# 1NC

## Offs

### 1

#### Counterplan text: The Committee on the Peaceful use of Outer Space ought to

#### establish an application system for property rights on celestial bodies conditioned upon open disclosure of data and applications.

#### Private entities will only be granted one property grant per celestial body at a time.

#### Private Entities will only mine and extract asteroids during the asteroids natural orbit.

#### CP solves the Case – 1] Solves Advantage 1 because it eliminates ambiguity over property rights regime and 2] Solves Advantage 2 because a] the Committee can stop rogue states and terrorist groups from illegally using mining for Asteroid Terrorism which their 1AC card concedes solves and b] Solving Collisions solves Asteroid Terrorism since Terrorist groups can’t hide Asteroid hijacking

#### Mining regulations ensure Mining is safe.

**Steffen 21** [Olaf Steffen, Olaf is a scientist at the Institute of Composite Structures and Adaptive Sytems at the German Aerospace Center. 12-2-2021, "Explore to Exploit: A Data-Centred Approach to Space Mining Regulation," Institute of Composite Structures and Adaptive Systems, German Aerospace Center, [https://www.sciencedirect.com/science/article/pii/S0265964621000515 accessed 12/12/21](https://www.sciencedirect.com/science/article/pii/S0265964621000515%20accessed%2012/12/21)] Adam

4. The data-centred approach to space mining regulation 4.1. Core description of the regulatory regime and mining rights acquisition process The data gathered in the exploration of a [celestial body](https://www.sciencedirect.com/topics/social-sciences/astronomical-systems) is not only of value for space mining companies for informing them whether, where and how to exploit resources from the body in question, but also for science. The irretrievability of information relating to the solar system contained in the body that will be lost during resource exploitation carries a value for humanity and future generations and can thus be assigned the characteristic of a common heritage for all mankind as invoked in the Moon Agreement. This characteristic makes exploration data an exceptional and unique candidate for use in a mechanism for acquiring mining rights because its preservation is of public interest and its disclosure in exchange for exclusive mining rights does not place any additional burden on the mining company. The following principles would form the cornerstones of the proposed regulatory regime and rights acquisition mechanism based on exploration data: Without preconditions, no entity has a right to mine the resources of a celestial body. An international regulatory body administers the existing rights of companies for mining a specific celestial body. Mining rights to such bodies can be applied for from this international regulatory body, with applications made public. The application expires after a pre-set period. Mining rights are granted on the provision and disclosure of exploration data on the celestial body within the pre-set period, proposedly gathered in situ, characterising this body and its resources in a pre-defined manner. The explorer's mining right to the resources of the celestial body is published by the regulatory body in a mining rights grant. The data concerning the celestial body are made public as part of the rights grant within the domain of all participating members of the regulatory regime. The exclusive mining rights to any specific body are tradeable. The scope of the regulatory body with respect to the granting of mining rights is not revenue-oriented. The international regulatory body would thus act as a curator of a rights register and an attached database of exploration data. The concept is superficially comparable to patent law, where exclusive rights are granted following the disclosure of an invention to incentivise the efforts made in the development process. In the following section, the characteristics of such a regulatory regime are further discussed with respect to the formation of [monopolies](https://www.sciencedirect.com/topics/social-sciences/monopolies), market dynamics, conflict avoidance, inclusivity towards less developed countries and the viability of implementation. 4.2. Discussion and means of implementation The proposed regulatory mechanism has advantages both from a business/investor and society perspective. First, it prevents already highly capitalised companies from acquiring exploitation rights in bulk to deny competitors those objects that are easiest to exploit or most valuable, which would otherwise be possible in any kind of pay-for-right mechanism and could result in preventing market access to smaller, emerging companies. Thus, early monopoly formation can be avoided. The use of data disclosure for the granting of mining rights ensures the scientific community has access to this invaluable source of information. In this way, space mining prospecting missions can lead to a boost in research on small celestial bodies at a speed unmatchable by pure government/agency funded science probes. This usefulness to the scientific community could lead to sustained partnerships between prospecting companies and scientific institutions and could even provide a source of funding for the companies through R&D grants and public-private partnerships. The results of the exploration efforts contribute to research on the formation of planets and the history of the solar system and provide valuable insight for space defence against asteroids. The transition of exploration from a tailored mission profile with a purpose-built spacecraft to a standard task in space flight would also lead to a cost reduction of the respective exploration spacecraft through [economies of scale](https://www.sciencedirect.com/topics/social-sciences/economies-of-scale). This describes the very benefits Elvis [[24](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib24)] and Crawford [[25](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib25)] imagined as possible effects of a space economy. Thus, there is an immediate return for society from the exploitation rights grant. It also reconciles the adverse interests of space development and [space science](https://www.sciencedirect.com/topics/social-sciences/space-sciences) as laid out by Schwartz [[26](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib26)]. It ensures that, by exploitation, information contained in celestial bodies is not lost for future generations.The application period should not be set in a manner that creates a situation that can be abused through the potential for stockpiling inventory rights. Rather, it is intended to prevent conflict in the phase before exploration data gathered by a mission, as a prerequisite to the mining rights grant, is available. In other words, only one exploration effort at a time can be permitted for a specific body. The time frame between the application and the granting of mining rights (meaning: availability of the required exploration data set) should be tight and should only consider necessary exploration time on site, transit time and possibly a reasonable launch preparation and data processing markup. These contributors to the application period make it clear that the time frame could be dynamic and individualistic, depending on the exploration target (transit time and duration of exploration) and the technology of the exploration probe (transit time). After the expiration of the application period, applications for the exploration target would again be permissible. To prevent the previously mentioned stockpiling of inventory rights, credible proof of an imminent exploration intention would need to be part of the application process, for example, a fixed launch contract or the advanced build status of the exploration probe. Such a mechanism would not contradict the statement in the OST that outer space shall be free for both exploration and scientific investigation. Applications would not apply to purely scientific exploration. An application would only be necessary as a prerequisite for mining. Even resource prospecting could take place without an application (for whatever reason), with a subsequent application comprising in situ data already gathered. For such cases, the application process would need to provide a short period for objections to enable the secretive explorer to make their efforts public. The publication of the application for the mining rights, which is nothing more than a statement of intention to explore, thus provides a strong measure for avoiding conflict. The transparency of where exploration spacecraft are located and, at a later stage, where mining activities take place, provides additional benefits for the sustainable use of space, trust building and deterrence against malign misuse of mining technology. Involuntary spacecraft collisions of competitors in deep space are prevented by the reduction of exploration efforts at the same destination through the application for mining rights by one applicant at a time. As pointed out by Newman and Williamson [[20](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib20)], this is relevant because space debris does not de-orbit in deep space as in the case of LEO. Deep space may be vast, but the velocities involved mean that small debris particles are no less dangerous. Considering NEO mining with fleets of small spacecraft, malfunctions and/or destructive events could create debris clouds crossing Earth's orbit around the sun on a regular basis, presenting another danger to satellites in Earth's own orbit. Thus, by effectively preventing the collision of two spacecraft, one source of debris creation can be mitigated through this regulation mechanism. With respect to Deudney's [[11](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib11)] scepticism of asteroid mining and the dual-use character of technology to manipulate orbits of celestial bodies, it has to be stated that this potential is truly inherent to asteroid mining. An asteroid redirect mission for scientific purposes was pursued by NASA [[49](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib49)] before reorientation towards a manned lunar mission. In one way or another, each type of asteroid mining will require the delivery of the targeted resource to a destination via a comparable technology as formerly envisioned by NASA, be it as a raw material or a useable resource processed in situ, even if this is not necessarily done through redirecting the whole asteroid and placing it in a lunar orbit. However, to be misused as a weapon, space mined resources would have to surpass a certain mass threshold to survive atmospheric entry at the target. This seems unfeasible for currently discussed mining concepts using small-scale spacecraft as described in this article. Redirecting larger masses or whole asteroids would require far more powerful mining vessels or small amounts of thrust over long periods of time. The continuous, (for a mining activity) untypical change in the orbit of an asteroid would make a redirect attempt with hostile intent easily identifiable, effectively deterring such an activity in the first place by ensuring the identification of the aggressor long before the projectile hits its target. The proposed database would provide a catalogue of asteroids with exploration and mining activities in place that should be tracked more closely because of their interaction with spacecraft. This would, in fact, be necessary per se as a precaution to avoid catastrophic mishaps, such as the accidental change of a NEO's orbit to intercept Earth by changing its mass through mining.

#### Ensuring Asteroid Mining only occurs in the Asteroids Orbit solves Collisions, Debris, and Astro-Terror – 1AC Ev.

Drmola and Mareš 15 - Jakub Drmola is a PhD student and Miroslav Mareš professor, at the Divison of Security and Strategic Studies, Masaryk University, Czech Republic, "Revisiting the deflection dilemma", *Astronomy & Geophysics*, Volume 56, Issue 5, October 2015, Pages 5.15–5.18, <https://academic.oup.com/astrogeo/article/56/5/5.15/235650>

There are two basic ways to go about moving the resources contained within a given asteroid to the Earth. They can be extracted from the asteroid during its natural orbit and then transported to the Earth, or the entire asteroid might be moved closer to a more convenient location before starting mining. Thus repositioned, it might even be used as a shielded habitat, once hollowed out (Ostro 1999). There are different speculative costs and benefits associated with either option, which would vary with the size, orbit and composition of the asteroid. But, crucially, the second option would entail putting asteroids into orbit around the Earth, the Moon or possibly at one of the Earth’s Lagrangian points. Indeed, NASA has already planned a mission to capture a small asteroid and place it in a high cislunar orbit, where it would serve as a destination for future manned missions and experiments. This “Asteroid Redirect Mission” is to take place in the next decade and is being pitched mainly as a stepping stone towards a future mission to Mars (see box “NASA’s Asteroid Redirect Mission”; Brophy et al. 2012, Burchell 2014, Gates et al. 2015). Programmes to redirect asteroids and, especially, plans to mine asteroids on an industrial scale essentially resurrect the deflection dilemma. But it is no longer a matter of superpowers intentionally misusing technology designed to prevent dangerous impacts. It becomes an issue of proliferation among private entities. Once private mining companies acquire the technical ability to redirect suitable NEOs (Baoyin et al. 2011) in order to extract platinum or water from them, perilous inflections become more likely. The probability of accidents will rise with the number of asteroids whose trajectories we decide to manipulate. Such accidents might be very unlikely, but even a tiny technical or human error in the execution of an inflection meant to place an asteroid into the lunar or geocentric orbit might send it crashing into the Earth with potentially devastating consequences. And while we might find solace in the low probabilities associated with such an accident, even contemporary industries which are considered very safe suffer from unlikely tragedies. Despite being dependable and reliable, airliners do crash; there are a lot of them flying and very improbable accidents do happen if the dice are rolled often enough. Undoubtedly, we will not be steering as many asteroids as we steer planes any time soon, but industries tend to be more accident-prone during their infancy. Furthermore, a single asteroid can do a lot more damage than a single plane. And who is to say how much metal or water we are going to need in space over the course of the 21st century, or the next? The second source of risk is the intentional misuse, similar to the original deflection dilemma. But the entry barrier for asteroid weaponization gets much lower if mining them and moving them around becomes a common industrial activity. This is in stark contrast to the original scenario which envisioned this technology to be used solely for planetary defence and under control of a very small number of the most powerful countries (Morrison 2010). If such a powerful technology becomes widely and commercially available, even rogue states and wellfunded terrorist groups might be tempted to use it for an unexpected and devastating attack. In addition, an active asteroid mining industry would make it more difficult to detect any hostile inflection attempts among the number of legitimate and benign ones. Policy implications Considering these possible future dangers, it seems prudent to consider what to do about them sooner rather than later. The most obvious “solution” would be a blanket ban on the development of any technology that might lead to artificially inflected asteroids crashing into the Earth. However, such a ban would be incompatible with the dream of increased presence of humans in the solar system. It would stymie both scientific exploration and economic development here on Earth, which is increasingly dependent on precious metals and spacebased technologies. Furthermore, this approach would leave us more vulnerable to natural impacts which, in the long view, seems less than desirable. Another approach might be similar to the current regime of non-proliferation of nuclear weapons, aiming to support peaceful civilian use of nuclear power while at the same time prohibiting the spread of weapons of mass destruction. The regime mostly works (with caveats, see Wood et al. 2008) because these applications require different infrastructures and fissile materials enriched to different levels of purity. This makes it possible, at least in principle, to tell apart operations meant for the production of electricity and those designed to create weapons. Unfortunately, the difference between legitimate and hostile trajectory modification would lie only in the acceleration imparted on the asteroid and not in the technical means to do it. As the spacecraft launched with the intent to cause impact with the Earth might be identical to those sent off to retrieve resources, telling them apart would be nearly impossible, until it was too late. And this approach makes no difference to the chances of an industrial accident. If monitoring equipment on Earth is unhelpful, the focus changes to space. In other words, all asteroid movement missions should be constantly monitored. For an attacker, it would make most sense to delay the final course adjustment for as long as possible in order to give the least warning and make the timeframe for reaction as short as possible. So an asteroid might head towards a safe orbit fit for resource extraction for most of its altered flight time, but be further accelerated at the last possible moment onto an impact trajectory, perhaps mere days before it hits a major city. Our current programmes cataloguing NEOs (such as CSS or Pan-STARRS), which look for new, previously unknown objects, are not ideally suited for the task of constantly tracking a number of different, already known asteroids. New instruments would be needed to track them in order to immediately detect any hazardous inflection, whether intentional or accidental. Once such a detection is made, emergency measures to evacuate the population or, preferably, to “re-deflect” the incoming object can be executed right away, regardless of the cause. Accidents and hostilities could be treated the same way and countered by the same system (initially, at least). Such a system would be more akin to an air traffic control than a non-proliferation regulation, offering security through vigilance, rather than absence. Additionally, development of a system able to deflect incoming objects at relatively short notice would be beneficial in case of an impending natural impact. Conclusion Perhaps none of these concerns will become relevant. Maybe the idea of asteroid mining will soon fizzle out because we will discover cheaper and more efficient local alternatives. Maybe humanity will lose the will or the capability to explore space any further. Or perhaps manipulating asteroid trajectories will prove impractical or too costly. Certainly, it would not be the first time that a promising and seemingly obvious future does not come about. In the 1960s it seemed almost self-evident that by the second decade of the 21st century we would have flying cars and a base on the Moon. Yet we do not. Asteroid mining might be a similar case of unfulfilled promises and misplaced visions. On the other hand, there are examples of industries that developed surprisingly fast despite being considered unrealistic, not too long ago: air travel, nuclear power generation, or commercial satellites. The spread of the internet and the accompanying digital information revolution is another example; hardly anyone anticipated having virtually the entire repository of human knowledge at our fingertips at all times (except Douglas Adams). Whether the deflection dilemma forever remains an unmaterialized threat or it becomes a palpable problem, it is something to be mindful of now, as the foundations of the prospective asteroid mining industry are being laid. In the end, the purpose of this paper is not to predict the future. Instead it aims to merely update a conscientious warning which called for our diligence more than 20 years ago. While the world has changed somewhat, the basic idea remains valid. Whether the danger comes from warring superpowers, terrorists or negligent corporations, we must be aware of the realistic risks in order to avoid being either stumped by unforeseen catastrophes or paralysed by unwarranted fear. Either extreme would be harmful for our future.●

### 2

#### Only the private sector can do it – governments lack incentive and the OST prohibits it

Eure 16 (, J., 2016. Space… the final frontier. [online] Campbell Law Observer. Available at: <http://campbelllawobserver.com/space-the-final-frontier/> [Accessed 28 December 2021] Jonathan Eure is a 2017 graduate of Campbell Law School, winner of the 2017 J. Bryan Boyd Award for Excellence in Legal Journalism, and served as a senior staff writer for the Campbell Law Observer. He lived in Morganton, in the foothills of North Carolina, before moving to Raleigh for law school. He earned BA’s in Political Science and History from the University of North Carolina at Chapel Hill, graduating in 2014. The summer after his first year of law school, Jonathan worked as a legislative research intern with Representative Rob Bryan in the North Carolina General Assembly. Jonathan now interns with the Honorable Paul Newby at the North Carolina Supreme Court. Jonathan is the Secretary for the Campbell Public Interest Law Student Association (CPILSA).)-rahulpenu

As a policy matter, though the **O**uter **S**pace **T**reaty uses lofty ideals to **bind** **nations** into mutual respect and perhaps even unity of purpose, focusing solely on those ideals discounts a key ingredient of the original space race. Promulgation of national ideology was the original motivator of the space race between the U.S. and the U.S.S.R. Without national ideology, prestige, or power as a motivating factor, there is really **no** **incentive** **for** the **governments** of major spacefaring nations **to** **spend** massive amounts of money over long periods of time **on** such risky endeavors as space **colonization**. For this reason, the **colonization** of Proxima b would more likely **fall** **to** private **corporations** with much to gain from the resources other worlds might offer. Private exploration of space becomes more of a reality each day, with private corporations such as SpaceX, Blue Origin, and Virgin Galactic testing new platforms for space travel. A **movement** has **grown** **up** **alongside** these private spacefaring **companies** **claiming** planets such as Proxima b might become a **new** **frontier**, where private citizens can stake their own personal claims. This movement has even **proposed** **legislation** in Congress. The “Space Settlement Prize Act,” which would **ultimately** **guarantee** that **any** **settlement** built privately on other planets, moons, asteroids, etc., would be **owned** **by** the private citizens or **corporations** **who** **claim** **them**. This act would likely function similarly to the Homestead Acts, which allowed settlers who worked unclaimed land, to buy that land at very little cost. Furthermore, these groups claim that they are **not** **subject** **to** the **O**uter **S**pace **T**reaty, as the treaty’s provisions only govern nations. “The language of the Outer Space Treaty does not forbid private claims on and settlement of celestial bodies, only national appropriations. Furthermore, nations themselves are answerable in case of any environmental damages.” It is an interesting theory, and these 21st century frontiersmen and women might be correct. The Outer Space Treaty does not only govern nations themselves, but national oversight of non-governmental organizations as well. As all private attempts at space colonization on Proxima b and any other celestial body would be through corporate entities. These corporate entities would certainly fall under the national mandate to authorize and continually supervise the operation of such groups. But just because governments must have some form of oversight in place to manage private space exploration corporations, does not mean there is a mandate to control the legal operation of such corporations. The language of the Outer Space Treaty does not forbid private claims on and settlement of celestial bodies, only national appropriations. Furthermore, nations themselves are answerable in case of any environmental damages. Nations can certainly pass laws regulating the actions of private corporations consistent with the Outer Space Treaty’s mandate, and in fact the U.S. is already considering and attempting to create policies governing private space craft and travel. The problem is that none of this law has become official yet.

#### Commercial mining solves extinction from scarcity, climate, terror, war, and disease.

Pelton 17—(Director Emeritus of the Space and Advanced Communications Research Institute at George Washington University, PHD in IR from Georgetown).. Pelton, Joseph N. 2017. The New Gold Rush: The Riches of Space Beckon! Springer. Accessed 8/30/19.

Are We Humans Doomed to Extinction? What will we do when Earth’s resources are used up by humanity? The world is now hugely over populated, with billions and billions crammed into our overcrowded cities. By 2050, we may be 9 billion strong, and by 2100 well over 11 billion people on Planet Earth. Some at the United Nations say we might even be an amazing 12 billion crawling around this small globe. And over 80 % of us will be living in congested cities. These cities will be ever more vulnerable to terrorist attack, natural disaster, and other plights that come with overcrowding and a dearth of jobs that will be fueled by rapid automation and the rise of artifi cial intelligence across the global economy. We are already rapidly running out of water and minerals. Climate change is threatening our very existence. Political leaders and even the Pope have cautioned us against inaction. Perhaps the naysayers are right. All humanity is at tremendous risk. Is there no hope for the future? This book is about hope. We think that there is literally heavenly hope for humanity. But we are not talking here about divine intervention. We are envisioning a new space economy that recognizes that there is more water in the skies that all our oceans. Th ere is a new wealth of natural resources and clean energy in the reaches of outer space—more than most of us could ever dream possible. There are those that say why waste money on outer space when we have severe problems here at home? Going into space is not a waste of money. It is our future. It is our hope for new jobs and resources. The great challenge of our times is to reverse public thinking to see space not as a resource drain but as the doorway to opportunity. The new space frontier can literally open up a “gold rush in the skies.” In brief, we think there is new hope for humanity. We see a new a pathway to the future via new ventures in space. For too long, space programs have been seen as a money pit. In the process, we have overlooked the great abundance available to us in the skies above. It is important to recognize there is already the beginning of a new gold rush in space—a pathway to astral abundance. “New Space” is a term increasingly used to describe radical new commercial space initiatives—many of which have come from Silicon Valley and often with backing from the group of entrepreneurs known popularly as the “space billionaires.” New space is revolutionizing the space industry with lower cost space transportation and space systems that represent significant cost savings and new technological breakthroughs. “New Commercial Space” and the “New Space Economy” represent more than a new way of looking at outer space. These new pathways to the stars could prove vital to human survival. If one does not believe in spending money to probe the mysteries of the universe then perhaps we can try what might be called “calibrated greed” on for size. One only needs to go to a cubesat workshop, or to Silicon Valley or one of many conferences like the “Disrupt Space” event in Bremen, Germany, held in April 2016 to recognize that entrepreneurial New Space initiatives are changing everything [ 1 ]. In fact, the very nature and dimensions of what outer space activities are today have changed forever. It is no longer your grandfather’s concept of outer space that was once dominated by the big national space agencies. The entrepreneurs are taking over. The hopeful statements in this book and the hard economic and technical data that backs them up are more than a minority opinion. It is a topic of growing interest at the World Economic Forum, where business and political heavyweights meet in Davos, Switzerland, to discuss how to stimulate new patterns of global economic growth. It is even the growing view of a group that call themselves “space ethicists.” Here is how Christopher J. Newman, at the University of Sunderland in the United Kingdom has put it: Space ethicists have offered the view that space exploration is not only desirable; it is a duty that we, as a species, must undertake in order to secure the survival of humanity over the longer term. Expanding both the resource base and, eventually, the habitats available for humanity means that any expenditure on space exploration, far from being viewed as frivolous, can legitimately be rationalized as an ethical investment choice. (Newman) On the other hand there are space ethicists and space exobiologists who argue that humans have created ecological ruin on the planet—and now space debris is starting to pollute space. Th ese countervailing thoughts by the “no growth” camp of space ethicists say we have no right to colonize other planets or to mine the Moon and asteroids—or at least no right to do so until we can prove we can sustain life here on Earth for the longer term. However, for most who are planning for the new space economy the opinion of space philosophers doesn’t really fl oat their boat. Legislators, bankers, and aspiring space entrepreneurs are far more interested in the views of the super-rich capitalists called the space billionaires. A number of these billionaires and space executives have already put some very serious money into enterprises intent on creating a new pathway to the stars. No less than five billionaires with established space ventures—Elon Musk, Paul Allen, Jeff Bezos, Sir Richard Branson, and Robert Bigelow—have invested millions if not billions of dollars into commercializing space. They are developing new technologies and establishing space enterprises that can bring the wealth of outer space down to Earth. This is not a pipe dream, but will increasingly be the economic reality of the 2020s. These wealthy space entrepreneurs see major new economic opportunities. To them space represents the last great frontier for enterprising pioneers. Th us they see an ever-expanding space frontier that offers opportunities in low-cost space transportation, satellite solar power satellites to produce clean energy 24h a day, space mining, space manufacturing and production, and eventually space habitats and colonies as a trajectory to a better human future. Some even more visionary thinkers envision the possibility of terraforming Mars, or creating new structures in space to protect our planet from cosmic hazards and even raising Earth’s orbit to escape the rising heat levels of the Sun in millennia to come. Some, of course, will say this is sci-fi hogwash. It can’t be done. We say that this is what people would have said in 1900 about airplanes, rocket ships, cell phones and nuclear devices. The skeptics laughed at Columbus and his plan to sail across the oceans to discover new worlds. When Thomas Jefferson bought the Louisiana Purchase from France or Seward bought Alaska, there were plenty of naysayers that said such investment in the unknown was an extravagant waste of money. A healthy skepticism is useful and can play a role in economic and business success. Before one dismisses the idea of an impending major new space economy and a new gold rush, it might useful to see what has already transpired in space development in just the past five decades. The world’s first geosynchronous communications satellite had a throughput capability of about 500 kb / s. In contrast, today’s state of the art Viasat 2 —a half century later— has an impressive throughput of some 140 Gb/s. Th is means that the relative throughput is nearly 300,000 greater, while its lifetime is some ten times longer (Figs. 1.1 and 1.2 ). Each new generation of communications satellite has had more power, better antenna systems, improved pointing and stabilization, and an extended lifetime. And the capabilities represented by remote sensing satellites , meteorological satellites , and navigation and timing satellites have also expanded their capabilities and performance in an impressive manner. When satellite applications first started, the market was measured in millions of dollars. Today commercial satellite services exceed a quarter of a billion dollars. Vital services such as the Internet, aircraft traffi c control and management, international banking, search and rescue and much, much more depend on application satellites. Th ose that would doubt the importance of satellites to the global economy might wish to view on You Tube the video “If Th ere Were a Day Without Satellites?” [ 2 ]. Let’s check in on what some of those very rich and smart guys think about the new space economy and its potential. (We are sorry to say that so far there are no female space billionaires, but surely this, too, will come someday soon.) Of course this twenty-fi rst century breakthrough that we call the New Space economy will not come just from new space commerce. It will also come from the amazing new technologies here on Earth. Vital new terrestrial technologies will accompany this cosmic journey into tomorrow. Information technology, robotics, artificial intelligence and commercial space travel systems have now set us on a course to allow us humans to harvest the amazing riches in the skies—new natural resources, new energy, and even totally new ways of looking at the purpose of human existence. If we pursue this course steadfastly, it can be the beginning of a New Space renaissance. But if we don’t seek to realize our ultimate destiny in space, Homo sapiens can end up in the dustbin of history—just like literally millions of already failed species. In each and every one of the five mass extinction events that have occurred over the last 1.5 billion years on Earth, some 50–80 % of all species have gone the way of the T. Rex, the woolly mammoth, and the Dodo bird along with extinct ferns, grasses and cacti. On the other hand, the best days of the human race could be just beginning. If we are smart about how we go about discovering and using these riches in the skies and applying the best of our new technologies, it could be the start of a new beginning for humanity. Konstantin Tsiokovsky, the Russian astronautics pioneer, who fi rst conceived of practical designs for spaceships, famously said: “A planet is the cradle of mankind, but one cannot live in a cradle forever.” Well before Tsiokovsky another genius, Leonardo da Vinci, said, quite poetically: “Once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return.” The founder of the X-Prize and of Planetary Resources, Inc., Dr. Peter Diamandis, has much more brashly said much the same thing in quite diff erent words when he said: “The meek shall inherit the Earth. The rest of us will go to Mars.” The New Space Billionaires Peter Diamandis is not alone in his thinking. From the list of “visionaries” quoted earlier, Elon Musk, the founder of SpaceX; Sir Richard Branson, the founder of Virgin Galactic; and Paul Allen, the co-founder of Microsoft and the man who financed SpaceShipOne, the world’s first successful spaceplane have all said the future will include a vibrant new space economy. Th ey, and others, have said that we can, we should and we soon shall go into space and realize the bounty that it can offer to us. Th e New Space enterprise is today indeed being led by those so-called space billionaires , who have an exciting vision of the future. They and others in the commercial space economy believe that the exploitation of outer space may open up a new golden age of astral abundance. They see outer space as a new frontier that can be a great source of new materials, energy and various forms of new wealth that might even save us from excesses of the past. Th is gold rush in the skies represents a new beginning. We are not talking about expensive new space ventures funded by NASA or other space agencies in Europe, Japan, China or India. No, these eff orts which we and others call New Space are today being forged by imaginative and resourceful commercial entrepreneurs. Th ese twenty-fi rst century visionaries have the fortitude and zeal to look to the abundance above. New breakthroughs in technology and New Space enterprises may be able to create an “astral life raft” for humanity. Just as Columbus and the Vikings had the imaginative drive that led them to discover the riches of a new world, we now have a cadre of space billionaires that are now leading us into this New Space era of tomorrow. These bold leaders, such as Paul Allen and Sir Richard Branson, plus other space entrepreneurs including Jeff Bezos of Amazon and Blue Origin, and Robert Bigelow, Chairman of Budget Suites and Bigelow Aerospace, not only dream of their future in the space industry but also have billions of dollars in assets. These are the bright stars of an entirely new industry that are leading us into the age of New Space commerce. These space billionaires, each in their own way, are proponents of a new age of astral abundance. Each of them is launching new commercial space industries. They are literally transforming our vision of tomorrow. These new types of entrepreneurial aerospace companies—the New Space enterprises—give new hope and new promise of transforming our world as we know it today. The New Space Frontier What happens in space in the next few decades, plus corresponding new information technologies and advanced robotics, will change our world forever. These changes will redefi ne wealth, change our views of work and employment and upend almost everything we think we know about economics, wealth, jobs, and politics. Th ese changes are about truly disruptive technologies of the most fundamental kinds. If you thought the Internet, smart phones, and spandex were disruptive technologies, just hang on. You have not seen anything yet. In short, if you want to understand a transition more fundamental than the changes brought to the twentieth century world by computers, communications and the Internet, then read this book. There are truly riches in the skies. Near-Earth asteroids largely composed of platinum and rare earth metals have an incredible value. Helium-3 isotopes accessible in outer space could provide clean and abundant energy. There is far more water in outer space than is in our oceans. In the pages that follow we will explain the potential for a cosmic shift in our global economy, our ecology, and our commercial and legal systems. These can take place by the end of this century. And if these changes do not take place we will be in trouble. Our conventional petro-chemical energy systems will fail us economically and eventually blanket us with a hydrocarbon haze of smog that will threaten our health and our very survival. Our rare precious metals that we need for modern electronic appliances will skyrocket in price, and the struggle between “haves” and “have nots” will grow increasingly ugly. A lack of affordable and readily available water, natural resources, food, health care and medical supplies, plus systematic threats to urban security and systemic warfare are the alternatives to astral abundance. The choices between astral abundance and a downward spiral in global standards of living are stark. Within the next few decades these problems will be increasingly real. By then the world may almost be begging for new, out of- the-box thinking. International peace and security will be an indispensable prerequisite for exploitation of astral abundance, as will good government for all. No one nation can be rich and secure when everyone else is poor and insecure. In short, global space security and strategic space defense, mediated by global space agreements, are part of this new pathway to the future.

#### Resource scarcity coming now and causes extinction—asteroid mining is the only way to solve

Crombrugghe 18 – Guerric, Business Development Manager Brussels, Brussels Capital Region, “Asteroid mining as a necessary answer to mineral scarcity”, LinkedIn, 1/11/2018, <https://www.linkedin.com/pulse/asteroid-mining-necessary-answer-mineral-scarcity-de-crombrugghe>

We need minerals, and we always will. Yet, our reserves are finite and a 100% end-of-life recycling rate is impossible to achieve. Eventually, new entrants will therefore be required to sustain our system. While the business case for asteroid mining can obviously not be closed with current technologies, it will someday become a necessity. We may as well start preparing ourselves. Scarcity of resources, the challenge of the 21st century According to the World Bank, in 2016 humanity's growth rate was of 1.18% in terms of population, and 2.50% in terms of GDP. Both of these, in turn, drive our staggering resource consumption: there are more of us, and each of us needs more. On the other, the Earth is a closed system, and resources are only available in a finite amount. We all know by now that there is only this much oil & gas, but the same can actually be said for water, arable land, minerals, etc. These two simple observations have sparkled the debate around the scarcity of resources. Even with the best intentions, mathematics teaches us that it is impossible to indefinitely extract resources from a given finite supply [1]. The problem arising in the short-term is the exhaustion of the existing supply. That limit is actually coming in fast. In a paper published in 2007, Stephen Kessler demonstrates that the global mineral reserves are only sufficient for the next 50 years. The figure on the right shows the ratio of known global reserve to global annual consumption, given a rough indication of adequacy in years. It dates from an earlier paper, published in 1994. Since then, the development of environmental-friendly technologies (e.g. batteries, electric engines, etc.) has drastically increased the consumption rate of high-tech metals such as cobalt, platinum, rare earths, or titanium. On the other hand, exploration programs have allowed to discover new deposits, notably of gold and diamond. We will certainly be able to continue to increase - or at least sustain - our reserves, but only temporarily. Recycling and other temporary fixes An obvious solution is recycling, i.e. rejuvenating our stocks. A popular concept to illustrate this idea is that of urban mining: retrieving the ores present in smartphones and other electronic devices. It may prove to be not only more environmental-friendly, be also safer and more cost-effective. Nevertheless, every solution based on recycling is, again, nothing more than a temporary fix, buying us a finite amount of time. The United Nations Environment Programme studied in a report the current recycling rate of 60 metals. More than half of them have an end-of-life recycling rate below 1%, and less than one-third are above 50%. Nickel, for example, is relatively easy to retrieve, with and end-of-life recycling rate of up to 63% under the best conditions. At that rate, less than 1% of the initial stock is available after only 10 cycle. Even with a staggering 99% efficiency, the same 1% limit is achieved in less than 460 cycles. Not bad, of course, but still not enough. Should our hunger for resources continue, and even with the most optimised recycling techniques, a second problem will arise in the longer term: the amount of resources needed at a given time will simply exceed the total available stock. Unless we manage to find growth vectors that do not require raw materials, that tipping point is an impassable limit. Its proximity obviously depends on our consumption rate. Asteroid mining? No matter which way we look at it, we will thus be short on resources, either through sheer exhaustion (i.e. transformation in an unrecoverable form) or because the demand will exceed the total reserves. We can - and should - talk about recycling, dematerialisation, and other more ethically questionable solutions such as bio-engineering. Nonetheless, no matter how good they are, these are only temporary fixes. If we don't radically change our lifestyle, we will sooner or later have to address the elephant in the room: the Earth is a closed system, we need new entrants. How can space help? Short answer: all these minerals can be found in space. Some are difficult to obtain, others are even more difficult, none are straightforward. The most accessible destination is near-Earth asteroids, a reservoir of over 17,000 known - and counting - giant rocks that regularly cross the orbit of our planet. They are commonly classified in three main families. The most interesting one, for our case, is that of the S-type asteroids. These are metallic bodies, containing first and foremost nickel, iron and cobalt, but also gold, ores from the platinum group. But the list doesn't stop there, many other minerals can be found in smaller amounts: iridium, silver, osmium, palladium, rhenium, rhodium, ruthenium, manganese, molybdenum, aluminium, titanium, etc. How do we get there? Let's take an example: Ryugu, formerly known as 1999 JU3. It's a C-type asteroid measured to be approximately one kilometre in size [2]. In addition to nickel, iron and cobalt, it also contains a fair share of water, nitrogen, hydrogen, and ammonia. Its total value is estimated to be approximately 80 billion USD. Fantastic! But how do we get there and, most importantly, how much does it cost? Well, we may have the start of an answer to these questions. Reaching Ryugu is a technological challenge, but it is feasible. In December 2014, the Japanese space agency has launched a spacecraft, Hayabusa2, heading to the asteroid. Its mission includes the collection of a small sample which will be sent back to the Earth, with a landing planned for December 2020. The target for the sample size is at least 100 µg. The total cost of the mission was projected to be around 200 million USD. That's 2 trillion USD per gram. Let's be optimistic and assume that the sample retrieved is pure gold. At today's rate, it is worth 42.5 USD per gram. That's a difference of over 10 orders of magnitude. Some may argue that Hayabusa2 has many other objectives that retrieving a sample. The mission does indeed include multiple landers, thorough scientific investigations, etc. There is actually another asteroid sample return mission underway, which we could you as a second point of comparison: OSIRIS-Rex, from NASA. It's heading for Bennu, also a C-type asteroid, which it will reach in August 2018. Total cost of the mission: 980 million USD. Target sample size: at least 60 g. We achieve thus roughly speaking 16 million USD per gram. Better, but still 6 orders of magnitude off compared to pure gold. It's pretty much as good as it gets with existing state-of-the-art technologies. Not much of a business case. Should we forget about it? Referring back to our earlier conclusion on resource scarcity, we had two options. Either we drastically reduce our resource consumption, to such a degree that reserves can last for longer than humanity itself, or we extend our closed system, the Earth, to nearby asteroids. In the current state of affairs, I am honestly not sure which course of action is the easiest. As they get increasingly rare, the cost of minerals will go up. On the other hand, as explained in a previous article, we can expect the cost of space activities to go steadily down. Step by step, these 6 orders of magnitude will slowly get munched away from both ends, until eventually asteroid mining becomes a viable operation. In other words: it will only become financially interesting once minerals become a thousand times more expensive and space activities a thousand times cheaper. As a point of reference, the introduction of reusable rockets by SpaceX, widely considered as one of the few truly disruptive changes in the aerospace sector in the last few decades, has "only" brought a cost reduction of 30%. While it's clearly amazing, we still need at least 220 innovations of the same calibre [3] before we can make it work (again: assuming the price of minerals simultaneously goes up by a factor of a thousand). It's therefore quite likely that space mining will not take place within our lifetime [4]. How can we accelerate the process? Firstly, we can only celebrate and support the numerous private initiatives which contribute to make that reality happen, either indirectly (e.g. launchers, space systems, etc.) or directly (e.g. in-space manufacturing, lunar exploration, etc.). Shout out to all the folks who manage to keep the flame of space exploration burning while generating profit for their investors. Secondly, space agencies and other institutional actors should continue to act as promoters of pioneering mission such as Hayabusa2, OSIRIS-REx, or DART. We can only regret that the Asteroid Redirect Mission from NASA and the Asteroid Impact Mission from ESA were not funded. From my perspective, these should actually be amongst the top priorities of our space exploration agenda. Not only are they instrumental to our understanding of the solar system, but they are also essential if we want to avoid the same fate as the dinosaurs. It's a question of survival. As a bonus, they also pave the way towards cost-efficient asteroid mining. In the meantime, we might want to consume existing resources a bit more efficiently.

#### Resource Shortages Exacerbate Conflict

Wingo 13 - Dennis Wingo, Former CTO of the Orbital Recovery Corporation, Founder & CEO of Skycorp Inc, and Greentrail Energy Inc., Co-Founder & CTO of Orbital Recovery Inc. Leader of NASA's the Lunar Orbiter Image Recovery Project (LOIRP), First in history to rescue and operate a spacecraft (ISEE-3) in interplanetary space, and University of Alabama in Huntsville Consortium for Materials Development in Space Researcher At University of Alabama in Huntsville Consortium for Materials Development in Space “Commentary | The Inevitability of Extraterrestrial Mining”, *Space News*, 7/29/2013, https://spacenews.com/36511the-inevitability-of-extraterrestrial-mining/

I am honored to provide the counterpoint to my esteemed colleague Ambassador Roger Harrison’s negative contention concerning the mining of extraterrestrial materials off of planet Earth. Let’s begin with his ending: “The conclusion is inescapable, though liable to be escaped, i.e., that raw materials will never be mined in space and sold profitably within the atmosphere or anywhere else. … Asteroids will continue unvexed in their obits, and the Moon too.” I bring a different quote, from the book “Empire Express,” the story of the intercontinental railroad, from U.S. Army Lt. Zebulon Pike, for whom Pike’s Peak is named: “In various places there were tracts of many leagues, where the wind had thrown up sand in all the fanciful forms of the ocean’s rolling wave, and on which not a spear of vegetable matter existed.” Pike’s visions of sand dunes, pathless wastes and sterile soils were reported, widely read and faithfully believed by geographers. The myth became innocently embellished by subsequent visitors, especially those in the party of Maj. Stephen H. Long, who traversed the whole area in 1820. It was reported to be “an unfit residence for any but a nomad population … forever to remain the unmolested haunt of the native hunter, the bison, and the jackal.” The delicious irony is that Mr. Harrison today lives in the shadow of Pike’s Peak, and the U.S. Air Force Academy where he teaches is in the middle of the confidently prophesied unmolested haunt. When Long’s report was written, the Erie Canal across New York was five years from completion and it was another 31 years before the first railroad was completed across the state. Mr. Harrison’s technical objections are for the most part valid today for his scenario, just as objections to a railroad across the North American continent were valid in the 1820s. However, technology is being developed today that will enable extraterrestrial mining, manufacturing and development just as technology was developed that would enable the creation of the national railroad. Mr. Harrison says it is an illusion that we are running out of resources. He is correct. That is not our claim. The claim is that extraction costs of economically viable terrestrial resources are rising dramatically and may soon exceed the cost of extraction from much more plentiful extraterrestrial sources. Today rapidly advancing costs and diminishing returns are rapidly redefining mining due to diminishing ore grades. This fact is developed in a 2012 distinguished lecture by Dan Wood before the Society of Environmental Geologists, “Crucial Challenges to Discovery and Mining — Tomorrow’s Deeper Ore Bodies.” This is a vitally important issue to solve as resource conflict has been the impetus for most wars in human history. We live in a global civilization of over 7 billion people, which will expand to over 9 billion before plateauing in mid-century. While American politicians are not paying attention to what this means, the rest of the world is noticing. Gross domestic product (GDP) growth and increasing global resource demand are addressed in “Iron Ore Outlook 2050,” a report commissioned for the Indian government. The GDP of the major powers (the United States, Europe, China, India and Japan) is forecast to rise from $48 trillion in 2010 to $149 trillion by 2050. The report’s substance is that with this massive increase in global GDP, an intensifying scramble for metal resources is inevitable. If the trend of resource consumption demand increase continues unabated, there are three likely potential outcomes. The first is collapse, forecast by the “Limits to Growth” school of thought. The second and more likely scenario is fierce national economic competition leading to wars over diminishing resources. The third, and most desirable, is to increase the global resource base by the economic and industrial development of the inner solar system. Mr. Harrison uses cost as the primary reason that extraterrestrial mining will never happen by focusing on a straw man argument related to mining asteroids in orbits far from Earth. Just as the U.S. railroad infrastructure began on shorter routes with lower capital requirements and shorter payback periods, asteroid mining can begin with our nearest neighbor, the Moon, where telepresence robotics, high-bandwidth communications and a short three-day trip for humans negate his premise. We know from the Apollo samples that plentiful metallic asteroidal materials exist in the lunar highlands. We also know from several missions that extensive water, titanium, thorium, uranium, aluminum and native iron all exist on the Moon, in easily separable oxide form. Improvements in remote sensing data from current missions and computer modeling continue to increase the amount of potential asteroidal material on the Moon, increasing confidence in the Moon first premise. The extensive resources of the Moon become the catalyst for an inner solar system-wide economy providing fuel, vehicles and the all-important experience in developing an industrial infrastructure off planet. The asteroids then become the force multiplier of inner solar system development with billions of tons of water, metals and free space energy from solar power. Mars figures in here as well as the second home of humanity, creating further demand for asteroidal resources, and providing something else that is becoming increasingly scarce on the Earth: hope for the future. The technical barriers that Mr. Harrison points to are being overcome just as those of the 19th century were. New technology developments in 3-D printing, additive manufacturing and advanced robotics are breaking down the final barriers to exploiting off-planet resources and indeed the industrial development of the inner solar system. It is not a question if, it is a question of when, and by whom. Just as the Pacific Railway Act of 1862 was a primary catalyst for a century of American economic growth, it should be the role of government to develop policies and concrete legislation to support this development for the continued health of the American economy and the future of all mankind.

#### Those Conflicts go Nuclear

Klare 13 – Michael T., professor emeritus of peace and world-security studies at Hampshire College and senior visiting fellow at the Arms Control Association in Washington, DC, " How Resource Scarcity and Climate Change Could Produce a Global Explosion", *The Nation*, 4/22/2013, <https://www.thenation.com/article/how-resource-scarcity-and-climate-change-could-produce-global-explosion/> JHW

Resource Shortages and Resource Wars Start with one simple given: the prospect of future scarcities of vital natural resources, including energy, water, land, food and critical minerals. This in itself would guarantee social unrest, geopolitical friction and war. It is important to note that absolute scarcity doesn’t have to be on the horizon in any given resource category for this scenario to kick in. A lack of adequate supplies to meet the needs of a growing, ever more urbanized and industrialized global population is enough. Given the wave of extinctions that scientists are recording, some resources—particular species of fish, animals and trees, for example—will become less abundant in the decades to come, and may even disappear altogether. But key materials for modern civilization like oil, uranium and copper will simply prove harder and more costly to acquire, leading to supply bottlenecks and periodic shortages. Oil—the single most important commodity in the international economy—provides an apt example. Although global oil supplies may actually grow in the coming decades, many experts doubt that they can be expanded sufficiently to meet the needs of a rising global middle class that is, for instance, expected to buy millions of new cars in the near future. In its 2011 World Energy Outlook, the International Energy Agency claimed that an anticipated global oil demand of 104 million barrels per day in 2035 will be satisfied. This, the report suggested, would be thanks in large part to additional supplies of “unconventional oil” (Canadian tar sands, shale oil and so on), as well as 55 million barrels of new oil from fields “yet to be found” and “yet to be developed.” However, many analysts scoff at this optimistic assessment, arguing that rising production costs (for energy that will be ever more difficult and costly to extract), environmental opposition, warfare, corruption and other impediments will make it extremely difficult to achieve increases of this magnitude. In other words, even if production manages for a time to top the 2010 level of 87 million barrels per day, the goal of 104 million barrels will never be reached and the world’s major consumers will face virtual, if not absolute, scarcity. Water provides another potent example. On an annual basis, the supply of drinking water provided by natural precipitation remains more or less constant: about 40,000 cubic kilometers. But much of this precipitation lands on Greenland, Antarctica, Siberia and inner Amazonia where there are very few people, so the supply available to major concentrations of humanity is often surprisingly limited. In many regions with high population levels, water supplies are already relatively sparse. This is especially true of North Africa, Central Asia and the Middle East, where the demand for water continues to grow as a result of rising populations, urbanization and the emergence of new water-intensive industries. The result, even when the supply remains constant, is an environment of increasing scarcity. Wherever you look, the picture is roughly the same: supplies of critical resources may be rising or falling, but rarely do they appear to be outpacing demand, producing a sense of widespread and systemic scarcity. However generated, a perception of scarcity—or imminent scarcity—regularly leads to anxiety, resentment, hostility and contentiousness. This pattern is very well understood, and has been evident throughout human history. In his book Constant Battles, for example, Steven LeBlanc, director of collections for Harvard’s Peabody Museum of Archaeology and Ethnology, notes that many ancient civilizations experienced higher levels of warfare when faced with resource shortages brought about by population growth, crop failures or persistent drought. Jared Diamond, author of the bestseller Collapse, has detected a similar pattern in Mayan civilization and the Anasazi culture of New Mexico’s Chaco Canyon. More recently, concern over adequate food for the home population was a significant factor in Japan’s invasion of Manchuria in 1931 and Germany’s invasions of Poland in 1939 and the Soviet Union in 1941, according to Lizzie Collingham, author of The Taste of War. Although the global supply of most basic commodities has grown enormously since the end of World War II, analysts see the persistence of resource-related conflict in areas where materials remain scarce or there is anxiety about the future reliability of supplies. Many experts believe, for example, that the fighting in Darfur and other war-ravaged areas of North Africa has been driven, at least in part, by competition among desert tribes for access to scarce water supplies, exacerbated in some cases by rising population levels. “In Darfur,” says a 2009 report from the UN Environment Programme on the role of natural resources in the conflict, “recurrent drought, increasing demographic pressures, and political marginalization are among the forces that have pushed the region into a spiral of lawlessness and violence that has led to 300,000 deaths and the displacement of more than two million people since 2003.” Anxiety over future supplies is often also a factor in conflicts that break out over access to oil or control of contested undersea reserves of oil and natural gas. In 1979, for instance, when the Islamic revolution in Iran overthrew the Shah and the Soviets invaded Afghanistan, Washington began to fear that someday it might be denied access to Persian Gulf oil. At that point, President Jimmy Carter promptly announced what came to be called the Carter Doctrine. In his 1980 State of the Union Address, Carter affirmed that any move to impede the flow of oil from the Gulf would be viewed as a threat to America’s “vital interests” and would be repelled by “any means necessary, including military force.” In 1990, this principle was invoked by President George H.W. Bush to justify intervention in the first Persian Gulf War, just as his son would use it, in part, to justify the 2003 invasion of Iraq. Today, it remains the basis for US plans to employ force to stop the Iranians from closing the Strait of Hormuz, the strategic waterway connecting the Persian Gulf to the Indian Ocean through which about 35 percent of the world’s seaborne oil commerce passes. Recently, a set of resource conflicts have been rising toward the boiling point between China and its neighbors in Southeast Asia when it comes to control of offshore oil and gas reserves in the South China Sea. Although the resulting naval clashes have yet to result in a loss of life, a strong possibility of military escalation exists. A similar situation has also arisen in the East China Sea, where China and Japan are jousting for control over similarly valuable undersea reserves. Meanwhile, in the South Atlantic Ocean, Argentina and Britain are once again squabbling over the Falkland Islands (called Las Malvinas by the Argentinians) because oil has been discovered in surrounding waters. By all accounts, resource-driven potential conflicts like these will only multiply in the years ahead as demand rises, supplies dwindle and more of what remains will be found in disputed areas. In a 2012 study titled Resources Futures, the respected British think-tank Chatham House expressed particular concern about possible resource wars over water, especially in areas like the Nile and Jordan River basins where several groups or countries must share the same river for the majority of their water supplies and few possess the wherewithal to develop alternatives. “Against this backdrop of tight supplies and competition, issues related to water rights, prices, and pollution are becoming contentious,” the report noted. “In areas with limited capacity to govern shared resources, balance competing demands, and mobilize new investments, tensions over water may erupt into more open confrontations.” Heading for a Resource-Shock World Tensions like these would be destined to grow by themselves because in so many areas supplies of key resources will not be able to keep up with demand. As it happens, though, they are not “by themselves.” On this planet, a second major force has entered the equation in a significant way. With the growing reality of climate change, everything becomes a lot more terrifying. Normally, when we consider the impact of climate change, we think primarily about the environment—the melting Arctic ice cap or Greenland ice shield, rising global sea levels, intensifying storms, expanding desert and endangered or disappearing species like the polar bear. But a growing number of experts are coming to realize that the most potent effects of climate change will be experienced by humans directly through the impairment or wholesale destruction of habitats upon which we rely for food production, industrial activities or simply to live. Essentially, climate change will wreak its havoc on us by constraining our access to the basics of life: vital resources that include food, water, land and energy. This will be devastating to human life, even as it significantly increases the danger of resource conflicts of all sorts erupting. We already know enough about the future effects of climate change to predict the following with reasonable confidence: \* Rising sea levels will in the next half-century erase many coastal areas, destroying large cities, critical infrastructure (including roads, railroads, ports, airports, pipelines, refineries and power plants) and prime agricultural land. \* Diminished rainfall and prolonged droughts will turn once-verdant croplands into dust bowls, reducing food output and turning millions into “climate refugees.” \* More severe storms and intense heat waves will kill crops, trigger forest fires, cause floods and destroy critical infrastructure. No one can predict how much food, land, water and energy will be lost as a result of this onslaught (and other climate-change effects that are harder to predict or even possibly imagine), but the cumulative effect will undoubtedly be staggering. In Resources Futures, Chatham House offers a particularly dire warning when it comes to the threat of diminished precipitation to rain-fed agriculture. “By 2020,” the report says, “yields from rain-fed agriculture could be reduced by up to 50%” in some areas. The highest rates of loss are expected to be in Africa, where reliance on rain-fed farming is greatest, but agriculture in China, India, Pakistan and Central Asia is also likely to be severely affected. Heat waves, droughts and other effects of climate change will also reduce the flow of many vital rivers, diminishing water supplies for irrigation, hydro-electricity power facilities and nuclear reactors (which need massive amounts of water for cooling purposes). The melting of glaciers, especially in the Andes in Latin America and the Himalayas in South Asia, will also rob communities and cities of crucial water supplies. An expected increase in the frequency of hurricanes and typhoons will pose a growing threat to offshore oil rigs, coastal refineries, transmission lines and other components of the global energy system. The melting of the Arctic ice cap will open that region to oil and gas exploration, but an increase in iceberg activity will make all efforts to exploit that region’s energy supplies perilous and exceedingly costly. Longer growing seasons in the north, especially Siberia and Canada’s northern provinces, might compensate to some degree for the desiccation of croplands in more southerly latitudes. However, moving the global agricultural system (and the world’s farmers) northward from abandoned farmlands in the United States, Mexico, Brazil, India, China, Argentina and Australia would be a daunting prospect. It is safe to assume that climate change, especially when combined with growing supply shortages, will result in a significant reduction in the planet’s vital resources, augmenting the kinds of pressures that have historically led to conflict, even under better circumstances. In this way, according to the Chatham House report, climate change is best understood as a “threat multiplier…a key factor exacerbating existing resource vulnerability” in states already prone to such disorders. Like other experts on the subject, Chatham House’s analysts claim, for example, that climate change will reduce crop output in many areas, sending global food prices soaring and triggering unrest among those already pushed to the limit under existing conditions. “Increased frequency and severity of extreme weather events, such as droughts, heat waves and floods, will also result in much larger and frequent local harvest shocks around the world….These shocks will affect global food prices whenever key centers of agricultural production area are hit—further amplifying global food price volatility.” This, in turn, will increase the likelihood of civil unrest. When, for instance, a brutal heat wave decimated Russia’s wheat crop during the summer of 2010, the global price of wheat (and so of that staple of life, bread) began an inexorable upward climb, reaching particularly high levels in North Africa and the Middle East. With local governments unwilling or unable to help desperate populations, anger over impossible-to-afford food merged with resentment toward autocratic regimes to trigger the massive popular outburst we know as the Arab Spring. Many such explosions are likely in the future, Chatham House suggests, if current trends continue as climate change and resource scarcity meld into a single reality in our world. A single provocative question from that group should haunt us all: “Are we on the cusp of a new world order dominated by struggles over access to affordable resources?” For the US intelligence community, which appears to have been influenced by the report, the response was blunt. In March, for the first time, Director of National Intelligence James R. Clapper listed “competition and scarcity involving natural resources” as a national security threat on a par with global terrorism, cyberwar and nuclear proliferation. “Many countries important to the United States are vulnerable to natural resource shocks that degrade economic development, frustrate attempts to democratize, raise the risk of regime-threatening instability, and aggravate regional tensions,” he wrote in his prepared statement for the Senate Select Committee on Intelligence. “Extreme weather events (floods, droughts, heat waves) will increasingly disrupt food and energy markets, exacerbating state weakness, forcing human migrations, and triggering riots, civil disobedience, and vandalism.” There was a new phrase embedded in his comments: “resource shocks.” It catches something of the world we’re barreling toward, and the language is striking for an intelligence community that, like the government it serves, has largely played down or ignored the dangers of climate change. For the first time, senior government analysts may be coming to appreciate what energy experts, resource analysts and scientists have long been warning about: the unbridled consumption of the world’s natural resources, combined with the advent of extreme climate change, could produce a global explosion of human chaos and conflict. We are now heading directly into a resource-shock world.

#### Mining solves Water Shortages

Kean 15 Sam Kean December 2015 "The End of Thirst" <https://www.theatlantic.com/magazine/archive/2015/12/the-end-of-thirst/413176/> (writer based in Washington DC for the Atlantic)//Elmer

Imagine turning on your tap and seeing no water come out. Or looking down into your village’s only well and finding it dust-dry. Much of the developing world could soon face such a scenario. According to the United Nations, 1.2 billion people already suffer from severe water shortages, and that number is expected to increase to 1.8 billion over the next decade, in part because of climate change. Developed countries probably won’t be immune. California and other states in the western U.S. are already experiencing extreme drought, and climate experts warn of even worse to come—multi-decade megadroughts. Mass migrations and wars over freshwater loom as real possibilities. Staving off disaster will require conservation, especially in agriculture, which consumes more than two-thirds of all the water humans use. Basic infrastructure maintenance would also go a long way: Some developing countries lose more than half their water through leaky pipes. But conservation and maintenance won’t solve all our water woes, especially as the planet warms and people continue to pack into cities. As a result, governments around the world are investing in new water-recycling and water-harvesting technologies. Here’s what the future of water might look like. 1. Drinking From the Sea … One obvious solution would be to drink ocean water. Converting seawater into freshwater by stripping out the salt—a process called desalination—offers several advantages. Roughly half the world’s population lives within 65 miles of an ocean, and saltwater accounts for about 97 percent of all water on Earth. Still, desalination presents obstacles. Older plants that boil seawater and collect the vapors, as many of those in the Middle East do, use ungodly amounts of energy. Newer plants that use reverse osmosis—whereby seawater is forced through membranes at high pressure—are more efficient, but still expensive and energy-intensive. The process also produces a briny waste that can harm marine life if not disposed of properly. We can nevertheless expect to see more desalination plants soon—thanks in part to Israel, which all but eliminated its chronic water shortages in the past decade by building four large reverse-osmosis plants, inspiring other countries to follow suit. A $1 billion plant operated by an Israeli company is about to open north of San Diego; it will be the largest in the Western Hemisphere, providing up to 50 million gallons of water a day to Californians. 2. … Or From the Toilet Instead of desalination, some experts favor recycling wastewater—cleaning the water from showers, washing machines, and, yes, toilets—for human consumption. Most water-recycling plants clean water in two basic ways. First, they force it through filters, some of which have holes hundreds of times narrower than a strand of human hair. These filters remove waste particles, organic chemicals, bacteria, viruses, and other dreck. Second, chemicals like hydrogen peroxide or ozone and pulses of ultraviolet light destroy any pathogens that have slipped through. Water recycling is a proven technology: California recycles hundreds of millions of gallons each day for irrigation and other uses. So what’s stopping recycled wastewater from going directly to our taps? Human psychology. The very idea of drinking it disgusts many people. They view such water as irredeemably dirty, little better than toilet water. In reality, recycled water is some of the cleanest drinking water around—as good as or better than the best bottled water. (Breweries in Oregon and California have plans to make beer with recycled water for this very reason—it’s so clean that it’s tasteless, a blank slate.) More to the point, recycled water is far purer than most tap water. By the time the water in the Mississippi reaches New Orleans, for instance, every drop has been used by cities along the river multiple times, and the treatment it gets before going through the taps is nowhere near as extensive as what a water-recycling plant provides. Singapore and Namibia have recycled water for years with no adverse health effects, and nasa began recycling water on the International Space Station in 2008. (The Russian cosmonauts there don’t recycle their pee, but they give the Americans bags of it to recycle and then drink.) In the United States, a few parched towns in Texas and New Mexico drink recycled wastewater already, and last year the city of San Diego—which gets most of its water from rivers that are running dry—approved a $3 billion recycling plant that would provide one-third of its tap water, 83 million gallons a day, by 2035. San Diego had rejected essentially the same plan in 1998, but this time the city decided it had no other choice. 3. Microbe Power Rather than filtering out organic waste, water-recycling plants might one day be able to break it down with microbes, a process that could bring an ancillary benefit: electric power. As they digest the gunk in wastewater, certain species of bacteria, called electricigens, can liberate electrons, the stuff of electricity. Producing electrons is actually common in nature—much of photosynthesis involves shuttling them around. Unlike plants, though, electricigens don’t store electrons internally. They use microscopic appendages that look like hairs to deposit the electrons onto external surfaces, usually minerals. In experimental fuel cells, scientists have replaced the minerals with wires and harvested electrons. Someday the bacteria might even generate enough power to run a water-recycling plant, making it self-sufficient. 4. Keeping It Simple Some up-and-coming water technologies are startlingly straightforward. People on arid plateaus, for instance, can string a fine plastic mesh between two posts and use it to capture water from fog that rolls through, collecting the drops in storage tanks. Existing systems in one small Guatemalan village can collect 6,300 liters a day, and more during the wet season. Scientists think that updating the mesh with new materials and tighter weaves could dramatically improve yields. People could even channel the water into hydroponic gardens to grow food. Imagine famously foggy San Francisco with a farm on every rooftop. Oil films present another low-tech opportunity. Reservoirs lose appalling amounts of water to evaporation: By some estimates, more water escapes into the air than is used by humans. But covering the surface with an extremely thin layer—even just one molecule thick—of nontoxic chemicals derived from coconut or palm oil can cut evaporative losses. Wind tends to break up layers of oil, re-exposing the water to the elements. But drones or blimps equipped with sensors could someday monitor reservoirs and signal where oil needed to be re-applied. In one recent test, spreading oil over a lake in Texas (via boats) appears to have cut evaporation by about 15 percent. 5. Making It Rain Of course, for every modest proposal to save water, there’s an audacious one floating around. Take weather modification. Advocates of the idea hope to significantly boost precipitation using a process called “cloud seeding”: spraying clouds with a chemical like silver iodide, which acts as a nucleus around which water droplets collect. The droplets then fall to Earth as rain or snow. That’s the theory, at least. The first large-scale experiments, in the 1940s, generated a lot of excitement. More recently, weather modification has been dogged by accusations of hype and questions about its reliability. A six-year program in Wyoming claimed to have squeezed 5 to 15 percent more precipitation out of the clouds it seeded. Unfortunately, conditions were suitable for seeding only 30 percent of the time, so the total increase in precipitation was closer to 3 percent. That’s not nothing, especially during droughts. But weather modification may be the flying car of water technology—a tantalizing idea that’s forever on the horizon. 6. The Moon Shot If Earth does run dry, we might be able to save ourselves by mining water from asteroids and comets. Scientists have landed probes on these space rocks to study them. Future landers could mine them in deep space or possibly even drag them back toward Earth. Though the idea sounds far-fetched, space-mining companies already exist, and one of them, Planetary Resources, expects to start harvesting resources from asteroids in about a decade. According to Planetary Resources, a single 1,600-foot-wide asteroid could yield more platinum than has ever been mined in human history. But water could prove to be the real prize for space-mining companies. Some astronomers believe that the asteroid Ceres, which sits between Jupiter and Mars, may contain more freshwater (as ice) than all of Earth does. In addition to quenching people’s thirst, this water could be turned into fuel for interplanetary spaceships. In that case, an ample supply of water would be the key to a happy future not just down here on the ground, but up among the stars as well.

#### Indo-Pak Water War goes Nuclear

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Interstate conflict over water might occur, the ICA indicated, when several states rely on a shared river system for much of their water supply and one or more of the riparian states sought to maximize the river’s flow for their own benefit at the expense of other states in the basin, amplifying any scarcities already present there. “We judge that as water shortages become more acute beyond the next ten years, water in shared basins will increasingly be used as leverage,” the ICA stated. An upstream state enjoying superior control over a river’s flow might exploit its advantage, say, to extract advantage in international negotiations or to attract international aid for infrastructure projects. As the ICA further noted, “…we assess that states will also use their inherent ability to construct and support major water projects to obtain regional influence or preserve their water interests.”16

The utilization of a state’s superior position in a shared river system to extract political or economic advantage can prove especially destabilizing, the ICA suggested, when weaker states in the system (typically the downstream countries) are especially vulnerable to water scarcity because of long-standing social, economic, and political conditions. Without identifying any particular states by name, the study suggested that this could occur when downstream states suffer from endemic corruption, poor water management practices, and systemic favoritism when it comes to the allocation of scarce water supplies. In such cases, any reduction in the flow of water by an upstream country could easily combine with internal factors in a downstream country to provoke widespread unrest and conflict. “Water shortages, and government failures to manage them, are likely to lead to social disruptions, pressure on national and local leaders, and potentially political instability,” the report noted.17

Although most discussion of the climate and water security nexus has continued to emphasize the risk of internal conflict arising from warming-related water scarcities, some analysts have pursued the line of inquiry introduced by the 2012 ICA, focusing on interstate tensions arising within shared river basins. This was a prominent theme, for example, of a 2013 study conducted by the National Research Council (NRC) on behalf of the IC. Entitled Climate and Social Stress: Implications for Security Analysis, the 2013 NRC report sought to better identify the links between global warming, pre-existing social vulnerabilities, and the likelihood of conflict. While it echoed earlier studies by the CNA and NIC in identifying internal factors like poverty, ethnic discord, and governmental ineptitude as likely pre-conditions for climate-related conflict, it also examined dangers arising from dependence on shared river systems, especially in cases where cooperation among the riparian powers in managing the system is limited and global warming is expected to reduce future water flows.18

For the NRC, the river systems of greatest concern in this respect were those that originate in the Himalayan Mountains and depend, for a significant share of the annual flow, on meltwater from the Himalayan glaciers. These glaciers are an important source of meltwater for many of Asia’s major rivers, including the Indus, Ganges, Brahmaputra, and

Mekong Rivers. These rivers originate in China but travel through India, Pakistan, Nepal, Bangladesh, Laos, Cambodia, Thailand, and Vietnam—countries with a combined population of over 3.4 billion people, or approximately 44 percent of the world’s total population.19 A large share of the population in these countries depends on agriculture for its livelihood, so ensuring access to adequate supplies of water is a prime local and national priority. During the monsoon season, heavy rains provide these rivers with abundant water, but during dry seasons they are dependent on glacial meltwater—and, with the rise in global temperatures, the Himalayan glaciers are melting, jeopardizing future water availability in these river basins. Given a history of ethnic and social discord within many of these countries and long-standing tensions among them, analysts fear that such shortages could aggravate both internal and external tensions and ignite interstate as well as intrastate conflict.20

As was the case of previous IC-initiated studies, the authors of the 2013 NRC report were reluctant to identify specific countries in their findings, referring again to “countries of security concern” or other such euphemisms. However, they did select one of these countries in particular: Pakistan. They chose that country for special analysis, the report indicated, because “Pakistan presents a clear example of a country where social dynamics and susceptibility to harm from climate events combine to create a potentially unstable situation.”21 Pakistan was said to suffer from multiple risk factors: Its economy is largely dependent on agriculture; much of the water used for irrigation purposes comes from just one source, the Indus River; control over the allocation of irrigation waters is often exercised by privileged elites, leaving millions of Pakistanis vulnerable to water shortages; and much of the water flowing into the Indus comes from China or from tributaries originating in India, leaving Pakistan in an unfavorable (downstream) position in the system. These conditions have led, in the past, to internal squabbles over water rights and to tensions with India over control of the Indus; now, with the likelihood of diminished meltwater from the Himalayan glaciers, the risk of water scarcity triggering violent conflict of one sort or another becomes that much greater.22

Pakistan, the Indus, and U.S. Security

There is no doubt that Pakistan is considered by U.S. security analysts as a “state important to U.S. national security interests,” the term used by the Defense Intelligence Agency to describe countries of concern in the 2012 ICA on water. Not only is Pakistan a critical—if not always wholehearted—partner in the global war on terror, but it also possesses a substantial arsenal of nuclear weapons whose security is a matter of enormous concern to American leaders.23 Should those munitions wind up with rogue elements of the Pakistani military (some of whose members are believed to maintain clandestine links to radical Islamic organizations), or even worse, should Pakistan descend into civil war and the weapons fall into untrustworthy or hostile hands, the safety of India and other US allies—as well as of American forces deployed in the region—would be at grave risk.24 Ensuring Pakistan’s stability therefore, has long been a major U.S. security objective, prompting regular deliveries of American arms and other military aid. Yet, despite billions of dollars in American aid, Pakistan remains vulnerable to social and ethnic internal strife.25

As noted, farming is the principal economic activity in Pakistan, and ensuring access to water is an overarching public and government concern. This means, above all, managing the use of the Indus—the country’s main source of water for irrigation and its major source of power for electricity generation. Pakistan’s rising population and growing cities, with their rings of factories, are placing an immense strain on the Indus, leading to competition between farmers, industrialists, and urban consumers. With water and power shortages becoming an increasingly frequent aspect of daily life, public protests—sometimes turning violent—have erupted across the country. In one particularly intense bout of rioting, following a prolonged power outage in June 2012, protestors burned trains, blocked roads, looted shops, and damaged banks and gas stations.26

However bad things might be in Pakistan today, climate change is likely to make conditions far worse in the years ahead. Prolonged droughts, climate scientists believe, will occur with increasing regularity, posing a severe threat to the nation’s agricultural sector and further reducing the supply of hydroelectric power. At the same time, warming is expected to increase the intensity of monsoon downpours, resulting in massive flooding (as occurred in 2010) and the loss of valuable topsoil, further adding to Pakistan’s woes. As the Himalayan glaciers melt, moreover, water flow through the Indus will diminish.27 With the competition for land and water resources bound to increase and with Pakistan already divided along ethnic and religious lines, widespread civil strife will become ever more likely, possibly jeopardizing the survival of the state.

It is impossible to predict exactly how the United States might respond to a systemic breakdown of state governance in Pakistan. One thing is clear, however: At the earliest sign that the country’s nuclear weapons are at risk of falling into the hands of hostile parties, the American military would respond with decisive force. In fact, research conducted by the nonpartisan Nuclear Threat Initiative (NTI) has revealed that the Joint Special Operations Command (JSOC) and specialized Army units have been training for such contingencies for some time and have deployed all the necessary gear to the region. In the event of a coup or crisis, the NTI revealed, “U.S. forces would rush into the country, crossing borders, rappelling down from helicopters, and parachuting out of airplanes, so they can secure known or suspected nuclear-storage sites.” Recognizing that any such actions by American forces could trigger widespread resistance by the Pakistani army and/or various jihadist groups, the U.S. Central Command, which has authority over all American forces in the region, has developed plans for backing up JSOC personnel with full-scale military support.28

Another scenario that has some analysts worried is the possibility that a time of sharply reduced water flow through the Indus will coincide with efforts by India to exploit its advantageous position as the upper riparian on three key tributaries of the Indus—the Ravi, the Beas, and the Sutlej—to divert water for its own use, thereby depriving downstream Pakistan of vital supplies and provoking a war between these two countries. India was granted control over the three tributaries under the Indus Water Treaty of 1960, and various Indian leaders have threatened at times to dam the rivers or otherwise reduce their flow into Pakistan as a reprisal for Pakistani attacks on Indian bases in the disputed territory of Kashmir (through which the tributaries flow); this, in turn, has provoked counter-threats from Pakistani leaders.29 What analysts fear most, in such a situation, is that India, possessing superior conventional forces, would overpower Pakistan’s equivalent armies, leading Pakistan’s leaders to order the use of nuclear weapons against India, igniting a regional nuclear war. Such a conflict, scientists have calculated, would result in 50 to 125 million fatalities, and produce a dust cloud covering much of the Earth, decimating global agriculture—an outcome with enormous implications for American national security.30

### 3

#### CP Text: States, except the United States, should ban the appropriation of outer space for asteroid mining by private entities. The United States should fund the appropriation of outer space for the mining of rare earth metals from asteroids by private entities.

#### Asteroids have REMs

AP 21 “Mining A $10,000 Quadrillion Asteroid.” AP News, Feb 1, 2021, <https://apnews.com/press-release/accesswire/technology-business-science-utilities-electric-utilities-7bb32ecaac33bebef6e4b97ade588c57> TG

There are several million asteroids. They fall into three main types: carbonaceous asteroids, metallic asteroids, and mixed salicaceous-mineral-metallic asteroids. Many of the metallic asteroids are composed mainly of nickel and iron, but also contain sizeable quantities of important rare earth elements and precious metals including platinum and gold. A metallic asteroid just 25 meters across could contain as much as 30 tons of platinum valued around $1 billion. 16 Psyche is a staggering 226 kilometers (140 miles) wide and the most mineral rich asteroid so far detected. It is speculated that 16 Psyche could be worth about $10,000 quadrillion (or €8,240 quadrillion euros). To explore 16 Psyche in greater detail, NASA has approved the Psyche mission, which is scheduled to launch in August 2022. The spacecraft will orbit around 16 Psyche for 21 months while studying the asteroid using a number of different scientific instruments. Twenty four percent of all asteroids are thought to be composed of metals and rare minerals. While it is quite difficult to analyze asteroid composition from here on the earth’s surface, there are another 10 asteroids have been identified as likely cost-effective mining targets to date.

#### The PIC is key to beat China and protect against Chinese REM gatekeeping

Stavridis 21 [(James, retired US Navy admiral, chief international diplomacy and national security analyst for NBC News, senior fellow at JHU Applied Physics Library, PhD in Law and Diplomacy from Tufts) “U.S. Needs a Strong Defense Against China’s Rare-Earth Weapon,” Bloomberg Opinion, March 4, 2021, <https://www.bloomberg.com/opinion/articles/2021-03-04/u-s-needs-a-strong-defense-against-china-s-rare-earth-weapon>] TDI

You could be forgiven if you are confused about what’s going on with rare-earth elements. On the one hand, news reports indicate that China may increase production quotas of the minerals this quarter as a [goodwill gesture](https://www.scmp.com/news/china/diplomacy/article/3122501/china-raises-rare-earth-quotas-goodwill-trade-signal-us) to the Joe Biden administration. But other sources say that China may ultimately ban the export of the rare earths altogether on “[security concerns](https://www.bloomberg.com/news/articles/2021-02-19/china-may-ban-rare-earth-technology-exports-on-security-concerns?sref=QYxyklwO).” What’s really going on here?

There are 17 elements considered [rare earths](https://www.bloomberg.com/news/articles/2021-02-16/why-rare-earths-are-achilles-heal-for-europe-u-s-quicktake) — lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium, scandium and yttrium — and while many aren’t actually rare in terms of global deposits, extracting them is difficult and expensive. They are used across high-tech manufacturing, including smartphones, fighter aircraft and components in virtually all advanced electronics. Of particular note, they are essential to many of the clean-energy technologies expected to come online in this decade.

I began to focus on rare-earth elements when I commanded the North Atlantic Treaty Organization’s presence in Afghanistan, known as the International Security Assistance Force. While Afghans live in an extremely poor country, [studies](https://thediplomat.com/2020/02/afghanistans-mineral-resources-are-a-lost-opportunity-and-a-threat/) have assessed that they sit atop $1 trillion to $3 trillion in a wide variety of minerals, including rare earths. Some [estimates](https://www.fraserinstitute.org/article/afghanistans-rare-earth-element-bonanza) put the rare-earth levels alone at 1.4 million metric tons.

But every time I tried to visit a mining facility, the answer I got from my security team was, “It’s too dangerous right now, admiral.” Unfortunately, despite a great deal of effort by the U.S. and NATO, those security challenges remain, deterring the large foreign-capital investments necessary to harvest the lodes. Which brings us back to Beijing.

China controls roughly 80% of the rare-earths market, between what it mines itself and processes in raw material from elsewhere. If it decided to wield the weapon of restricting the supply — something it has repeatedly [threatened](https://www.wsj.com/articles/china-trade-fight-raises-specter-of-rare-earth-shortage-11559304000) to do — it would create a significant challenge for manufacturers and a geopolitical predicament for the industrialized world.

It could happen. In 2010, Beijing threatened to cut off exports to Japan over the disputed Senkaku Islands. Two years ago, Beijing was reportedly considering restrictions on exports to the U.S. generally, as well as against specific companies (such as defense giant Lockheed Martin Corp.) that it deemed in violation of its policies against selling advanced weapons to Taiwan.

President Donald Trump’s administration issued an executive order to spur the production of rare earths domestically, and created an [Energy Resource Governance Initiative](https://www.state.gov/wp-content/uploads/2019/06/Energy-Resource-Governance-Initiative-ERGI-Fact-Sheet.pdf) to promote international mining. The European Union and Japan, among others, are also aggressively seeking newer sources of rare earths.

Given this tension, it was superficially surprising that China announced it would boost its mining quotas in the first quarter of 2021 by nearly 30%, reflecting a continuation in strong (and rising) demand. But the increase occurs under a shadow of uncertainty, as the Chinese Communist Party is undertaking a “review” of its policies concerning future sales of rare earths. In all probability, the tactics of the increase are temporary, and fit within a larger strategy.

China will go to great lengths to maintain overall control of the global rare-earths supply. This fits neatly within the geo-economic approach of the [One Belt, One Road](https://www.bloomberg.com/opinion/articles/2019-10-30/china-is-determined-to-reshape-the-globe) initiative, which seeks to use a variety of carrots and sticks — economic, trade, diplomatic and security — to create zones of influence globally. In terms of rare earths, the strategy seems to be allowing carefully calibrated access to the elements at a level that makes it economically less attractive for competitors to undertake costly exploration and mining operations. This is similar to the oil-market strategy used by Russia and the Organization of Petroleum Exporting Countries for decades.

Some free-market advocates believe that China will not take aggressive action choking off supply because that could [precipitate retaliation](https://www.bloomberg.com/opinion/articles/2021-02-22/china-weaponizing-rare-earths-technology-will-probably-backfire) or accelerate the search for alternate sources in global markets. What seems more likely is a series of targeted shutdowns directed against specific entities such as U.S. defense companies, Japanese consumer electronics makers, or European industrial concerns that have offended Beijing.

The path to rare-earth independence for the U.S. must include: Ensuring supply chains of rare earths necessary for national security; promoting the exploitation of the elements domestically (and removing barriers to responsibly doing so); mandating that defense contractors and other critical-infrastructure entities wean themselves off Chinese rare earths; sponsoring research and development to find alternative materials, especially for clean energy technology; and creating a substantial stockpile of the elements in case of a Chinese boycott.

This is a bipartisan agenda. The Trump administration’s [strategic assessment](https://www.commerce.gov/news/press-releases/2019/06/department-commerce-releases-report-critical-minerals) of what needs to be done (which goes beyond just 17 rare earths to include a total of 35 critical minerals) is thoughtful, and should serve as a basis for the Biden administration and Congress.

#### REM access key to military primacy and tech advancement – alternatives fail

Trigaux 12 (David, University Honors Program University of South Florida St. Petersburg) “The US, China and Rare Earth Metals: The Future Of Green Technology, Military Tech, and a Potential Achilles‟ Heel to American Hegemony,” USF St. Petersberg, May 2, 2012, <https://digital.stpetersburg.usf.edu/cgi/viewcontent.cgi?article=1132&context=honorstheses>] TDI

* Ok maybe I painted this tm but it’s a great card

The implications of a rare earth shortage aren’t strictly related to the environment, and energy dependence, but have distinct military implications as well that could threaten the position of the United States world’s strongest military. The United States place in the world was assured by powerful and decisive deployments in World War One and World War Two. Our military expansion was built upon a large, powerful industrial base that created more, better weapons of war for our soldiers. During the World Wars, a well-organized draft that sent millions of men into battle in a short amount of time proved decisive, but as the war ended, and soldiers drafted into service returned to civilian life, the U.S. technological superiority over its opponents provided it with sustained dominance over its enemies, even as the numerical size of the army declined. New technologies, such as the use of the airplane in combat, rocket launched missiles, radar systems, and later, GPS, precision guided missiles, missile defense systems, high tech tanks, lasers, and other technologies now make the difference between victory and defeat.

The United States military now serves many important functions, deterring threats across the world. The United States projects its power internationally, through a network of bases and allied nations. Thus, the United States is a powerful player in all regions of the world, and often serves as a buffer against conflict in these regions. US military presence serves as a buffer against Chinese military modernization in Eastern Asia, against an increasingly nationalist Russia in Europe, and smaller regional actors, such as Venezuela in South America and Iran in the Middle East. The U.S. Navy is deployed all over the world, as the guarantor of international maritime trade routes. The US Navy leads action against challenges to its maritime sovereignty on the other side of the globe, such as current action against Somali piracy. Presence in regions across the world prevents escalation of potential crisis. These could result in either a larger power fighting a smaller nation or nations (Russia and Georgia, Taiwan and China), religious opponents (Israel and Iran), or traditional foes (Ethiopia and Eretria, Venezuela and Colombia, India and Pakistan). US projection is also key deterring emerging threats such as terrorism and nuclear proliferation. While not direct challenges to US primacy, both terrorism and nuclear proliferation can kill thousands.

The US Air Force has a commanding lead over the rest of the world, in terms of both numbers and capabilities. American ground forces have few peers, and are unmatched in their ability to deploy to anywhere in the world at an equally unmatched pace.

The only perceived challenge to the United States militarily comes from the People’s Republic of China.76 While the United States outspends all other nations in the world put together in terms of military spending, China follows as a close second, and has begun an extensive modernization program to boot.77 The Chinese military however, is several decades behind the United States in air power and nuclear capabilities.78 To compensate, China has begun the construction of access-denial technology, preventing the US from exercising its dominance in China’s sphere of influence.79 Chinese modernization efforts have a serious long-term advantage over the United States; access to rare earth metals, and a large concentration of rare earth chemists doing research.80 This advantage, coupled with the U.S. losing access to rare earth metals, will even the odds much quicker than policymakers had previously anticipated. 81

The largest example is US airpower. With every successive generation of military aircraft, the U.S. Air Force becomes more and more dependent on Rare Earth Metals.82 As planes get faster and faster, they have to get lighter and lighter, while adding weight from extra computers and other features on board.83 To lighten the weight of the plane, scandium is used to produce lightweight aluminum alloys for the body of the plane. Rare Earth metals are also useful in fighter jet engines, and fuel cells.84 For example, rare earths are required to producing miniaturized fins, and samarium is required to build the motors for the F-35 fighter jet.85 F-35 jets are the next generation fighter jet that works together to form the dual plane combination that cements U.S. dominance in air power over the Russian PAK FA.86

Rare earth shortages don’t just affect air power, also compromising the navigation system of Abrams Tanks, which need samarium cobalt magnets. The Abrams Tank is the primary offensive mechanized vehicle in the U.S. arsenal. The Aegis Spy 1 Radar also uses samarium.87 Many naval ships require neodymium. Hell Fire missiles, satellites, night vision goggles, avionics, and precision guided munitions all require rare earth metals. 88

American military superiority is based on technological advancement that outstrips the rest of the world. Command and control technology allows the U.S. to fight multiple wars at once and maintain readiness for other issues, as well as have overwhelming force against rising challengers. This technology helps the U.S. know who, where, and what is going to attack them, and respond effectively, regardless of the source of the threat.

Rare Earth Elements make this technological superiority possible.

To make matters worse, the defense industrial base is often a single market industry, dependent on government contracts for its business. If China tightens the export quotas further, major US defense contractors will be in trouble.89 Every sector of the defense industrial base is dependent on rare earth metals. Without rare earths, these contractors can’t build anything, which collapses the industry.90

Rare Earth shortages are actually already affecting our military, with shortages of lanthanum, cerium, europium and gadolinium happening in the status quo. This prevents us not only from building the next generation of high tech weaponry, but also from constructing more of the weapons and munitions that are needed in the status quo. As current weapon systems age and they can’t be replaced, the US primacy will be undermined. Of special concern is that U.S. domestic mining doesn’t produce “heavy” rare earth metals that are needed for many advanced components of military technologies. Given the nature of many military applications, substitutions aren’t possible. 91

#### Primacy and allied commitments solve arms races and great power war – unipolarity is sustainable, and prevents power vacuums and global escalation

Brands 18 [Hal, Henry Kissinger Distinguished Professor at Johns Hopkins University's School of Advanced International Studies and a senior fellow at the Center for Strategic and Budgetary Assessments." American Grand Strategy in the Age of Trump." Page 129-133] TDI

Since World War II, the United States has had a military second to none. Since the Cold War, America has committed to having overwhelming military primacy. The idea, as George W. Bush declared in 2002, that America must possess “strengths beyond challenge” has featured in every major U.S. strategy document for a quarter century; it has also been reflected in concrete terms.6

From the early 1990s, for example, the United States consistently accounted for around 35 to 45 percent of world defense spending and maintained peerless global power-projection capabilities.7 Perhaps more important, U.S. primacy was also unrivaled in key overseas strategic regions—Europe, East Asia, the Middle East. From thrashing Saddam Hussein’s million-man Iraqi military during Operation Desert Storm, to deploying—with impunity—two carrier strike groups off Taiwan during the China-Taiwan crisis of 1995– 96, Washington has been able to project military power superior to anything a regional rival could employ even on its own geopolitical doorstep.

This military dominance has constituted the hard-power backbone of an ambitious global strategy. After the Cold War, U.S. policymakers committed to averting a return to the unstable multipolarity of earlier eras, and to perpetuating the more favorable unipolar order. They committed to building on the successes of the postwar era by further advancing liberal political values and an open international economy, and to suppressing international scourges such as rogue states, nuclear proliferation, and catastrophic terrorism. And because they recognized that military force remained the ultima ratio regum, they understood the centrality of military preponderance.

Washington would need the military power necessary to underwrite worldwide alliance commitments. It would have to preserve substantial overmatch versus any potential great-power rival. It must be able to answer the sharpest challenges to the international system, such as Saddam’s invasion of Kuwait in 1990 or jihadist extremism after 9/11. Finally, because prevailing global norms generally reflect hard-power realities, America would need the superiority to assure that its own values remained ascendant. It was impolitic to say that U.S. strategy and the international order required “strengths beyond challenge,” but it was not at all inaccurate.

American primacy, moreover, was eminently affordable. At the height of the Cold War, the United States spent over 12 percent of GDP on defense. Since the mid-1990s, the number has usually been between 3 and 4 percent.8 In a historically favorable international environment, Washington could enjoy primacy—and its geopolitical fruits—on the cheap.

Yet U.S. strategy also heeded, at least until recently, the fact that there was a limit to how cheaply that primacy could be had. The American military did shrink significantly during the 1990s, but U.S. officials understood that if Washington cut back too far, its primacy would erode to a point where it ceased to deliver its geopolitical benefits. Alliances would lose credibility; the stability of key regions would be eroded; rivals would be emboldened; international crises would go unaddressed. American primacy was thus like a reasonably priced insurance policy. It required nontrivial expenditures, but protected against far costlier outcomes.9 Washington paid its insurance premiums for two decades after the Cold War. But more recently American primacy and strategic solvency have been imperiled.

THE DARKENING HORIZON For most of the post–Cold War era, the international system was— by historical standards—remarkably benign. Dangers existed, and as the terrorist attacks of September 11, 2001, demonstrated, they could manifest with horrific effect. But for two decades after the Soviet collapse, the world was characterized by remarkably low levels of great-power competition, high levels of security in key theaters such as Europe and East Asia, and the comparative weakness of those “rogue” actors—Iran, Iraq, North Korea, al-Qaeda—who most aggressively challenged American power. During the 1990s, some observers even spoke of a “strategic pause,” the idea being that the end of the Cold War had afforded the United States a respite from normal levels of geopolitical danger and competition. Now, however, the strategic horizon is darkening, due to four factors.

First, great-power military competition is back. The world’s two leading authoritarian powers—China and Russia—are seeking regional hegemony, contesting global norms such as nonaggression and freedom of navigation, and developing the military punch to underwrite these ambitions. Notwithstanding severe economic and demographic problems, Russia has conducted a major military modernization emphasizing nuclear weapons, high-end conventional capabilities, and rapid-deployment and special operations forces— and utilized many of these capabilities in conflicts in Ukraine and Syria.10 China, meanwhile, has carried out a buildup of historic proportions, with constant-dollar defense outlays rising from US$26 billion in 1995 to US$226 billion in 2016.11 Ominously, these expenditures have funded development of power-projection and antiaccess/area denial (A2/AD) tools necessary to threaten China’s neighbors and complicate U.S. intervention on their behalf. Washington has grown accustomed to having a generational military lead; Russian and Chinese modernization efforts are now creating a far more competitive environment.

#### 1AR theory is skewed towards the aff – a) the 2NR must cover substance and over-cover theory, since they get the collapse and persuasive spin advantage of the 3min 2AR, b) their responses to my counter interp will be new, which means 1AR theory necessitates intervention. Implications – a) reject 1AR theory since it can’t be a legitimate check for abuse, b) drop the arg to minimize the chance the round is decided unfairly, c) use reasonability with a bar of defense or the aff always wins since the 2AR can line by line the whole 2NR without winning real abuse

## Case

### Space Wars

#### AT Foster – 1] This flows Negative – it says that ambiguity over space property causes conflict – the Plan doesn’t clarify a new way to interpret property, it just gets rid of any property claims which doesn’t resolve patchwork disputes since it’s purely a negative action and 2] Doesn’t conclude that we should ban mining – it just needs “uniform satellite oversight and regulatory guidance”.

#### AT MacWhorter – Multiple alt causes to OST vagueness

Pershing 19, Abigail D. "Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today." Yale J. Int'l L. 44 (2019): 149. (Robina Fellow at European Court of Human Rights. European Court of Human Rights Yale Law School)//Elmer

Though the Outer Space Treaty flatly prohibits national appropriation of space,150 it leaves unanswered many questions as to what actually counts as appropriation. As far back as 1969, scholars wondered about the implications of this article.151 While it is clear that a nation may not claim ownership of the moon, other questions are not so clear. Does the prohibition extend to collecting scientific samples?152 Does creating space debris count as appropriation by occupation?

While the answers to these questions are most likely no, simply because of the difficulties that would be caused otherwise, there are some questions that are more difficult to answer, and more pressing. As commercial space flight becomes more and more prevalent,153 the question of whether private entities can appropriate property in space becomes very important. Whereas once it took a nation to get into space, it will soon take only a corporation, and scholars have pondered whether these entities will be able to claim property in space.154 Though this seems allowable, since the treaty only prohibits “national appropriation,”155 allowing such appropriation would lead to an absurd result. This is because the only value that lies in recognition of a claim is the ability to have that claim enforced.156 If a nation recognized and enforced such a claim, this enforcement would constitute state action.157 It would serve to exclude members of other nations and would thus serve as a form of national appropriation, even though the nation never attempted to directly appropriate the property.158 Furthermore, the Outer Space Treaty also requires that non-governmental entities must be authorized and monitored by the entities’ home countries to operate in space.159 Since a nation cannot authorize its citizens to act in contradiction to international law, a nation would not be allowed to license a private entity to appropriate property in space.160 While this nonappropriation principle is great for allowing free access to space, thereby encouraging research and development in the field, it makes it difficult to create or police a solution to the space debris problem. A viable solution will have to work without becoming an appropriation. There is, however, very little substantive law on what actually counts as appropriation in the context of space.161 So, the best way to see what is and is not allowed is to look both at the general international law regarding appropriations and to look at the past actions of space actors to see what has been allowed (or at least tolerated) and what has been prohibited or rejected.

#### AT Mallick and Rajagopalan – this is power-tagged – they make an internal link to space weaponization but not “escalating space wars” – they also haven’t read a U/Q argument about how companies want to weaponize mining w/ WMD’s – it’s just about how it could happen.

#### AT Funnell – this is a two sentence card about how a conflict over “space assets” is inevitable – 1] No External Internal Link – they didn’t highlight a card about how governments would intervene – especially true since many companies are trans-national an

#### AT Jamasmie – 1] This card is about lunar resource basing via the Artemis Accords… it isn’t about asteroid mining – here’s a re-cutting.

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.

#### AT Grego - No space war – prefer data over political rhetoric

Klimas interviewing Weeden 18 [Brian Weeden, smart space guy. Is the space war threat being hyped? August 3, 2018. https://www.politico.com/story/2018/08/03/space-war-threat-hype-force-760781]

There’s been increasing rhetoric...about the militarization of space and the potential for conflicts on Earth to extend into space. That’s driven in part by reports about anti-satellite testing in Russia and China...The report really grew out of our frustration at the level of publicly available information on this topic.

A lot of what you get are public statements from military leadership or politicians, or sometimes news articles talking about something and it’s really hard to get down to details and...sort through what might be real, what might be hype. Our goal was to dig into the open source material and see what we could determine from a factual standpoint was really going on -- what types of capabilities were being developed and how might they be used in a future conflict.

Ultimately we hoped that would lead to a more informed debate about what U.S. strategy should be to address those threats.

What sort of feedback have you gotten so far?

A lot of the feedback has been either informal or private because a lot of the issues we talk about, people in the government research using classified materials. So it’s difficult for them to give detailed feedback.

In general, the feedback we’ve gotten has been pretty positive. People have said they like the fact that this sort of stuff is being put in the public domain and encouraged us to continue.

Were your findings better or worse than the picture public discourse paints?

In general, it’s a little bit better. A lot of political rhetoric and news stories focus on the most extreme examples, so using kinetic weapons to blow up satellites. While there is research and development going on to develop those capabilities, what we found is there’s yet to be any publicly-known example of them being used.

What is being used and what seems to be of the most utility are the non-kinetic things, like jamming and cyber attacks. The good news is we have yet to see the most destructive kinetic attacks that can cause really harmful long-term damage to the space environment, but unfortunately we are seeing non-kinetic attacks being used, and that’s likely to continue.

### Sats

#### Collision risk is infinitesimally small – also answers terror

Fange 17 Daniel Von Fange 17, Web Application Engineer, Founder and Owner of LeanCoder, Full Stack, Polyglot Web Developer, “Kessler Syndrome is Over Hyped”, 5/21/2017, http://braino.org/essays/kessler\_syndrome\_is\_over\_hyped/

The orbital area around earth can be broken down into four regions. Low LEO - Up to about 400km. Things that orbit here burn up in the earth’s atmosphere quickly - between a few months to two years. The space station operates at the high end of this range. It loses about a kilometer of altitude a month and if not pushed higher every few months, would soon burn up. For all practical purposes, Low LEO doesn’t matter for Kessler Syndrome. If Low LEO was ever full of space junk, we’d just wait a year and a half, and the problem would be over. High LEO - 400km to 2000km. This where most heavy satellites and most space junk orbits. The air is thin enough here that satellites only go down slowly, and they have a much farther distance to fall. It can take 50 years for stuff here to get down. This is where Kessler Syndrome could be an issue. Mid Orbit - GPS satellites and other navigation satellites travel here in lonely, long lives. The volume of space is so huge, and the number of satellites so few, that we don’t need to worry about Kessler here. GEO - If you put a satellite far enough out from earth, the speed that the satellite travels around the earth will match the speed of the surface of the earth rotating under it. From the ground, the satellite will appear to hang motionless. Usually the geostationary orbit is used by big weather satellites and big TV broadcasting satellites. (This apparent motionlessness is why satellite TV dishes can be mounted pointing in a fixed direction. You can find approximate south just by looking around at the dishes in your northern hemisphere neighborhood.) For Kessler purposes, GEO orbit is roughly a ring 384,400 km around. However, all the satellites here are moving the same direction at the same speed - debris doesn’t get free velocity from the speed of the satellites. Also, it’s quite expensive to get a satellite here, and so there aren’t many, only about one satellite per 1000km of the ring. Kessler is not a problem here. How bad could Kessler Syndrome in High LEO be? Let’s imagine a worst case scenario. An evil alien intelligence chops up everything in High LEO, turning it into 1cm cubes of death orbiting at 1000km, spread as evenly across the surface of this sphere as orbital mechanics would allow. Is humanity cut off from space? I’m guessing the world has launched about 10,000 tons of satellites total. For guessing purposes, I’ll assume 2,500 tons of satellites and junk currently in High LEO. If satellites are made of aluminum, with a density of 2.70 g/cm3, then that’s 839,985,870 1cm cubes. A sphere for an orbit of 1,000km has a surface area of 682,752,000 square KM. So there would be one cube of junk per .81 square KM. If a rocket traveled through that, its odds of hitting that cube are tiny - less than 1 in 10,000.

### Asteroids

#### No Asteroids Impact

**Siegel 15** – Ethan, professor of astronomy at Lewis/Clark College, NASA columnist, October 5 2015 (“NASA Wakes Up: Saving Earth From Killer Asteroids Is A Waste,” Forbes, http://www.forbes.com/sites/ethansiegel/2015/10/05/nasa-wakes-up-saving-us-from-killer-asteroids-is-a-waste/)

The answer to the first question — should we be monitoring what’s out there — is *yes*, but not with the urgency so many advocate. And to the second question — should we be prepping the defenses — the answer is *not likely*. We may get some very smart, very famous people arguing counter to this, but even smart people fall prey to a common human fallacy: risk estimation when the odds are low but the consequences are great. There are three things to consider here: Common asteroid strikes. These are the twice-a-year variety, and realistically, even if they hit over a populated area, they’re likely to cause as much property damage as a modest tornado, and fewer fatalities. We’re talking millions of dollar in damage, tops, and we have yet to record an asteroid-related death here on Earth. So that’s not consequential. City-killer asteroids. These *could* be bad. Tunguska-level events are similar in scale to the strike that created Meteor Crater (Barringer Crater) in Arizona. These may happen as frequently as once per century, but nearly 90% of the time, they fall over a completely unpopulated area. Even if they do happen to be over a large city — like London, New York or Tokyo — those strikes will be incredibly rare: only occurring once every 100,000 years or so. Species-ending strikes. This — if it happened — would be the big one. All human life on Earth would end, with a total of (as of today) around seven billion human casualties. Even though this only happens once every 100,000,000 years or so, the consequences are tremendous. So with all of this taken into account, what are *your* odds of dying in an asteroid strike in any given year? About 1-in-70,000,000. On average, that means approximately 100 people will die of an asteroid strike in a given year: less than die in earthquakes, tornadoes, volcanoes, hurricanes, floods or by lightning strike. In its quest to map hazardous asteroids and defend Earth from them, the Sentinel mission was hoping to raise $450 million, and then partner with NASA to launch its satellites for tracking purposes. They’ve [fallen well short of their goal](http://motherboard.vice.com/read/nasa-has-cut-off-the-group-that-wants-to-save-us-from-killer-asteroids), and NASA is terminating the partnership indefinitely due to missed deadlines. Normally, I’ll take any excuse to increase excitement and funding for space exploration, but I’m happy to see resources diverted elsewhere. There’s a whole Universe out there to explore, and a whole planet that we can all work to improve. Defending us from asteroids, from a reasonable cost-benefit analysis, simply isn’t worth the investment, statistically. There are real dangers to Earth (and to the humans on it) facing us today, but asteroids aren’t one of them. If our species sticks around for another few thousand years, it will be time to make that investment. But until then? We’ve got a planet to save, and an entire Universe to discover.