strangers. Though we will inevitably share their fates, the people we will become in a decade, quarter century, or more, are unknown to us. This impedes our ability to make good choices on their—which of course is our own—behalf. That bright, shiny New Year’s resolution? If you feel perfectly justified in breaking it, it may be because it feels like it was a promise someone else made. “It’s kind of a weird notion,” says Hal Hershfield, an assistant professor at New York University’s Stern School of Business. “On a psychological and emotional level we really consider that future self as if it’s another person.” Using MRI, Hershfield and colleagues studied brain activity changes when people imagine their future and consider their present. They homed in on two areas of the brain called the medial prefrontal cortex and the rostral anterior cingulate cortex, which are more active when a subject thinks about himself than when he thinks of someone else. They found these same areas were more strongly activated when subjects thought of themselves today, than of themselves in the future. Their future self “felt” like somebody else. In fact, their neural activity when they described themselves in a decade was similar to that when they described Matt Damon or Natalie Portman. And subjects whose brain activity changed the most when they spoke about their future selves were the least likely to favor large long-term financial gains over small immediate ones. Emily Pronin, a psychologist at Princeton, has come to similar conclusions in her research. In a 2008 study, Pronin and her team told college students that they were taking part in an experiment on disgust that required drinking a concoction made of ketchup and soy sauce. The more they, their future selves, or other students consumed, they were told, the greater the benefit to science. Students who were told they’d have to down the distasteful quaff that day committed to consuming two tablespoons. But those that were committing their future selves (the following semester) or other students to participate agreed to guzzle an average of half a cup. We think of our future selves, says Pronin, like we think of others: in the third person.

### Contention 1 is Collisions

#### Private entities are increasing mining now – US is key

Robert Garcia 18, currently an LLM Candidate in Cornell Law School's Law, Entrepreneurship & Technology program at Cornell Tech in NYC., “Regulating International Space Mining, an Enormous Industry,” Pacific Council on International Policy, 10-23-2018, https://www.pacificcouncil.org/newsroom/regulating-international-space-mining-enormous-industry

In 2015, the United States passed the U.S. Commercial Space Launch Competitiveness Act. The law’s passage has caused some consternation in the international space exploration community, as it specifically contemplates U.S. citizens performing commercial recovery in what would be a clear appropriation of asteroid and space resources. The law in pertinent part states that such U.S. citizens: shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States (emphasis added). Luxembourg was quick to follow suit, and it passed its own national space mining law styled the Law of 20 July 2017 on the Exploration and Use of Space Resources. This law seeks to parallel U.S. law. However, according to a spokesman for the Luxembourg Ministry of Economy, there is one significant expansion over U.S. law, in that "in the U.S. law, a majority of a company's stakeholders must be in the United States, while the Luxembourg law places no restrictions on stakeholder locations." Critics state that the controlling international law is to be found in the United Nations treaties on space exploration. There are five major space treaties, but two specifically address exploitation of outer space resources. The first is the "Outer Space Treaty" (OST). One hundred nations, including the major spacefaring nations-the United States, China, Japan, and the Russian Federation-have ratified it. A subsequent treaty-the Moon Agreement-provides in a relevant part in Article 11, Paragraph 2, that "[t]he moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means." As of January 2018, relatively few states (18 total) had ratified the Moon Agreement and four additional states had signed but not ratified the agreement. However, of these 22 states, perhaps only Australia, France, and India have the capability to launch space vehicles. The Moon Agreement could have provided some guidance on exploitation of space resources, as it ostensibly prohibits claiming lunar natural resources for private ownership. However, the United States and Luxembourg are not parties to the Moon Agreement, and in consequence the treaty has no "governing effect." Nonetheless, some legal scholars contend that the United States would be in breach of its international obligations if it were to "unilaterally pretend" that its citizens may exercise ownership over extracted space resources, given the absence of recognition of such rights under international law. Clearly it is the stated aim of both the United States and Luxembourg to promote the commercial exploitation of space resources. The two nations’ respective pieces of legislation attempt to provide a legal basis for private citizens to engage in such activities, which some critics would characterize as prohibited "appropriation" under international law. The international community would be well-served by resolving the issue conclusively with an appropriate body of rules. As the technologies advance, we are inexorably headed toward space mining becoming a reality. Whether it will lead to increased resources, providing a net benefit for all people on earth, or serve to increase economic inequality by disproportionately favoring the spacefaring nations remains to be seen.

#### It causes dangerous space mining and deregulation globally – multilateralism solves.

Edd Gent 20, freelance science and technology writer, “Space Mining Should Be a Global Project—But It's Not Starting Off That Way,” Singularity Hub, 10-12-2020, <https://singularityhub.com/2020/10/12/the-us-is-trying-to-hijack-space-mining-and-there-could-be-disastrous-consequences/>

* US space mining about to happen – sets unchangeable precedent that it is okay to mine at whatever cost and shatters int’l space law
* Competitiveness of private companies leads them to eschew safety in all private endeavors and collapse of intl regulations makes forcing them impossible cuz countries want domestic industry to win
* International collective debris cleanup would be hindered cuz of rift between countries from competitiveness and i-law irrelevant
* Mining will be overwhelming contributor to debris

Exploiting the resources of outer space might be key to the future expansion of the human species. But researchers argue that the US is trying to skew the game in its favor, with potentially disastrous consequences. The enormous cost of lifting material into space means that any serious effort to colonize the solar system will require us to rely on resources beyond our atmosphere. Water will be the new gold thanks to its crucial role in sustaining life, as well as the fact it can be split into hydrogen fuel and oxygen for breathing. Regolith found on the surface of rocky bodies like the moon and Mars will be a crucial building material, while some companies think it will eventually be profitable to extract precious metals and rare earth elements from asteroids and return them to Earth. But so far, there’s little in the way of regulation designed to govern how these activities should be managed. Now two Canadian researchers argue in a paper in Science that recent policy moves by the US are part of a concerted effort to refocus international space cooperation towards short-term commercial interests, which could precipitate a “race to the bottom” that sabotages efforts to safely manage the development of space. Aaron Boley and Michael Byers at the University of British Columbia trace back the start of this push to the 2015 Commercial Space Launch Competitiveness Act, which gave US citizens and companies the right to own and sell space resources under US law. In April this year, President Trump doubled down with an executive order affirming the right to commercial space mining and explicitly rejecting the idea that space is a “global commons,” flying in the face of established international norms. Since then, NASA has announced that any countries wishing to partner on its forthcoming Artemis missions designed to establish a permanent human presence on the moon will have to sign bilateral agreements known as Artemis Accords. These agreements will enshrine the idea that commercial space mining will be governed by national laws rather than international ones, the authors write, and that companies can declare “safety zones” around their operations to exclude others. Speaking to Space.com Mike Gold, the acting associate administrator for NASA’s Office of International and Interagency Relations, disputes the authors’ characterization of the accords and says they are based on the internationally-recognized Outer Space Treaty. He says they don’t include agreement on national regulation of mining or companies’ rights to establish safety zones, though they do assert the right to extract and use space resources. But given that they’ve yet to be released or even finalized, it’s not clear how far these rights extend or how they are enshrined in the agreements. And the authors point out that the fact that they are being negotiated bilaterally means the US will be able to use its dominant position to push its interpretation of international law and its overtly commercial goals for space development. Space policy designed around the exploitation of resources holds many dangers, say the paper authors. For a start, loosely-regulated space mining could result in the destruction of deposits that could hold invaluable scientific information. It could also kick up dangerous amounts of lunar dust that can cause serious damage to space vehicles, increase the amount of space debris, or in a worst-case scenario, create meteorites that could threaten satellites or even impact Earth. By eschewing a multilateral approach to setting space policy, the US also opens the door to a free-for-all where every country makes up its own rules. Russia is highly critical of the Artemis Accords process and China appears to be frozen out of it, suggesting that two major space powers will not be bound by the new rules. That potentially sets the scene for a race to the bottom, where countries compete to set the laxest rules for space mining to attract investment. The authors call on other nations to speak up and attempt to set rules through the UN Committee on the Peaceful Uses of Outer Space. Writing in The Conversation, Scott Shackelford from Indiana University suggests a good model could be the 1959 Antarctic Treaty, which froze territorial claims and reserved the continent for “peaceful purposes” and “scientific investigation.” But the momentum behind the US’ push might be difficult to overcome. Last month, the agency announced it would pay companies to excavate small amounts of regolith on the moon. Boley and Byers admit that if this went ahead and was not protested by other nations, it could set a precedent in international law that would be hard to overcome. For better or worse, it seems that US dominance in space exploration means it’s in the driver’s seat when it comes to setting the rules. As they say, to the victor go the spoils.

#### Dangerous mining greatly increases the risk of space debris.

* Any activity (landing, transport, mining) on asteroid surface causes hundreds of small particles
* Larger chunks can break into rubble and could increase risk to satellites by 30%

Sarah Scoles 15, “Dust from asteroid mining spells danger for satellites,” New Scientist, 5-27-2015, https://www.newscientist.com/article/mg22630235-100-dust-from-asteroid-mining-spells-danger-for-satellites/

NASA chose the second option for its Asteroid Redirect Mission, which aims to pluck a boulder from an asteroid’s surface and relocate it to a stable orbit around the moon. But an asteroid’s gravity is so weak that it’s not hard for surface particles to escape into space. Now a new model warns that debris shed by such transplanted rocks could intrude where many defence and communication satellites live – in geosynchronous orbit. According to Casey Handmer of the California Institute of Technology in Pasadena and Javier Roa of the Technical University of Madrid in Spain, 5 per cent of the escaped debris will end up in regions traversed by satellites. Over 10 years, it would cross geosynchronous orbit 63 times on average. A satellite in the wrong spot at the wrong time will suffer a damaging high-speed collision with that dust. The study also looks at the “catastrophic disruption” of an asteroid 5 metres across or bigger. Its total break-up into a pile of rubble would increase the risk to satellites by more than 30 per cent (arxiv.org/abs/1505.03800). That may not have immediate consequences. But as Earth orbits get more crowded with spent rocket stages and satellites, we will have to worry about cascades of collisions like the one depicted in the movie Gravity. Handmer and Roa want to point out the problem now so that we can find a solution before any satellites get dinged. “It is possible to quantify and manage the risk,” says Handmer. “A few basic precautions will prevent harm due to stray asteroid material.”

#### Clustering makes the risk of collisions *uniquely high* and the risk is understated

* Models fail to account for clusters which make up 50% of mass in LEO
* Clusters have higher probability of collision because of density and orbital similarity

Dr. Darren McKnight 17, Ph.D., Technical Director for Integrity Applications, Previously Senior Vice President and Director of Science and Technology Strategy at Science Applications International Corporation, “Proposed Series of Orbital Debris Remediation Activities,” 3rd International Conference and Exhibition on Satellite & Space Missions, 5/13/2017, https://conference.sdo.esoc.esa.int/proceedings/sdc7/paper/1/SDC7-paper1.pdf [graphics omitted]

In the future, this population will be added to primarily from collisions between large objects in orbit as the number of LNT produced is proportional to the mass involved in a collision (or explosion).2 Cataloged debris produced from a catastrophic collision will be liberated at about 1-3 fragments per kilogram of mass involved while LNT production is around 10-40 fragments per kilogram of mass involved. The Iridium/Cosmos collision involved a total mass of 2,000kg and produced over 3,000 trackable fragments and likely 10,000-15,0003 LNT debris. The Feng-Yun purposeful collision yielded over 2,200 trackable fragments and likely over 30,000 LNT from only ~850kg of mass involved. While it is important to prevent these types of events from occurring in the future, the consequence of a collision (based on number of LNT produced) will be proportional to the mass involved in the collision. The term “mass involved” implies a good coupling of the impactor mass with the target mass. For a large fragment (e.g., several kilograms) striking a typical payload (that is densely built) in its main satellite body (vice striking a solar array or other appendage) at hypervelocity speeds (i.e., above 6km/s) will result in all the mass being “involved” in the debris. However, a large fragment striking a derelict rocket body, due to the way that the mass is concentrated at the ends of a rocket body, will likely not result in all of the mass being “involved” in the liberated debris. However, it is likely that when two large derelicts, either rocket bodies or payloads, collide with each other, then all of the mass will be involved due to the likely direct physical interaction between the mass. The table below summarizes the mass involvement scenarios which highlight why the massive-on-massive collisions are the focus of our analyses. Therefore, it is best to prevent the collision of the most massive objects with each other (higher consequence) and the ones that are the most likely (higher probability) since risk is probability multiplied by consequence. Our ability to model and predict the rate of collisions is based empirically upon only one catastrophic accidental collision event and a model developed on the kinetic theory of gases (KTG). However, clusters of massive objects that have identical inclinations plus similar and overlapping apogees/perigees may indeed have a greater probability of collision than predicted by the KTG-based algorithms as they are not randomly distributed and their orbital element evolution (e.g., change in right ascension of ascending node and argument of perigee) is also similar. It is hypothesized that these similarities could result in resonances of collision dynamics that may lead to larger probability of collision values than predicted with current algorithms. The not well-known fact is that many of the most massive objects are in tightly clumped clusters that will likely produce greater probability of collision than estimated by the KTG approach (see attached paper) and with the much larger consequence (i.e., creation of catalogued LNT fragments). The attached paper that studied this possibility shows some initial indications that this may indeed be true but much more analysis is needed to provide this conclusively. This table of clusters represents well over 50% of the total derelict mass in LEO. However, no one is currently monitoring these potential events. It is proposed that it would be a prudent risk management approach for space flight safety to monitor and characterize this inter-cluster collision risk. The Massive Collision Monitoring Activity (MCMA) is proposed whereby the encounters between members of these clusters are constantly monitored and close encounter information collected, plotted, analyzed, and shared. This would provide a rich research base for scientists and a predictive service for spacefaring countries. I am currently executing a subset of this proposed activity in an ad hoc fashion in conjunction with JSpOC. I have been monitoring the interaction dynamics between the SL-16 population in the 820- 865km altitude region for the last nine months.

#### Debris cascades cause global nuke war

* Troops movements, arms treaties, bomb tracking impossible to verify
* Heightened by economic disaster
* Debris could be misattributed as an attack causing second-strike

Les Johnson 13, Deputy Manager for NASA's Advanced Concepts Office at the Marshall Space Flight Center, Co-Investigator for the JAXA T-Rex Space Tether Experiment and PI of NASA's ProSEDS Experiment, Master's Degree in Physics from Vanderbilt University, Popular Science Writer, and NASA Technologist, Frequent Contributor to the Journal of the British Interplanetary Sodety and Member of the American Institute of Aeronautics and Astronautics, National Space Society, the World Future Society, and MENSA, Sky Alert!: When Satellites Fail, p. 9-12 [language modified]

Whatever the initial cause, the result may be the same. A satellite destroyed in orbit will break apart into thousands of pieces, each traveling at over 8 km/sec. This virtual shotgun blast, with pellets traveling 20 times faster than a bullet, will quickly spread out, with each pellet now following its own orbit around the Earth. With over 300,000 other pieces of junk already there, the tipping point is crossed and a runaway series of collisions begins. A few orbits later, two of the new debris pieces strike other satellites, causing them to explode into thousands more pieces of debris. The rate of collisions increases, now with more spacecraft being destroyed. Called the "Kessler Effect", after the NASA scientist who first warned of its dangers, these debris objects, now numbering in the millions, cascade around the Earth, destroying every satellite in low Earth orbit. Without an atmosphere to slow them down, thus allowing debris pieces to bum up, most debris (perhaps numbering in the millions) will remain in space for hundreds or thousands of years. Any new satellite will be threatened by destruction as soon as it enters space, effectively rendering many Earth orbits unusable. But what about us on the ground? How will this affect us? Imagine a world that suddenly loses all of its space technology. If you are like most people, then you would probably have a few fleeting thoughts about the Apollo-era missions to the Moon, perhaps a vision of the Space Shuttle launching astronauts into space for a visit to the International Space Station (ISS), or you might fondly recall the "wow" images taken by the orbiting Hubble Space Telescope. In short, you would know that things important to science would be lost, but you would likely not assume that their loss would have any impact on your daily life. Now imagine a world that suddenly loses network and cable television, accurate weather forecasts, Global Positioning System (GPS) navigation, some cellular phone networks, on-time delivery of food and medical supplies via truck and train to stores and hospitals in virtually every community in America, as well as science useful in monitoring such things as climate change and agricultural sustainability. Add to this the [weakening] ~~crippling~~ of the US military who now depend upon spy satellites, space-based communications systems, and GPS to know where their troops and supplies are located at all times and anywhere in the world. The result is a nightmarish world, one step away from nuclear war, economic disaster, and potential mass starvation. This is the world in which we are now perilously close to living. Space satellites now touch our lives in many ways. And, unfortunately, these satellites are extremely vulnerable to risks arising from a half-century of carelessness regarding protecting the space environment around the Earth as well as from potential adversaries such as China, North Korea, and Iran. No government policy has put us at risk. It has not been the result of a conspiracy. No, we are dependent upon them simply because they offer capabilities that are simply unavailable any other way. Individuals, corporations, and governments found ways to use the unique environment of space to provide services, make money, and better defend the country. In fact, only a few space visionaries and futurists could have foreseen where the advent of rocketry and space technology would take us a mere 50 years since those first satellites orbited the Earth. It was the slow progression of capability followed by dependence that puts us at risk. The exploration and use of space began in 1957 with the launch of Sputnik 1 by the Soviet Union. The United States soon followed with Explorer 1. Since then, the nations of the world have launched over 8,000 spacecraft. Of these, several hundred are still providing information and services to the global economy and the world's governments. Over time, nations, corporations, and individuals have grown accustomed to the services these spacecraft provide and many are dependent upon them. Commercial aviation, shipping, emergency services, vehicle fleet tracking, financial transactions, and agriculture are areas of the economy that are increasingly reliant on space. Telestar 1, launched into space in the year of my birth, 1962, relayed the world's first live transatlantic news feed and showed that space satellites can be used to relay television signals, telephone calls, and data. The modern telecommunications age was born. We've come a long way since Telstar; most television networks now distribute most, if not ali, of their programming via satellite. Cable television signals are received by local providers from satellite relays before being sent to our homes and businesses using cables. With 65% of US households relying on cable television and a growing percentage using satellite dishes to receive signals from direct-to-home satellite television providers, a large number of people would be cut off from vital information in an emergency should these satellites be destroyed. And communications satellites relay more than television signals. They serve as hosts to corporate video conferences and convey business, banking, and other commercial information to and from all areas of the planet. The first successful weather satellite was TIROS. Launched in 1960, TIROS operated for only 78 days but it served as the precursor for today's much more long-lived weather satellites, which provide continuous monitoring of weather conditions around the world. Without them, providing accurate weather forecasts for virtually any place on the globe more than a day in advance would be nearly impossible. Figure !.1 shows a satellite image of Hurricane Ivan approaching the Alabama Gulf coast in 2004. Without this type of information, evacuation warnings would have to be given more generally, resulting in needless evacuations and lost economic activity (from areas that avoid landfall) and potentially increasing loss of life in areas that may be unexpectedly hit. The formerly top-secret Corona spy satellites began operation in 1959 and provided critical information about the Soviet Union's military and industrial capabilities to a nervous West in a time of unprecedented paranoia and nuclear risk. With these satellites, US military planners were able to understand and assess the real military threat posed by the Soviet Union. They used information provided by spy satellites to help avert potential military confrontations on numerous occasions. Conversely, the Soviet Union's spy satellites were able to observe the United States and its allies, with similar results. It is nearly impossible to move an army and hide it from multiple eyes in the sky. Satellite information is critical to all aspects of US intelligence and military planning. Spy satellites are used to monitor compliance with international arms treaties and to assess the military activities of countries such as China, Russia, Iran, and North Korea. Figure 1.2 shows the capability of modem unclassified space-based imaging. The capability of the classified systems is presumed to be significantly better, providing much more detail. Losing these satellites would place global militaries on high alert and have them operating, literally, in the blind. Our military would suddenly become vulnerable in other areas as well. GPS, a network of 24-32 satellites in medium-Earth orbit, was developed to provide precise position information to the military, and it is now in common use by individuals and industry. The network, which became fully operational in 1993, allows our armed forces to know their exact locations anywhere in the world. It is used to guide bombs to their targets with unprecedented accuracy, requiring that only one bomb be used to destroy a target that would have previously required perhaps hundreds of bombs to destroy in the pre-GPS world (which, incidentally, has resulted in us reducing our stockpile of non-GPS-guided munitions dramatically). It allows soldiers to navigate in the dark or in adverse weather or sandstorms. Without GPS, our military advantage over potential adversaries would be dramatically reduced or eliminated.

#### Satellites are key to environmental monitoring – debris collapses it and causes climate extinction

* Sats monitor all environmental processes (ice melt, wildfires, atmospheric concentrations) – data collected overdetermine how to respond to warming and motivate countries to respond as seen by Paris
* Montreal Protocol prevented ozone dissolution and was only possible through sat observation

Ben Biggs 18, PhD Researcher in Computer Vision and Deep Learning at the University of Cambridge, “How Satellites Can Protect Planet Earth From Disaster”, HowItWorks Daily, 12/22/2018, https://www.howitworksdaily.com/how-satellites-can-protect-planet-earth-from-disaster/

It might not look it, but our planet is a fragile place. A delicate balance of pressure, temperature and gases keeps us alive, as our atmosphere lets in enough heat for us to thrive – but not too much that we get too toasty. For many years our planet has looked after itself with ease. Now, with humans on the scene, things are changing more than ever, from climate change to mass deforestation. If our planet is going to survive long into the future it’s going to need our help. Fortunately, we’ve got plenty of missions that are working for the benefit of our world already. Using observation satellites in orbit, scientists have been monitoring Earth for decades, watching how the planet pulsates and changes over time. From orbit we can watch how species migrate, identify and predict environmental changes and even fix problems. A great example of this was the global effort to repair a hole in the ozone above the Antarctic back in 1987. Two years prior, scientists had discovered that chemicals known as chlorofluorocarbons (CFCs) – produced by fridges and aerosols, among other things – were causing the hole to grow. As a result countries around the world agreed to phase out the use of CFC as part of the Montreal Protocol. In early 2018, NASA announced that its Aura satellite had watched the hole successfully close, with it expected to fully repair as early as 2060. It was proof that we could work together to change the planet for the better. Aura is part of a broader NASA project called the Earth Observing System (EOS). This programme, which began in 1997, has seen NASA launch missions and instruments into orbit. This has included the groundbreaking Landsat series of satellites, which have provided surface images of the whole globe. Then there’s the Terra mission that launched in 2009 and studies clouds, sea ice and more from orbit. Most of these satellites are in polar orbits, which means they orbit the planet from top to bottom so that it rotates underneath and gives them a global view. Planning for the EOS began back in the 1980s, with NASA keen to regularly fly instruments for at least 15 years. “Human activity has altered the condition of the Earth by reconfiguring the landscape, by changing the composition of the global atmosphere, and by stressing the biosphere in countless ways,” they noted in a handbook in 1993. “There are strong indications that natural change is being accelerated by human intervention.” More than two dozen missions have been launched as part of the EOS to date. Among the programme’s many accomplishments, scientists watched as an ice shelf collapsed on the Antarctic Peninsula in 2002 using the Terra satellite. The same satellite, along with the Aqua satellite launched in 2002, has provided a global view of how the vegetation cycle changes over the course of a year and the effect the climate has on it. Those same two satellites have also allowed us to see how summer sea ice in the Arctic is decreasing, which means that more of the Sun’s light is being absorbed rather than being reflected, raising global temperatures. The EOS has helped in other ways too, such as enabling scientists to keep a close eye on the levels of toxic gases like carbon monoxide being emitted from massive fires in the atmosphere. This allows people on the ground to be alerted to these dangers, and they can in turn be advised to limit their outdoor activity to protect their health. The EOS is even helping to track and monitor rare animals, such as chameleons in Madagascar. Here, scientists have been able to use satellite imagery, combined with known habitats of the animals, to map out where they are likely to be living. It would take survey teams on the ground thousands of years to replicate this information without satellites. It’s not just NASA that has been keeping a close eye on the planet. The European Space Agency (ESA) runs the Copernicus project, billed as the world’s largest single Earth observation campaign. Previously known as the Global Monitoring for Environment and Security (GMES) programme, it began with the launch of the Sentinel-1A satellite in April 2014. This radar imaging satellite provides images both day and night and during all weather conditions, and these are being used to map sea ice, track oil spills and more. This has been followed by half a dozen more missions, with the latest – Sentinel-3B – launching on 25 April 2018. This mission is focusing on monitoring the behaviour and health of the oceans, but it has a wide range of abilities. It flies in formation with its predecessor, Sentinel-3A, and together the two of them can provide global data for Earth across an entire day. The satellites can measure the temperature over oceans, as well as the colour and height of the sea. They can also monitor wildfires from space, check the health of vegetation and map the way that land is being used around the world. And there are more Sentinel satellites on the way. In the coming years we’ll see the Sentinel-4 and Sentinel-5 missions launch, studying the composition of our planet’s atmosphere, while Sentinel-6 will measure global sea surface height for ocean and climate studies. “Copernicus will help shape the future of our planet for the benefit of all,” said the ESA, also noting that it isthe “most ambitious Earth observation programme to date,” one that will provide accurate and timely data on the environment, climate change and more. All of this data is vital for directing climate policy and other human activities on Earth. By observing our planet around the clock from space we can see the direct effect that humans are having on it. These are not the only climate-monitoring missions run by NASA and the ESA. The former has a number of other missions, including the Deep Space Climate Observatory, which observes the sunlit side of Earth. The latter has eight missions on the books in its Earth Explorer programme, including a mission to study how Earth’s gravity field varies over the surface of the planet, called the Gravity field and steady-state Ocean Circulation Explorer (GOCE), which ended in 2013. In 2016, countries of the world came together to sign the Paris Climate Agreement, a global effort to reduce carbon emissions to prevent the global average temperature rising by two degrees Celsius above pre-industrial levels. While the US later infamously reneged from this agreement, it was proof that with enough level-headed minds, minds that can see the data from missions showing how the planet is changing, we can take action. Humans continue to have a major effect on the planet, for better or worse, and monitoring that change is vital to our planet’s survival.

### Contention 2 is Space Wars

#### Inevitable market expansion guarantees wars over property rights—governments get quickly involved

Funnell 18 – Anthony, Writer for Future Tense News Citing Dean of Law at University of Adelaide, “War in space 'inevitable' because there's so much money to be made, expert warns”, ABC News, 8/23/2018, <https://www.abc.net.au/news/2018-08-24/conflict-in-space-is-inevitable-expert-warns/10146314>

* Companies fiercely competitive and rapidly growing in critical space sector which makes states protectionist

A leading Australian space law expert has warned conflict over space assets is "inevitable", and more needs to be done now to avert the potential for hostility. Professor Melissa de Zwart, the Dean of Law at the University of Adelaide, says growing commercial interest in the mining of precious minerals on asteroids and planets has heightened the danger. "I think you have to be a realist about that," she said. "Where you have resources, where you have competition for those resources, where you have investment of money in the extraction of those resources ... there will be an expectation of security around that investment." While full-scale mining is yet to be tried, there is significant international interest. Japanese aerospace agency Jaxa has already successfully landed a robotic craft on an asteroid and taken samples. It currently has another probe hovering over an asteroid named Ryugu. Artist's impression of Hayabusa 2 PHOTO: Artist's impression of Jaxa's robotic craft flying above Ryugu. (Source: JAXA) Two American companies — Deep Space Industries and Planetary Resources — are thought to be the leaders in the field, but in May this year a UK firm called Asteroid Mining Corporation also entered the race. "Those corporations will be looking to the nation-state to say, well, are you going to protect our investment in this business?" Professor de Zwart said. A very crowded space The US Government and American firms continue to play a dominant role in more traditional space technology development and deployment. SpaceX, for example, is a major private supplier of rockets, while the US Air Force currently coordinates international satellite traffic, providing advanced warnings about potentially dangerous space debris. Listen to the episode Are we moving away from the notion that space is for all humankind? And is conflict in space inevitable? But the number of players is rapidly increasing. The OECD's Space Forum says more than 80 countries now have some form of space program, mostly concentrated on rockets, satellites and satellite-related services and technology. They estimate the global industry is worth somewhere around $US400 billion and growing quickly. And that figure could skyrocket if, and when, asteroid mining kicks off. Eric Stallmer, the president of the US-based Commercial Spaceflight Federation, a consortium of 85 space-related organisations and businesses, believes that moment is fast approaching. "I think we are looking at a five to 10-year timetable for developing that technology. It makes for an exciting time," he said

#### Asteroid mining furthers tensions between the US, China and Russia and escalates

* Drives competition between Artemis and non-Artemis nations
* No international treaty to guide appropriation which heightens tensions

Jamasmie 21 Cecilia Jamasmie [Cecilia has covered mining for more than a decade. She is particularly interested in Corporate Social Responsibility (CSR), Diamonds and Latin America. Cecilia has been interviewed by BBC News and CBC among others and has been a guest speaker at mining conventions, including MINExpo 2016 and the World’s Copper Conference 2018. She is also member of the expert panel on Social License to Operate (SLO) at the European project MIREU (Mining and Metallurgic Regions EU). She holds a Master of Journalism from the University of British Columbia, and is based in Nova Scotia.], 2-2-2021, "Experts warn of brewing space mining war among US, China and Russia," MINING, <https://www.mining.com/experts-warn-of-brewing-space-mining-war-among-us-china-and-russia/> DD AG

A brewing war to set a mining base in space is likely to see China and Russia joining forces to keep the US increasing attempts to dominate extra-terrestrial commerce at bay, experts warn. The Trump Administration took an active interest in space, announcing that America would return astronauts to the moon by 2024 and creating the Space Force as the newest branch of the US military. It also proposed global legal framework for mining on the moon, called the Artemis Accords, encouraging citizens to mine the Earth’s natural satellite and other celestial bodies with commercial purposes. The directive classified outer space as a “legally and physically unique domain of human activity” instead of a “global commons,” paving the way for mining the moon without any sort of international treaty. Spearheaded by the US National Aeronautics and Space Administration (NASA), the Artemis Accords were signed in October by Australia, Canada, England, Japan, Luxembourg, Italy and the United Emirates “Unfortunately, the Trump Administration exacerbated a national security threat and risked the economic opportunity it hoped to secure in outer space by failing to engage Russia or China as potential partners,” says Elya Taichman, former legislative director for then-Republican Michelle Lujan Grisham. “Instead, the Artemis Accords have driven China and Russia toward increased cooperation in space out of fear and necessity,” he writes.Russia’s space agency Roscosmos was the first to speak up, likening the policy to colonialism. “There have already been examples in history when one country decided to start seizing territories in its interest — everyone remembers what came of it,” Roscosmos’ deputy general director for international cooperation, Sergey Saveliev, said at the time.China, which made history in 2019 by becoming the first country to land a probe on the far side of the Moon, chose a different approach. Since the Artemis Accords were first announced, Beijing has approached Russia to jointly build a lunar research base. President Xi Jinping has also he made sure China planted its flag on the Moon, which happened in December 2020, more than 50 years after the US reached the lunar surface.

#### Space wars go nuclear

* Very easy to take out sats creates use-or-lose pressures
* Dual use weapons means taboo on attacking nuke sats goes away

Grego 18 – Laura, Senior Scientist in the Global Security Program at the Union of Concerned Scientists, Postdoctoral Researcher at the Harvard-Smithsonian Center for Astrophysics, PhD in Experimental Physics at the California Institute of Technology, Space and Crisis Stability, Union of Concerned Scientists, 3-19-18, <https://www.law.upenn.edu/live/files/7804-grego-space-and-crisis-stabilitypdf>

Why space is a particular problem for crisis stability For a number of reasons, space poses particular challenges in preventing a crisis from starting or from being managed well. Some of these are to do with the physical nature of space, such as the short timelines and difficulty of attribution inherent in space operations. Some are due to the way space is used, such as the entanglement of strategic and tactical missions and the prevalence of dual-use technologies. Some are due to the history of space, such the absence of a shared understanding of appropriate behaviors and consequences, and a dearth of stabilizing personal and institutional relationships. While some of these have terrestrial equivalents, taken together, they present a special challenge. The vulnerability of satellites and first strike incentives Satellites are inherently fragile and difficult to protect; in the language of strategic planners, space is an “offense-dominant” regime. This can lead to a number of pressures to strike first that don‘t exist for other, better-protected domains. Satellites travel on predictable orbits, and many pass repeatedly over all of the earth‘s nations. Low-earth orbiting satellites are reachable by missiles much less capable than those needed to launch satellites into orbit, as well as by directed energy which can interfere with sensors or with communications channels. Because launch mass is at a premium, satellite armor is impractical. Maneuvers on orbit need costly amounts of fuel, which has to be brought along on launch, limiting satellites‘ ability to move away from threats. And so, these very valuable satellites are also inherently vulnerable and may present as attractive targets. Thus, an actor with substantial dependence on space has an incentive to strike first if hostilities look probable, to ensure these valuable assets are not lost. Even if both (or all) sides in a conflict prefer not to engage in war, this weakness may provide an incentive to approach it closely anyway. A RAND Corporation monograph commissioned by the Air Force15 described the issue this way: First-strike stability is a concept that Glenn Kent and David Thaler developed in 1989 to examine the structural dynamics of mutual deterrence between two or more nuclear states.16 It is similar to crisis stability, which Charles Glaser described as ―a measure of the countries‘ incentives not to preempt in a crisis, that is, not to attack first in order to beat the attack of the enemy,‖17 except that it does not delve into the psychological factors present in specific crises. Rather, first strike stability focuses on each side‘s force posture and the balance of capabilities and vulnerabilities that could make a crisis unstable should a confrontation occur. For example, in the case of the United States, the fact that conventional weapons are so heavily dependent on vulnerable satellites may create incentives for the US to strike first terrestrially in the lead up to a confrontation, before its space-derived advantages are eroded by anti-satellite attacks.18 Indeed, any actor for which satellites or space-based weapons are an important part of its military posture, whether for support missions or on-orbit weapons, will feel “use it or lose it” pressure because of the inherent vulnerability of satellites. Short timelines and difficulty of attribution The compressed timelines characteristic of crises combine with these “use it or lose it” pressures to shrink timelines. This dynamic couples dangerously with the inherent difficulty of determining the causes of satellite degradation, whether malicious or from natural causes, in a timely way. Space is a difficult environment in which to operate. Satellites orbit amidst increasing amounts of debris. A collision with a debris object the size of a marble could be catastrophic for a satellite, but objects of that size cannot be reliably tracked. So a failure due to a collision with a small piece of untracked debris may be left open to other interpretations. Satellite electronics are also subject to high levels of damaging radiation. Because of their remoteness, satellites as a rule cannot be repaired or maintained. While on-board diagnostics and space surveillance can help the user understand what went wrong, it is difficult to have a complete picture on short timescales. Satellite failure on-orbit is a regular occurrence19 (indeed, many satellites are kept in service long past their intended lifetimes). In the past, when fewer actors had access to satellite-disrupting technologies, satellite failures were usually ascribed to “natural” causes. But increasingly, even during times of peace operators may assume malicious intent. More to the point, in a crisis when the costs of inaction may be perceived to be costly, there is an incentive to choose the worst-case interpretation of events even if the information is incomplete or inconclusive. Entanglement of strategic and tactical missions During the Cold War, nuclear and conventional arms were well separated, and escalation pathways were relatively clear. While space-based assets performed critical strategic missions, including early warning of ballistic missile launch and secure communications in a crisis, there was a relatively clear sense that these targets were off limits, as attacks could undermine nuclear deterrence. In the Strategic Arms Limitation Treaty, the US and Soviet Union pledged not to interfere with each other‘s ―national technical means‖ of verifying compliance with the agreement, yet another recognition that attacking strategically important satellites could be destabilizing.20 There was also restraint in building the hardware that could hold these assets at risk. However, where the lines between strategic satellite missions and other missions are blurred, these norms can be weakened. For example, the satellites that provide early warning of ballistic missile launch are associated with nuclear deterrent posture, but also are critical sensors for missile defenses. Strategic surveillance and missile warning satellites also support efforts to locate and destroy mobile conventional missile launchers. Interfering with an early warning sensor satellite might be intended to dissuade an adversary from using nuclear weapons first by degrading their missile defenses and thus hindering their first-strike posture. However, for a state that uses early warning satellites to enable a “hair trigger” or launch-on-attack posture, the interference with such a satellite might instead be interpreted as a precursor to a nuclear attack. It may accelerate the use of nuclear weapons rather than inhibit it. Misperception and dual-use technologies Some space technologies and activities can be used both for relatively benign purposes but also for hostile ones. It may be difficult for an actor to understand the intent behind the development, testing, use, and stockpiling of these technologies, and see threats where there are none. (Or miss a threat until it is too late.) This may start a cycle of action and reaction based on misperception. For example, relatively low-mass satellites can now maneuver autonomously and closely approach other satellites without their cooperation; this may be for peaceful purposes such as satellite maintenance or the building of complex space structures, or for more controversial reasons such as intelligence-gathering or anti-satellite attacks. Ground-based lasers can be used to dazzle the sensors of an adversary‘s remote sensing satellites, and with sufficient power, they may damage those sensors. The power needed to dazzle a satellite is low, achievable with commercially available lasers coupled to a mirror which can track the satellite. Laser ranging networks use low-powered lasers to track satellites and to monitor precisely the Earth‘s shape and gravitational field, and use similar technologies. 21 Higher-powered lasers coupled with satellite-tracking optics have fewer legitimate uses. Because midcourse missile defense systems are intended to destroy long-range ballistic missile warheads, which travel at speeds and altitudes comparable to those of satellites, such defense systems also have inherent ASAT capabilities. In fact, while the technologies being developed for long-range missile defenses might not prove very effective against ballistic missiles—for example, because of the countermeasure problems associated with midcourse missile defense— they could be far more effective against satellites. This capacity is not just theoretical. In 2007, China demonstrated a direct-ascent anti-satellite capability which could be used both in an ASAT and missile defense role, and in 2009, the United States used a ship-based missile defense interceptor to destroy a satellite, as well. US plans indicated a projected inventory of missile defense interceptors with capability to reach all low earth orbiting satellites in the dozens in the 2020s, and in the hundreds by 2030.22 Discrimination The consequences of interfering with a satellite may be vastly different depending on who is affected and how, and whether the satellite represents a legitimate military objective. However, it will not always be clear who the owners and operators of a satellite are, and users of a satellite‘s services may be numerous and not public. Registration of satellites is incomplete23 and current ownership is not necessarily updated in a readily available repository. The identification of a satellite as military or civilian may be deliberately obscured. Or its value as a military asset may change over time; for example, the share of capacity of a commercial satellite used by military customers may wax and wane. A potential adversary‘s satellite may have different or additional missions that are more vital to that adversary than an outsider may perceive. An ASAT attack that creates persistent debris could result in significant collateral damage to a wide range of other actors; unlike terrestrial attacks, these consequences are not limited geographically, and could harm other users unpredictably. In 2015, the Pentagon‘s annual wargame**,** or simulated conflict, involving space assets focused on a future regional conflict. The official report out24warnedthatit was hard to keep the conflict contained geographically when using anti-satellite weapons: As the wargame unfolded, a regional crisis quickly escalated, partly because of the interconnectedness of a multi-domain fight involving a capable adversary. The wargame participants emphasized the challenges in containing horizontal escalation once space control capabilities are employedto achieve limited national objectives. Lack of shared understanding of consequences/proportionalityStates havefairly similar understandings of the implications of military actions on the ground, in the air, and at sea,built over decades of experience. The United States and the Soviet Union/Russia have built some shared understanding of each other‘s strategic thinking on nuclear weapons, though this is less true for other states with nuclear weapons. But in the context of nuclear weapons, there is an arguable understanding about the crisis escalation based on the type of weapon (strategic or tactical) and the target (counterforce—against other nuclear targets, or countervalue—against civilian targets). Because of a lack of experience in hostilities that target space-based capabilities, it is not entirely clear what the proper response to a space activity is and where the escalation thresholds or “red lines” lie. Exacerbating this is the asymmetry in space investments; not all actors will assign the same value to a given target or same escalatory nature to different weapons.

#### Nuclear war causes extinction.

Starr ’17 (Steven; director of the University of Missouri’s Clinical Laboratory Science Program, senior scientist at the Physicians for Social Responsibility, Associate member of the Nuclear Age Peace Foundation, expert in the environmental consequences of nuclear war; 1/9/17; “Turning a Blind Eye Towards Armageddon — U.S. Leaders Reject Nuclear Winter Studies”; <https://fas.org/2017/01/turning-a-blind-eye-towards-armageddon-u-s-leaders-reject-nuclear-winter-studies/>; Federation of American Scientists; accessed 11/24/18; TV) [AV]

The detonation of an atomic bomb with this explosive power will **instantly ignite fires** over a surface area of three to five square miles. In the recent studies, the scientists calculated that the **blast**, **fire**, and **radiation** from a war fought with 100 atomic bombs could produce **direct fatalities** comparable to all of those worldwide in World War II, or to those once estimated for a “**counterforce**” nuclear war between the superpowers. However, the **long-term environmental effects** of the war couldsignificantly disrupt the global weather for at least a decade, which would likely result in a vast global famine. The scientists predicted that **nuclear firestorms** in the burning cities would cause at least five million tons of **black carbon smoke** to quickly rise above cloud level into the stratosphere, where it could not be rained out. The smoke would circle the Earth in **less than two weeks** and would form **a** global **stratospheric smoke layer** that **would remain for** more than **a decade**. The smoke would absorb warming sunlight, which would **heat the smoke** to temperatures near the boiling point of water, producing **ozone losses of** 20 to **50 percent** over populated areas. This would almost double the amount of UV-B reaching the most populated regions of the mid-latitudes, and it would create UV-B indices unprecedented in human history. In North America and Central Europe, the time required to get a painful sunburn at mid-day in June could decrease to as little as six minutes for fair-skinned individuals. As the smoke layer blocked warming sunlight from reaching the Earth’s surface, it would produce the **coldest** average **surface temperatures** in the last 1,000 years. The scientists calculated that global **food production would decrease** by 20 to **40 percent** during a five-year period following such a war. Medical experts have predicted that the shortening of growing seasons and corresponding decreases in agricultural production could cause up to **two billion** people to perish from **famine**. The climatologists also investigated the effects of a nuclear war fought with the vastly more powerful modern **thermonuclear** weapons possessed by the United States, Russia, China, France, and England. Some of the thermonuclear weapons constructed during the 1950s and 1960s were 1,000 times more powerful than an atomic bomb. During the last 30 years, the average size of thermonuclear or “strategic” nuclear weapons has decreased. Yet today, each of the approximately 3,540 strategic weapons deployed by the United States and Russia is seven to **80 times** more powerful than the atomic bombs modeled in the India-Pakistan study. The smallest strategic nuclear weapon has an explosive power of **100,000 tons of TNT**, compared to an atomic bomb with an average explosive power of 15,000 tons of TNT. Strategic nuclear weapons produce much larger nuclear firestorms than do atomic bombs. For example, a standard Russian 800-kiloton warhead, on an average day, will ignite fires covering a surface area of 90 to 152 square miles. A **war** fought with hundreds or thousands of U.S. and Russian strategic nuclear weapons would **ignite immense** **nuclear firestorms** covering land surface areas of many thousands or **tens of thousands** of square miles. The scientists calculated that these fires would produce up to **180 million tons** of black carbon soot and **smoke**, which would form a dense, **global stratospheric smoke layer**. The smoke would remain in the stratosphere for 10 to **20 years**, and it **would block** as much as **70 percent of sunlight** from reaching the surface of the Northern Hemisphere and 35 percent from the Southern Hemisphere. So much sunlight would be blocked by the smoke that the noonday sun would resemble a full moon at midnight. Under such conditions, it would only require a matter of days or weeks for daily minimum **temperatures** to **fall below freezing** in the largest agricultural areas of the Northern Hemisphere, where freezing temperatures would occur every day for a period of between one to more than two years. Average surface temperatures would become colder than those experienced 18,000 years ago at the height of the last Ice Age, and the prolonged cold would cause average rainfall to decrease by up to 90%. Growing seasons would be completely eliminated for more than a decade; it would be **too cold and dark** to grow food crops, **which would doom the** majority of the **human population.** NUCLEAR WINTER IN BRIEF The profound cold and darkness following nuclear war became known as nuclear winter and was first predicted in 1983 by a group of NASA scientists led by Carl Sagan. During the mid-1980s, a large body of research was done by such groups as the Scientific Committee on Problems of the Environment (SCOPE), the World Meteorological Organization, and the U.S. National Research Council of the U.S. National Academy of Sciences; their work essentially supported the initial findings of the 1983 studies. The idea of nuclear winter, published and supported by prominent scientists, generated extensive public alarm and put political pressure on the United States and Soviet Union to reverse a runaway nuclear arms race, which, by 1986, had created a global nuclear arsenal of more than 65,000 nuclear weapons. Unfortunately, this created a backlash among many powerful military and industrial interests, who undertook an extensive media campaign to brand nuclear winter as “bad science” and the scientists who discovered it as “irresponsible.” Critics used various uncertainties in the studies and the first climate models (which are primitive by today’s standards) as a basis to criticize and reject the concept of nuclear winter. In 1986, the Council on Foreign Relations published an article by scientists from the National Center for Atmospheric Research, who predicted drops in global cooling about half as large as those first predicted by the 1983 studies and described this as a “nuclear autumn.”

#### No turns – barriers to current tech are too high to solve resource scarcities on earth. Be suspect of ev otherwise – it’s hype to attract investment.

* Resources will be used in space ie sat fuel
* Too long and expensive to return to earth

Riederer 14 - editor-in-chief of Guernica magazine and writer at The New Yorker

Rachel Riederer, “Silicon Valley Says Space Mining Is Awesome and Will Change Life on Earth. That’s Only Half Right”, New Republic, 4/19/14 , <https://newrepublic.com/article/117815/space-mining-will-not-solve-earths-conflict-over-natural-resources>

It's become clear that there’s just not enough stuff on Earth to go around. We’re constantly fighting over land and water, jockeying for access to our home planet’s diamonds or oil or sugarcane or schools of fish. In the last few years a chorus of voices has arisen to suggest that we could solve these petty human squabbles by looking to space. “Everything we hold of value on this planet, metals, minerals, real estate, energy sources, fuel—the things we fight wars over—are literally in near infinite quantities in the solar system,” says Peter Diamandis, one of the founders of the asteroid-mining company Planetary Resources. He claims we have a “moral obligation to become an interplanetary species,” and that if we harness the resources in space, "the entire human race will be the beneficiary." Naveen Jain, founder of Moon Express, wants to do on the moon what Diamandis wants to do with asteroids. A recent CNBC profile quotes him as saying, “Once you take a mind-set of scarcity and replace it with a mind-set of abundance, amazing things can happen here on Earth.” MOST POPULAR Police Killed Her Boyfriend, Then Charged Her With His Murder Texas Is Bracing for a Blue Wave in 2020. Yes, Texas. America’s Most Powerful Gun Supporter What Indigenous Rights Have to Do With Fighting Climate Change Open Borders Made America Great This kind of exultant talk is perhaps to be expected from entrepreneurs describing their companies’ dreams, but Diamandis and Jain are not alone. In a radio interview this April, Neil deGrasse Tyson, the public face of American astrophysics, also voiced his excitement about the potential of space mining. “If you haul an asteroid the size of a house to Earth, it could have more platinum on it than has ever been mined in the history of the world. More gold than has ever been mined in the history of the world. When that happens”—and here his voice takes on the dreamy tone familiar to fans of "COSMOS: A Spacetime Odyssey," the Fox series he hosts—“the scarcity that has led to human-to-human violence, there’s a chance it could all go away.” Tyson admitted that he was being “a little hopeful”—he has also noted that it is far more likely that any resources found in space will be put to use in space first, not hauled back to Earth (more on that later)—but his comment captures the aura of starry-eyed excitement that surrounds space mining ventures. At Slate, Will Oremus wrote about the terrestrial tech world’s blasé response to the founding of Planetary Resources, and commanded, “Wake up! This is outer space we’re talking about! This is awesome!” It is awesome. To read about these ambitious plans, and to contemplate the scale of human brainpower and industriousness required to pull them off, fills one with awe. These new companies talk about space in a way that sounds unfamiliar to the civilian ear accustomed to the reverent tone of planetarium field trips; rather than the vastness of space, the companies emphasize its accessibility. Moon Express calls the moon “the eighth continent.” Planetary Resources wants to “bring the solar system into humanity’s sphere of influence.” Experiencing awe is fun. It's even more fun to imagine a world of outer-space abundance in which we don’t have to worry about fossil fuels and everyone can afford a platinum case for their iPhone. And there is great potential for resource extraction in space, though these ventures will carry great upfront costs and plenty of uncertainty about whether they will actually come to fruition. Many deadlines and timeline estimates are fast approaching or have passed already. What’s misleading about these projects isn’t that they’re subject to budget problems and delays, but that they come couched in overblown rhetoric about their potential to radically alter human life, to do away with the notion of scarcity and deliver us to a future of plenty and peace. It’s a pattern that has become familiar in Silicon Valley: develop a plan for a business that will do something cool and make a lot of money, but describe it instead as something that will change the world. Return to that platinum asteroid for a moment. There’s one that Planetary Resources has been tracking: It passes near the Earth’s orbit every 23 months and is a half-kilometer by one kilometer in size. A spacecraft could travel to it in around eight months. Diamandis estimates its total worth at between $300 billion and $5 trillion. If it were to be mined at some point in the future, it would drive down the global price of platinum, which might make some items more affordable—luxury jewelry, of course, but also catalytic converters for cars and hard disks for laptops and DVRs—but it would primarily make the investors of Planetary Resources extremely rich. Allusions to the Wild West abound in the literature of space-mining companies. The Moon Express website talks about “brave pioneers” who explored new territories "with the backing of a monarch or a state.” For these entrepreneurs, space is not a distant emptiness; beyond the frontier, they envision a business-place. And with the exception of a Cold War–era treaty prohibiting national appropriation of the moon, there aren’t laws about ownership in space; its riches are there for the taking, like gold nuggets in a California stream. In a March debate on "Selling Space," at the American Museum of Natural History, Space Foundation CEO Elliot Pulham said that asteroids are clearly up for grabs: “There’s no law that says you can’t snag an asteroid. Knock yourself out.” It’s certainly true that space is full of valuables. Billions of years ago, during the formation of the solar system, gravity pulled the heavy materials on would-be planets toward their cores, forcing the comparatively lighter rocky material out to the surface. When those planets broke apart, they became asteroids. Some are made of rocky surface fragments, but some are made of the core materials—platinum, gold, silver, palladium—that are rare and precious on Earth. At a press roundtable after the "Selling Space" debate, Tyson explained why this process matters so much to those who would mine the sky: “Nature has pre-sifted the ingredients for you. You go grab yourself an asteroid made from the core of a planet that never survived, and you’ve got this stuff concentrated in the palm of your hand.” This is what Manifest Destiny must have felt and sounded like. Wealth beyond your wildest dreams, and it’s there for the taking. You just have to get there first. The “getting there first” will not be simple, or cheap. Most of the asteroids in the solar system are in the asteroid belt between Mars and Jupiter. But the orbit paths of some near-Earth asteroids, or NEAs, bring them relatively close to our planet—that is, within around 30 million miles. Planetary Resources has developed what is essentially an outer-space drone: a small telescope-equipped spacecraft, around the size of a desktop computer, that will survey near-Earth asteroids. Once an asteroid is identified and determined to be valuable, the extraction could begin, though that introduces a new set of technical obstacles. Because of the difficulty and expense of getting heavy machinery from Earth into space, some have suggested using 3D printing technology to use materials found in space to create the necessary equipment. Then, some modified version of a terrestrial mining method, like drilling or magnetic separation, could be used for the mining itself. But these extraction processes have been developed for the pressure and gravity of Earth, and they would need to be overhauled to function in the low-gravity, vacuum environment of space. If this part of the process sounds unclear, it’s because it is. To give an idea of the scale—in time and difficulty—of these kinds of operations, consider the government’s version of asteroid prospecting. In April, NASA greenlighted a mission in which a spacecraft called OSIRIS-REx will rendezvous with an asteroid called Bennu. OSIRIS-Rex is scheduled to launch in 2016, reach the asteroid in 2018, reconnoiter it for over a year, and then bring back samples for scientific study. The amount of asteroid that NASA plans to collect after all this time and trouble? Two ounces. A major premise of private space mining companies is that they will be able to work far faster and more economically than NASA, and will be willing to take on levels of risk beyond that of a government operation, but the scale and timeline of OSIRIS-REx shows how complex these operations will be, even for the swiftest companies. Rick Sternbach / KISS BAG IT, TAG IT, SELL IT An illustration, from the Cal Tech study, of an asteroid retrieval spacecraft capturing a 500-ton asteroid. The most far-out proposal in space mining is to "redirect" an NEA toward Earth and into lunar orbit. There, the asteroid could spin safely around the moon, accessible to our planet. A 2012 Cal Tech study determined that this method would be not only feasible, but “essential” for long-term human space exploration. According to the study, it will soon be possible for an unmanned spacecraft to identify a target asteroid—one around seven meters in diameter and 500,000 kilograms in mass—approach it, “loiter” nearby to determine its spin, and ultimately enclose the asteroid in what is described as a “draw-string bag.” (Take a moment to imagine a man-made drawstring bag capturing a giant mass of precious metal hurtling through space. “This is awesome!” does feel like the only reasonable response.) Once the asteroid and spacecraft are connected, a solar-powered propulsion system could fly the asteroid back to our moon and deposit it in lunar orbit. Depending on the mass of the asteroid, this retrieval flight would last between six and ten years. This idea, like the other space-mining projects, will require tremendous patience, money, vision, and bluster. So it's no surprise that the futurists of Silicon Valley are behind them: The group of companies founded with the intention of mining space are backed largely by investors who made their names and fortunes in tech. Peter Diamandis is the founder of the X Prize Foundation and of Silicon Valley’s Singularity University, which he co-founded with futurist Ray Kurzweil; Eric Schmidt is one of Planetary Resources’ major investors; before starting Moon Express, Naveen Jain was a senior executive at Microsoft and then CEO of his own startup, InfoSpace; Elon Musk founded PayPal and now has a private space company, SpaceX, currently under contract with NASA to begin carrying astronauts to the International Space Station. The New Yorker's George Packer identifies the “conflicting pressures” of Silicon Valley as “work ethic, status consciousness, idealism, and greed.” All of these pressures are present in the space-mining race, too. The work required to pull it off is undeniable—as is the idealistic delusion that outer-space extraction would bring world peace. Whoever accomplishes this first will be hailed, from Mountain View to Capitol Hill, as a genius. They will also become unfathomably wealthy, and rightly so: Entering a new, high-risk, high-tech field of business should come with the possibility for enormous reward. These entrepreneurs have evinced as much in less-utopian, off-the-cuff remarks. Diamandis has joked that his company’s financing plan is to buy puts in the platinum market and then announce their plan to bring a platinum asteroid home. Jain imagines coming back from trips to the moon with payloads worth billions of dollars: “I don’t care what people say," he said in an interview with Wired's editor last year. "That’s a shit load of money.” It’s telling that the foundational text of the space mining industry—1997's Mining the Sky, by John Lewis, a professor of planetary science at the University of Arizona and the chief scientist of Deep Space Industries—begins not with a catalog of the wealth of space, but with a brief history of exploration and military domination on Earth. Here, there isn’t enough, but in space, rather than nothingness, we find “a lively, rich understanding of the unity and lawfulness of Creation, within which the diversity and complexity of local materials and events falls into place.” Thanks to the saving power of technology, the very ideas of “limited resources and finite living space” are “tired old myths,” he writes. It’s exhilarating, this notion that tech advances could end scarcity as we know it, relegating wars over mineral wealth and energy sources to the list of woes defeated by science, alongside plague and polio. But it’s a dangerous exhilaration. It seems far more likely that new sources of wealth will, in their abundance, be one more thing for us to scrabble over. The space-mining notion is immensely appealing: the sky is full of infinite riches and abundance leads to peace. But why wouldn’t riches from the heavens cause conflicts and problems? Their vulgar terrestrial cousins always have. The problem with comparing space-mining to the Wild West isn’t just that it won’t revolutionize our economy like Manifest Destiny did. It isn’t even that there’s something suspect in taking the sky—something that feels so shared, so very deeply part of the commons—and turning it into a set of privately held commodities. It’s that this rhetoric gives the industry a kind of up-by-the-bootstraps patina, calling to mind a situation in which anyone with a gold-pan could go and seek their fortune, if one were plucky and lucky enough to set out for virgin territory. This simply does not apply to space mining, an industry where—to an even greater degree than modern-day resource extraction businesses on Earth—the barriers to entry in terms of both technology and capital are so immense that it is only open to entrepreneurs who are already billionaires. Would-be space mining companies are often called “crazy,” their plans described as wild schemes. In fact, these companies are not crazy at all. As Jain, of Moon Express, says in a promotional video, "It is not just a fun project. It is also a great business." Space-mining investors may be thinking extremely far outside the box, and willing to take on levels of risk that governments—the only entities with dealings in space until just recently—would never take on. But these are savvy investors, not a bunch of kids with a kooky dream, and they expect an eventual return on that investment. That might explain why, as the Wall Street Journal reported recently, Planetary Adventures has shifted its focus from precious metals "to a more mundane space resource: water," which "could be processed into fuel to extend the useful lives of aging commercial satellites." Granted, water has been a part of Planetary Resources’s business plan for years: When the company announced two years ago its intentions to mine asteroids, it said in a press release that “accessing water resources in space will revolutionize exploration.” But it never got headlines, for obvious reasons. As John Logsdon of the GWU Institute of Space Policy said after the "Selling Space" debate in March, “It’s not as sexy as platinum but I think the most valuable resource in space is water.” Harvesting asteroid ice could be very profitable in its own right, but it doesn’t conjure the same Panglossian platitudes as giant chunks of space gold do. That's just as well. It's a more practical approach for the near future. Because of the tremendous cost—both in terms of energy and money—of launching something out of Earth’s atmosphere or back into it, the most efficient use of resources extracted in space will be right there: in space. And that, in turn, should help bring the peace-and-abundance rhetoric back down to Earth. It's like much of what Silicon Valley invents: Not as awesome as the elevator pitch makes it sound, but useful in its own little way.