### DA – Asteroid Mining

#### Asteroid mining is coming

MacWhorter 16, Kevin [J.D. Candidate at William & Mary Law School]. “Sustainable Mining: Incentivizing Asteroid Mining in the Name of Environmentalism”; February 2016; *William and Mary Environmental Law and Policy Review* [https://scholarship.law.wm.edu/cgi/viewcontent.cgi?article=1653&context=wmelpr]

Although companies likely are not able to send mining ventures to asteroids immediately, as the preceding section suggested, asteroid mining is a possibility in the near future.70 First of all, two companies are developing the technology needed to mine asteroids.71Planetary Resources is creating cheaper prospecting spacecraft small enough to hitch a ride into space with larger, primary payloads. 72 Another company, Deep Space Industries (DSI), is developing a four-stage system for mining in space: Prospecting, Processing, Harvesting, and Manufacturing.73 It has already invented one spacecraft to be used for the Prospecting stage: a tiny probe, called FireFly, designed to scout asteroids and study their size, shape, spin and composition . . . . 74 For the Processing phase, DSI is creating technology required to transform regolith to raw materials for manufacture.75 The company is currently developing another spacecraft, called a Harvestor, for the third stage to collect and transport resources.76Finally, the company is creating technology to manufacture finished products in space

#### The plan prevents asteroid mining because it prohibits appropriation.

Leon 18, Amanda M. [J.D., University of Virginia School of Law, 2017]. “Mining for Meaning: An Examination of the Legality of Property Rights in Space Resources”; May 15, 2018; *Virginia Law Review* [https://www.caplindrysdale.com/files/24323\_leon\_final\_note.pdf]

Appropriation. The term “appropriation” also remains ambiguous. Webster’s defines the verb “appropriate” as “to take to oneself in exclusion of others; to claim or use as by an exclusive or pre-eminent right; as, let no man appropriate a common benefit.”165 Similarly, Black’s Law Dictionary describes “appropriate” as an act “[t]o make a thing one’s own; to make a thing the subject of property; to exercise dominion over an object to the extent, and for the purpose, of making it subserve one’s own proper use or pleasure.”166 Oftentimes, appropriation refers to the setting aside of government funds, the taking of land for public purposes, or a tort of wrongfully taking another’s property as one’s own. The term appropriation is often used not only with respect to real property but also with water. According to U.S. case law, a person completes an appropriation of water by diversion of the water and an application of the water to beneficial use.167 This common use of the term “appropriation” with respect to water illustrates two key points: (1) the term applies to natural resources—e.g., water or minerals—not just real property, and (2) mining space resources and putting them to beneficial use—e.g., selling or manufacturing the mined resources— could reasonably be interpreted as an “appropriation” of outer space. While the ordinary meaning of “appropriation” reasonably includes the taking of natural resources as well as land, whether the drafters and parties to the OST envisioned such a broad meaning of the term remains difficult to determine with any certainty. The prohibition against appropriation “by any other means” supports such a reading, though, by expanding the prohibition to other types not explicitly described.16

#### Asteroid mining replaces terrestrial mining.

Ross 01, Shane D. [Control and Dynamical Systems Caltech]. “Near-Earth Asteroid Mining”; December 14, 2001; *Space Industry Report* [http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.614.9343&rep=rep1&type=pdf]

Many terrestrial resources, such as precious metals and fossil fuels, are running out. As new terrestrial sources are sought, materials are obtained at increasing economic and environmental cost. Society pays for this depletion of resources in the form of higher prices for manufactured goods, would-be technologies that are not developed for lack of raw materials, global and regional conflicts spurred by competition for remaining resources, and environmental damage caused by development of poorer and more problematic deposits. Utilization of asteroid resources may provide a partial solution to the problem, as they hold the potential for becoming the main sources of some metals and other materials. Precious metals and semiconducting elements in iron meteorites, which form the metallic cores of asteroids, are found in relatively large concentrations compared to Earth sources. In such sources, it may be possible to extract up to 187 parts per million (ppm) of precious metals, which includes Au, the Pt-group metals (Pt, Ru, Rh, Pd, Os, and It), Re, and Ge. More than 1000 ppm of other metals, semiconductors, and nonmetals may may one day be extracted and imported by Earth from asteroids, such as Ag, In, Co, Ga, and As

#### Asteroid mining prevents extinction in two ways.

#### 1] Only asteroid mining can provide us with the research and understanding to prevent extinction

Elvis 21 [Martin Elvis is a senior astrophysicist at the Center for Astrophysics | Harvard & Smithsonian. He is the author of Asteroids: How Love, Fear, and Greed Will Determine Our Future in Space (2021). “Riches in space.” Aeon. July 2, 2021. <https://aeon.co/essays/asteroid-mining-could-pay-for-space-exploration-and-adventure>] HW AL

If knowledge or greed isn’t motivation enough to set your sights on the asteroids, then the one thing virtually all people agree on is that having humanity wiped off the face of Earth would be bad, at least for us. Of all the multiple threats to humanity’s existence, the only one that we can definitely eliminate is that of a large asteroid slamming into our home planet and killing us off, together with most other species, following the lead of the dinosaurs who were made extinct by an asteroid slamming into the ocean. There’s a T-shirt popular among space cadets that has the slogan ‘Asteroids are nature’s way of saying “How’s that space programme coming along?”’ If we can find all the killer asteroids, then we can divert them to render them harmless. Best to play it safe. There are several searches underway for undiscovered, potentially dangerous asteroids. Thanks to the first big survey, Spaceguard, 90 per cent of the dinosaur-killer-sized asteroids out there have already been found. None of them pose any danger for the next century at least. That still leaves an uneasily large number of about 100 extinction-event-sized rocks out there that we haven’t found yet. Smaller, city-killer asteroids are much less well-surveyed for. To remedy this concern, two new surveys will begin in the next few years, and they will both be more or less done by 2030. They are the Vera C Rubin Observatory ‘Legacy Survey of Space and Time’, which will start scanning the whole sky every few nights from 2023 onwards. Its mission has been complicated by the mushrooming constellations of thousands of internet satellites now being launched by several companies, with SpaceX being the most visible. Hopefully a solution will be found. The Vera C Rubin Observatory, on a mountain in Chile, will record its image using normal visible light. For asteroids, that light is reflected sunlight. But many asteroids are pitch black, reflecting only a few percent of the sunlight pouring on to their surfaces. How do you find those dark asteroids? The answer is to use the long wavelength – infrared – light they emit because they’re warm: their ‘black body radiation’. NASA is building a special mission just for this purpose. Developed by a team lead by Amy Mainzer, now of the University of Arizona, Tucson, it’s called the Near-Earth Object Surveillance Mission. Starting around 2025, it will scan the sky repeatedly for five years looking for moving objects that are bright in infrared light, and has wavelengths some 10 to 20 times longer than we can see with our eyes. The team’s tagline is ‘Finding Asteroids Before They Find Us.’ Good idea! This will be the first time that humanity has deliberately changed the orbit of any celestial body An advantage of using the black body radiation is that it also tells us quite accurately how big each asteroid is. That helps in assessing their threat, as well giving us a first guess at how much they might yield in resources. Combining the two surveys will indicate how much sunlight each asteroid reflects – its ‘albedo’ – and that’s a clue to what they’re made of. We want to know that because a metal asteroid of a given size is more dangerous than one made of rock, and is more difficult to push out of the way. The composition also helps us explore all two dozen types of asteroid out there, the better to decipher the history of our solar system. As a side product, the surveys will pin down their potential value. By 2030, we’ll have better rockets than we have today. Several are set to fly within five years. They’ll let us reach many more asteroids with more massive payloads to deflect them, study them or mine them. Also by 2030, several more asteroids will have been visited by our exploration spacecraft. JAXA, the Japanese space agency, and NASA each had recent missions to return samples from carbonaceous asteroids. The Japanese Hayabusa2 went to the spinning-top-shaped asteroid named Ryugu, and NASA’s OSIRIS-REx went to the asteroid called Bennu. Such carbonaceous asteroids are the least changed, we believe, from the time of their formation at the beginning of the solar system’s formation. They are called carbonaceous because they are chockfull of organic (carbon-containing) molecules; many of them also contain quite a lot of water. There are more missions planned to more distant asteroids such as Psyche, a metal asteroid in the Main Belt, and to the Trojan asteroids trailing Jupiter’s orbit. OSIRIS-REx samples and leaves asteroid Bennu. Courtesy of NASA **Every time we visit an asteroid, it surprises us.** Bennu was found to be throwing rocks off its surface as it spun around its axis, and when OSIRIS-REx put down its outstretched arm to grab a sample off the surface, the arm sank half a metre into the asteroid; it stopped going deeper only when the retrorockets fired to stop it. That’s really not how rubble behaves on Earth! The more we know about asteroids, the more confident we can be that we can deflect their path away from Earth. A NASA mission called DART will make a high-speed impact on the small moon of the asteroid Didymos in late 2022 to see if we can slow down a dangerous asteroid to stop it causing devastation on Earth. (Don’t worry: the target was chosen to be a safe one for us.) This will be the first time that humanity has deliberately changed the orbit of any celestial body. It isn’t likely to be the last. Once all the good-sized accessible asteroids have been found, their orbits mapped, their sizes known, and at least a good clue found as to what they’re made of, the barriers to mining them will be much lower. **After visiting a half dozen asteroids up close, we’ll have learned a great deal about their origins, how to deflect them should one be headed our way, and how to handle them.** That will put us in a good place to begin to extract their resources. I predict this will happen right around 2030, when demand for in-space materials should be picking up. **The stars seem to be aligning for mining the asteroids. Mining will expand our capabilities in space, especially making it easier to deflect a dangerous asteroid.** In a virtuous cycle, those new capabilities will lead us on to greater exploration of the many worlds in our solar system and, with bigger, better telescopes, to the Universe beyond. It should be fun.

#### 2] Provides the resources for a space solar array

Taylor 19, Chris [Veteran journalist and the author of 'How Star Wars Conquered the Universe.']. “The Asteroid Boom”; 2019; *Mashable* [https://mashable.com/feature/asteroid-mining-space-economy]

Secondly, there’s the climate change fix. Suarez sees asteroid mining as the only way we’re going to build solar power satellites. Which, as you probably know, is a form of uninterrupted solar power collection that is theoretically more effective, inch for inch, than any solar panels on Earth at high noon, but operating 24/7. (In space, basically, it’s always double high noon). The power collected is beamed back to large receptors on Earth with large, low-power microwaves, which researchers think will be harmless enough to let humans and animals pass through the beam. A space solar power array like the one China is said to be working on could reliably supply 2,000 gigawatts — or over 1,000 times more power than the largest solar farm currently in existence. “We're looking at a 20-year window to completely replace human civilization's power infrastructure,” Suarez told me, citing the report of the Intergovernmental Panel on Climate Change on the coming catastrophe. Solar satellite technology “has existed since the 1970s. What we were missing is millions of tons of construction materials in orbit. Asteroid mining can place it there.”

#### Climate change causes global extinction

Schultz 16, Robert A. [Received a Ph.D. in philosophy from Harvard University]. “Modern Technology and Human Extinction”; 2016; *Proceedings of Informing Science & IT Education Conference* [http://proceedings.informingscience.org/InSITE2016/InSITE16p131-145Schultz2307.pdf]

There is consensus that there is a relatively short window to reduce carbon emissions before drastic effects occur. Recent credible projections of the result of lack of rapid drastic action is an average temperature increase of about 10o F by 2050. This change alone will be incredibly disruptive to all life, but will also cause great weather and climate change. For comparison purposes, a 10 degree (Fahrenheit) decrease was enough to cause an ice layer 4000 feet thick over Wisconsin (Co2gether, 2012). Recently relevant information has surfaced about a massive previous extinction. This is the Permian extinction, which happened 252 million years ago, during which 95% of all species on earth, both terrestrial and aquatic, vanished. The ocean temperature after almost all life had disappeared was 15 degrees (Fahrenheit) above current ocean temperatures. Recent information about the Permian extinction indicates it was caused by a rapid increase in land and ocean temperatures, caused by the sudden appearance of stupendous amounts of carbon in the form of greenhouse gases (Kolbert, 2014, pp. 102-144). The origin of the carbon in these enormous quantities is not yet known, but one possibility is the sudden release of methane gases stored in permafrost. This is also a possibility in our current situation. If so, extinction would be a natural side effect of human processes. There is also a real but smaller possibility of what is called “runaway greenhouse,” in which the earth’s temperature becomes like Venus’ surface temperature of 800o The threat of extinction here is not entirely sudden. The threat is, if anything, worse. Changes in the atmosphere--mainly increases in the concentration of greenhouse gases in the atmosphere-- can start processes that can’t be reversed but which take long periods of time to manifest. “Runaway greenhouse” may be the worst. Once again, suggestions of technological solutions to this situation should be treated with some skepticism. These proposals are often made by technophiles ignoring all the evidence that technology is very much subject to unanticipated side effects and unanticipated failures. What has happened concerning the depletion of the ozone layer should be a clear warning against the facile uses of technology through geoengineering to alter the makeup of the entire planet and its atmosphere. The complicating factor in assessing extinction likelihood from climate change is corporations, especially American fossil fuel corporations such as Exxon-Mobil and Shell. Through their contributions, they have been able to delay legislation ameliorating global warming and climate change. As mentioned before, recently released papers from Exxon-Mobil show that the corporation did accept the scientific findings about global warming and climate change. But they concluded that maintaining their profits was more important than acting to ameliorate climate change. Modern Technology and Human Extinction 140 Since it is not a matter of getting corporations to appreciate scientific facts, the chances of extinction from climate change are good. To ameliorate climate change, it is important to leave a high percentage of fossil fuel reserves in the ground. But this is exactly what a profit-seeking fossil fuel corporation cannot do. One can still hope that because fossil fuel corporations are made up of individuals, increasingly bad consequences of global warming and climate change will change their minds about profits. But because of the lag in effects, this mind change will probably be too late. So I conclude we will probably see something like the effects of the Permian extinction perhaps some time around 2050. (The Permian extinction was 95% extinction of all species.) This assumes the release of methane from the arctic will take place around then.

### DA – China

**The private space industry is the only thing preventing Chinese dominance of outer space – they’ve already copied SpaceX’s innovations**

**Berger 21**

Eric Berger, reporter, CNN.  Why China's space program could overtake NASA, CNN.com April 1, 2021.  Eric Berger, a reporter and editor based in Houston, is the author of ["LIFTOFF: Elon Musk and the Desperate Early Days that Launched SpaceX."](https://www.harpercollins.com/products/liftoff-eric-berger?variant=32126620205090) After a long career at the Houston Chronicle, he joined Ars Technica in 2015 as the site's senior space editor, covering SpaceX, NASA and everything beyond. He was a Pulitzer Prize finalist for his coverage of Hurricane Ike in the Houston Chronicle in 2008. <https://www.cnn.com/2021/04/01/opinions/china-space-race-us-spacex-berger/index.html> -CAT

China has a good chance of becoming the dominant space power in the 21st century, and it's not just looking to copy NASA on the way to the top. Instead, the country is paying close attention to what innovative US companies like SpaceX are doing as well. To get ahead in space, communism is learning from capitalism. In the summer of 2019, a small Chinese rocket launched from an inland spaceport in the southern part of the country. Close-up photos, posted afterward on Chinese social media accounts, showed small grid fins affixed to the upper part of this Long March 2C rocket for the first time. They were virtually identical in design to the grid fins SpaceX uses to steer its Falcon 9 rocket through the atmosphere for landings on its ocean-based drone ships. A year after this test, China's main space contractor revealed plans to develop the ability to reuse its Long March 8 booster, which is powered by kerosene fuel, the same type of power that fuels SpaceX rockets. By 2025, Chinese officials said, this rocket would be capable of landing on a sea platform like SpaceX's Falcon 9 booster. And it is not just the Chinese government contractors that are emulating SpaceX. A growing number of semi-private Chinese companies have also announced plans to develop reusable rockets. Chinese firms such as LinkSpace and Galactic Energy have released schematics that seem to mimic SpaceX technology. None of this should be particularly surprising. Government-launched enterprises in both Russia and Europe also recently revealed plans to develop reusable rockets that are similar both in appearance and function to the Falcon 9 booster. But what makes the Chinese efforts to emulate SpaceX particularly notable is the country's expansive ambitions in space and its vast resources to back up these long-term goals. Earlier this month, the Chinese government signed an agreement with Russia to work together to build a Moon base. China has also begun planning to launch crewed missions to Mars and deploy a massive space-based, commercial-scale solar power plant by 2050. They're playing the long game, and they're playing to win. Based on China's recent accomplishments in space, it would be wise to take these grand ambitions seriously. In December, China became only the third nation to return Moon rocks to Earth. Later this spring, it will seek to join the United States as only the second country to land and operate a rover on the surface of Mars. All the while, China is racing across a number of other fronts in space, from building an orbital space station to maturing anti-satellite capabilities in space to establishing a base on the moon. As China advances in space, NASA has spent more than $20 billion building a large rocket, the Space Launch System, that could soon be obsolete. And flying this single-use rocket is so expensive that, in combination with its Artemis program, NASA could exceed its congressional funds by more than 43%. NASA could also abandon the International Space Station in a few years. Meanwhile, China is training European astronauts and teaching them Chinese so that they might visit its large, modular space station. Some of these European astronauts may subsequently join the China-Russia lunar exploration effort. Increasingly, **the US' main advantage over China lies in its** burgeoning **commercial space industry**, led by SpaceX. If America wants to compete, it should unleash the full potential of SpaceX and other commercial space companies that seek to go further in space, faster and for less money. This kind of public-private partnership has already worked in low-Earth orbit, with NASA buying services from companies such as SpaceX, Northrop Grumman and Boeing to deliver cargo and astronauts to the International Space Station. This is one reason why, about five years ago, China began backing dozens of companies to commercialize rockets and satellites. **The** 21st century **space race**, therefore, **is not** so much **between China and NASA**. Rather, it **is between China and** **the US commercial space industry**. Astronauts relocated a spacecraft outside the International Space Station Astronauts relocated a spacecraft outside the International Space Station Nearly a decade ago, SpaceX attracted international acclaim when it began to successfully land its Falcon 9 rockets, accomplishing an engineering feat many previously deemed impossible or impractical. While historically rocket boosters have been discarded in the ocean after they expend their fuel on the way to orbit, SpaceX figured out how to land its boosters upright on platforms at sea and on land, allowing the company to recover and refurbish the rockets and save money. Later, the company strapped three of these Falcon 9 cores together to build a larger and much more powerful rocket, called the Falcon Heavy. And it is now testing an even larger, reusable booster, its Starship vehicle, intended to ferry humans to and from Mars. In late February, China unveiled strikingly similar space plans. The country's space agency said it would build a triple core rocket, which looks like a SpaceX Falcon Heavy. And it also confirmed plans to move forward with its titanic Long March 9 rocket, capable of lifting as much as 140 metric tons to low-Earth orbit, the same amount as the Saturn V rocket, an American super heavy-lift launch vehicle that remains the most powerful rocket that has ever flown successfully. This massive rocket would be unlike anything NASA built, however; Chinese officials, taking a page from the SpaceX playbook, said they would like it to be reusable. And, they added, they aim to one day launch the Long March 9 to take its taikonauts to Mars. While SpaceX became a transformational space company, the US and China have been locked in an increasingly intense battle for influence and economic resources on Earth. That conflict, which has already emerged in low-Earth orbit, will extend to the Moon and eventually Mars in the coming decades. In the contest for geopolitical influence and economic wealth, space will come to represent the ultimate high ground. China is definitely going. For now, the US and NASA have the advantage of a more robust space program and a stronger commercial space industry. But for the last decade, the US commercial space industry has succeeded despite Congress, not because of it. Unless Congress and NASA more closely embrace commercial space and follow a bold plan of exploration, China's constancy of purpose and mimicking of Western strengths will overcome this head start.

**Chinese dominance would allow them to monopolize lunar Helium-3 and control the world’s economy.**

**Bilder 10**

Richard B. Bilder, Foley & Lardner-Bascom Emeritus Professor of Law, University of Wisconsin Law School A LEGAL REGIME FOR THE MINING OF HELIUM-3 ON THE MOON: U.S. POLICY OPTIONS 33 Fordham Int’l L.J. 243 Fordham International Law Journal January, 2010 -CAT

A LEGAL REGIME FOR THE MINING OF HELIUM-3 ON THE MOON: U.S. POLICY OPTIONS During the past several years, the United States and three of the world’s other leading space powers, Russia, China, and India, have each announced their intent to establish a base on the Moon, in part with the purpose--or, in the case of the United States, at least the exploratory goal--of seeking to mine and bring to Earth helium-3 (“He-3”), an isotope1 of helium rarely found naturally on Earth but believed to be present in large amounts as a component of the lunar soil.2 The potential value of \*246 He-3 is that it is theoretically an ideal fuel for thermonuclear fusion power reactors, which could serve as a virtually limitless source of safe and non-polluting energy.3 For example, it is estimated that forty tons of liquefied He-3 brought from the Moon to the Earth--about the amount that would comfortably fit in the cargo bays of two current U.S. space shuttles--would provide sufficient fuel for He-3 fusion reactors to meet the full electrical needs of the United States, or one quarter of the entire world’s electrical needs, for an entire year.4 While the technological and economic feasibility of fusion-based nuclear energy, particularly fusion reactors utilizing He-3 \*247 as fuel, is still uncertain and contested, and its commercial realization at best decades away,5 the implications of such a development could be far-reaching and profound. Fusion energy could significantly reduce the world’s heavy dependence on fossil fuels, which are associated with environmental pollution, greenhouse gas emissions, and global warming--not to mention their rising price and role in recurrent geopolitical and economic tensions. Fusion energy could also provide a safer alternative to many countries’ growing reliance on energy generated from nuclear fission reactors, which hold the potential dangers of nuclear accidents, terrorism, weapons proliferation, and radioactive waste disposal. Moreover, in contrast to the prospect of depletion of terrestrial fossil fuels, it is estimated that there is sufficient He-3 present on the Moon to meet humanity’s rapidly growing energy needs for many centuries to come.6 Thus, despite the problematic future of He-3-based fusion energy, it is not surprising that the United States and other major powers are beginning to position themselves to ensure their future access to lunar He-3 resources. However, the growing interest in lunar He-3 poses its own problems. As yet, there is no international consensus on whether, or how, any nation or private entity can exploit or acquire title to lunar resources. The U.N.-developed 1967 Outer Space Treaty7 does not specifically address this question. The related U.N.-sponsored 1979 Moon Agreement8 purports to lay the groundwork for the eventual establishment of a regime for the exploitation of lunar resources, but that agreement has thus far been ratified by only a very few countries--not including the United States and none of which are currently leading space \*248 powers.9 Absent an agreed international legal framework, attempts by the United States or any other nation or private entity to acquire and bring to Earth significant quantities of He-3 could give rise to controversy and conflict. Indeed, without the security of an established legal regime, nations or private entities might well be reluctant to commit the very substantial money, effort, and resources necessary to mine, process, and transport back to Earth the amounts of lunar He-3 sufficient to support the broad-scale terrestrial use of He-3-based fusion energy. Consequently, it seems timely to revisit the issue of the legal regime potentially applicable to exploiting He-3 and other lunar resources.10 Part I of this Article will briefly discuss the technical \*249 and economic prospects for the development of He-3-based fusion energy. Part II lays out the present legal situation concerning the exploitation of lunar resources such as He-3. Part III analyzes whether it is prudent for the United States to seek an international lunar resource regime. Concluding that it would \*250 be, Part IV provides possible policy options for the United States concerning the establishment of an international legal regime capable of facilitating the development of He-3-based fusion energy. I. THE PROSPECTS FOR HE-3-BASED FUSION ENERGY11 He-3 is a component of the “solar wind” comprised of gas and charged particles continuously emitted by the sun into the solar system in the course of its thermonuclear fusion processes.12 During more than four billion years in which the solar wind has impacted the Moon, significant amounts of He-3, in addition to particles of other ionized components of the solar wind, have become embedded in the Moon’s regolith--the loose and dusty upper layer of rocks and soil comprising much of the Moon’s surface.13 While He-3 constitutes only a minute proportion of the lunar regolith,14 it is estimated that, altogether, there may be as much as one million metric tons of He-3 potentially recoverable \*251 from the Moon’s surface.15 This amount of He-3 is theoretically **equivalent to ten times the energy content of all of the coal, oil, and natural gas economically recoverable on Earth**.16 Since the Earth, unlike the Moon, possesses a magnetic field and atmosphere that deflect the solar wind, He-3 is rarely found naturally on Earth.17 The small amounts of He-3 available for research and experiment on Earth are derived principally from the decay of tritium used in thermonuclear weapons.18 While interest in lunar He-3 relates to its potential use as a fuel for thermonuclear power reactors,19 the technological and economic feasibility of fusion power itself has yet to be demonstrated.20 Unlike the engineering and material requirements for power production in the uranium and plutonium-fueled nuclear fission reactors now operating in the United States and a number of other countries, the generation of power by thermonuclear fusion requires the containment of ionized plasmas at extremely high temperatures, a feat not easily or economically achievable at present with existing materials and technology.21 Nevertheless, the enormous potential of fusion \*252 energy continues to spur persistent and intensive efforts to overcome these obstacles. One of the most significant efforts is the recent establishment, by a consortium of the European Union (through the European Atomic Energy Community), Japan, the People’s Republic of China, the Republic of India, the Republic of Korea, the Russian Federation, and the United States, of the International Thermonuclear Experimental Reactor (“ITER”),22 a large-scale, international experimental research project designed to explore the scientific and engineering feasibility of magnetic containment fusion power production.23 The program will be located in Cadarache, France, and is expected to cost over US$12 billion and continue for thirty years.24 For a number of reasons, including the limited terrestrial availability of He-3 and the very high temperatures required to achieve He-3-based fusion, most current research, and any first generation fusion power reactors, will likely be based on a fuel cycle involving the fusion of deuterium (“D”) and tritium (“T”), \*253 two isotopes of hydrogen available on Earth and capable of fusing at considerably lower temperatures.25 However, an He-3-D fuel cycle, if and when technically achievable, theoretically offers significant advantages as compared with the D-T fuel cycle. Unlike a D-T fusion reaction, which results in considerable neutron radiation, an He-3-D fusion reaction would produce little radioactivity and a substantially higher proportion of directly usable energy.26 More specifically, the comparative \*254 advantages of an He-3-D fuel cycle over a D-T fuel cycle would include: (1) increased electrical conversion efficiency; (2) reduced radiation damage to containment vessels, obviating the need for frequent expensive replacement; (3) reduced radioactive waste, with consequent reduced costs of protection and disposal; (4) increased levels of safety in the event of accident; and (5) potentially lower costs of electricity production.27 In particular, an He-3-D fuel cycle would significantly reduce the risk of nuclear proliferation because an He-3-D reaction, unlike a D-T reaction, would produce few neutrons and could not be readily employed to produce plutonium or other weapons-grade fissile materials.28 Consequently, interest in developing He-3-fueled thermonuclear energy is likely to continue. How would lunar He-3 be extracted and transported to Earth?29 Because the solar wind components are weakly bound to the lunar regolith,30 it should be relatively easy to extract them utilizing reasonable extensions of existing technology. In one proposed scenario, once a lunar base is established, robotic lunar mining vehicles fitted with solar heat collectors would: (1) traverse appropriate areas of the Moon’s surface--probably, in particular, the lunar maria, or “seas”--scooping up the loose upper layer of the lunar regolith and sizing it into small particles; (2) utilize solar energy to process and heat the collected regolith to the temperatures necessary to release, separate, and collect in a gaseous state the He-3, along with certain other solar-wind elements embedded in the regolith particles; (3) discharge the spent regolith back to the lunar surface; and (4) return with the collected He-3 and other gaseous byproducts to the lunar base.31 \*255 The collected He-3 gas could then be liquified in the lunar cold and transported to Earth, perhaps in remotely-operated shuttles.32 Importantly, this type of mining operation could result in the collection not only of He-3 but also significant amounts of hydrogen, oxygen, nitrogen, carbon dioxide, and water, all potentially very useful--indeed, perhaps indispensable--for the maintenance of a lunar base or further outer space activities such as expeditions to Mars or other planets.33 Since He-3 is believed to comprise only a small proportion of the lunar regolith, it will probably be necessary to process large amounts of lunar regolith in order to obtain the quantities of He-3 necessary to sustain a large-scale terrestrial He-3-based power program. However, the extraction of He-3 and other solar wind components from the lunar soil seems in itself unlikely to have a significant detrimental impact on the lunar environment because the regolith will be discharged back to the Moon’s surface immediately after processing.34 Whether the production of lunar He-3-based fusion power will prove commercially viable remains a complex and disputed question. The commercial success of such a development will clearly depend, among other things, on the parallel and integrated achievement of both economically efficient He-3-fueled fusion power reactors and a sustainable lunar mining enterprise capable of economically extracting and returning to Earth an assured supply of He-3 to fuel such reactors; neither is worth pursuing without the other. However, the development of He-3-based fusion need not start from scratch, but instead will likely build on the substantial research and investment already committed to the development of fusion power more generally in ITER and other already ongoing projects. Moreover, the development of lunar He-3 mining can similarly build on--and indeed form an additional rationale for--the already existing \*256 commitment of various space powers to establish lunar bases. As indicated earlier, lunar mining activities may be worth developing not only to extract He-3 from the regolith, but also to obtain a variety of other byproducts highly useful for the support of lunar bases.35 Finally, the economic viability of He-3-based fusion power will, of course, depend on its eventual production cost relative to alternative sources of energy such as fossil fuel or other conventional sources of energy, energy produced by nuclear fission reactors, or other forms of fusion energy--all figures difficult to accurately predict at this time. Proponents of He-3-based fusion energy argue that, notwithstanding the substantial costs involved in developing He-3 fusion reactors, establishing a lunar mining operation, and transporting He-3 back to Earth, He-3-based fusion power will eventually be more than competitive with the cost of other types of energy resources and provide more than sufficient incentive for the participation of both government and private enterprise.36 But other \*257 commentators are more skeptical, doubting both the technical feasibility of such a complex and challenging development and the likelihood of He-3-based fusion power ever competing successfully with more traditional Earth-based energy systems.37 Suffice it to say, major space powers currently consider the potential of He-3-based fusion energy sufficiently promising as to warrant their serious interest and to furnish at least an additional rationale for their commitment to programs to establish national stations on the Moon.

**That’s a recipe for an authoritarian hellscape of global war**

**Schuman 20**

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What kind of superpower will China be? That’s the question of the 21st century. According to American leaders such as Secretary of State Mike Pompeo, China will be a rapacious authoritarian nightmare, intent on destroying democracy itself. Beijing, needless to say, doesn’t quite agree. Fortunately for those of us seeking answers to this question, China was a major power for long stretches of history, and the foreign policies and practices of its great dynasties can offer us insights into how modern Chinese leaders may wield their widening power now and in the future. Of course, Chinese society today is not the same as it was 100 years ago—let alone 1,000 years. But I’ve long been studying imperial China’s foreign relations, and clear patterns of a consistent worldview emerge that are likely to shape Beijing’s perceptions and projection of power in the modern world. **China will not be a pacifist power** In an address to the United Nations General Assembly in September, Chinese President Xi Jinping repeated Beijing’s oft-stated claim that it was committed to peaceful development, and there is a widely held view that Chinese emperors of the past generally eschewed the use of force. It is certainly true that the country’s dynasties enjoyed stable relations with some of their East Asian neighbors for extended periods of time—unlike in Europe, where competing monarchies were almost constantly at each other’s throats. Modern Chinese like to contrast brutal European colonial adventures with the 15th-century voyages of Chinese Admiral Zheng He and his treasure fleets, which sailed across the Indian Ocean but conquered no one. But this quaint picture of Chinese pacifism ignores that the country’s dynasties were almost constantly at war. Sure, many of these wars were defensive, mainly against a panoply of invading northern tribesmen. But at the height of their power, the emperors were quite aggressive expansionists, too. The Han dynasty (206 B.C.–220 A.D.) and the Tang dynasty (618–907) had armies marching from Central Asia to the Korean peninsula. The Song dynasty (960–1279) fought wars with and sought territory from rival states; it just wasn’t very good at it. The most acquisitive of the dynasties was the Qing (1644–1912), which carved up and controlled Tibet and conquered today’s Xinjiang. The Qing emperors were Manchu, a northern people, but lands they acquired are now considered indisputable parts of the motherland. (Mao Zedong’s People’s Liberation Army had to reclaim Tibet, which had drifted away from China amid the chaos of the Qing collapse, while the Xinjiang region, which had attained a high degree of autonomy, had to be reintegrated as well.) China will insist on its own world order The states China didn’t or couldn’t overrun were absorbed into the Chinese world through a system of diplomacy and trade that the emperors controlled. Other governments were expected to pay tribute to the Chinese court as an acknowledgment of Chinese superiority, at least ceremonially, and the emperors then considered them vassals. Whether such a tribute system really existed as a hard-and-fast or consistently applied foreign policy is debated among historians. But it is clear that the Chinese usually tried to foist their diplomatic norms and practices onto those who desired formal relations with China. Think of it as the rules of the game of foreign affairs in East Asia, dictated by China. This order was rarely challenged, at least by the more established East Asian states. Unlike Europe, where states of roughly similar muscle contended for territory, trade, and influence, China had no real rivals. Generally speaking, its neighbors accepted Chinese dominance and followed its rules of engagement. When China faced a challenge, however, it could resort to force. The short-lived Sui dynasty (581–618) and the Tang spent decades, for example, trying to destroy the strong Koguryo kingdom in Korea. Zheng He, the supposedly peaceful admiral, launched a military expedition on the island of Sumatra (now part of Indonesia) against a rival to the local king and Chinese vassal. When the Japanese invaded the Korean peninsula in 1592, the Ming dynasty (1368–1644) sent troops to help the Koreans expel them. As late as the 1880s, the Qing dynasty went to war to aid its Vietnamese tributaries against the French. The Chinese would also police their system in other, coercive ways—by, for instance, denying proper trading rights to unruly foreigners. So while Xi told the UN in September that Beijing “will never seek hegemony, expansion, or sphere of influence,” history suggests that China will use force or coercion against other countries when they contest Chinese power. This has implications for Vietnam and other Southeast Asian countries that dispute China’s claim to nearly all of the South China Sea, and for Taiwan, which Beijing sees as a renegade province. There are also signs that the Chinese will restore aspects of the old imperial order as their power expands. On two occasions, Xi has summoned high-level delegations from countries participating in his infrastructure-building Belt and Road Initiative to pomp-heavy Beijing forums—tribute missions in all but name. Conversely, when countries defy Beijing’s edicts, they are denied access to its bounty. China blocked imports from Canada and Australia amid recent diplomatic tussles, and Beijing targeted South Korean businesses in China three years ago after Seoul agreed to deploy a U.S. missile defense system that the Chinese saw as a security threat. Chinese police officers watch a cargo ship at a port in Qingdao in China's eastern Shandong province. (AFP / Getty) China will export its values One reason supporting the notion that China will be a benign superpower is the amorality of its current foreign policy. Unlike the U.S., with its missionary zeal to bring its form of liberty to all, China doesn’t seem as interested in changing the world, this argument goes, just making money from it. There is some truth to this. The Chinese are equally happy to sell Huawei 5G networks to autocratic Russia and democratic Germany without a fuss. Historically, though, the Chinese believed that their culture had a transformative power—it could change barbarism into civilization. Confucius himself thought so. In the Analects, China’s greatest sage expressed a desire to live among barbarian tribes. A startled listener asked how he could tolerate their uncouth habits. Not to worry, Confucius answered. “If a superior man dwelt among them, what rudeness would there be?” Practically speaking, China’s historic statesmen didn’t really expect the world to “go Chinese,” but they did promote their civilization. Ceremonies for visiting ambassadors at the imperial court were designed to awe. Tang officials built dormitories for foreign students who wanted to study Chinese literature at the country’s famous academies. The voyages of Zheng He were meant most of all to display Chinese greatness: The Ming emperor who launched them, Yongle, imagined that the people of Cochin in southern India “went down on their hands and knees,” and, “looking to Heaven, they bowed and all said: ‘How fortunate we are that the civilizing influences of the Chinese sages should reach us.’” The Chinese also understood the link between culture and power. Other peoples naturally looked to China, the most advanced society in East Asia, when building their own kingdoms, and they liberally borrowed legal codes and governing institutions, artistic and literary styles, and, most famously, Chinese written characters. This common cultural bond sustained Chinese influence in the region even when the country itself was politically weakened. Xi knows this full well, and he intends to build up China’s soft power by pushing Chinese values, both old and new. “Facts prove that our path and system … are successful,” he once said. “We should popularize our cultural spirit across countries as well as across time and space, with contemporary values and the eternal charm of Chinese culture.” This is the purpose of Confucius Institutes, a state-run program aimed at promoting Chinese language and culture. In the wake of Beijing’s (supposedly) superior coronavirus-busting effort, Chinese officials and state media outlets have been relentlessly marketing their (authoritarian) governance system as superior, while denigrating the (democratic) U.S. by mocking its pandemic response. The implication of this is that modern China will prefer other countries to be more like them, not unlike the emperors of old. In imperial times, China’s rulers tended to favor foreigners who were “more Chinese.” In the first century A.D., the Chinese historian Ban Gu developed the concept of an “inner” world—comprised of societies touched by Chinese civilization—and an “outer,” of incorrigible barbarians who remained blind to China’s light. The inner crowd was treated more benignly and participated more closely in Chinese affairs. This suggests that ultimately China will support like-minded (read: authoritarian) regimes. Indeed, it already does: It befriends illiberal governments shunned by most other countries, such as North Korea, Iran, Belarus, and Venezuela. China only tolerates relationships it can dominate Even in deep antiquity, the Chinese considered themselves better than other peoples because they believed that their civilization was civilization. This formed the basis of a worldview in which the Chinese sat atop the hierarchy. They did not believe in equal relationships, at least in official or ideological terms. Their world order, with its rules and norms, was based on the principle of Chinese superiority, and the acceptance of that superiority by all others. Traditionally, when the Chinese were forced into a subordinate or even an equal position with another power, usually due to military weakness, they resented it and tried to reassert their usual dominance when they were strong enough to turn the tables. And it is happening again today. Seething at what they consider humiliations inflicted by Western powers—from the Opium War to what the Chinese call “unequal” treaties that sapped their sovereignty—China is on a mission to regain the upper hand. As Xi put it, the country “will never again tolerate being bullied by any nation.” That’s the goal behind much of his current policies, from a significant buildup of military capabilities to state-funded programs aimed at helping China overtake the West in technology. More and more, China’s diplomacy turns threatening when faced with challenges from other countries, whether the U.S., India, or Australia. What becomes clear from an examination of China’s history is that the Chinese don’t just want to be a great power—they believe they deserve to be. In centuries past, the Chinese thought their sovereign had a right to rule “all under Heaven.” Due to the realities of technology and distance, China’s reach usually remained regional. But now, in the age of globalization, Beijing’s influence may achieve that lofty goal.

**The US will use nuclear first strikes to defend Taiwan**

**Westcott 21**

Ben Westcott, CNN reporter, US military considered using nuclear weapons against China in 1958 Taiwan Strait crisis, leaked documents show, May 24, 2021. <https://www.cnn.com/2021/05/24/china/us-china-taiwan-1958-nuclear-intl-hnk/index.html> -CAT

Hong Kong (CNN)Military planners in Washington pushed for the White House to prepare plans to use nuclear weapons against mainland China during the Taiwan Strait crisis in 1958, newly leaked documents appear to confirm. The documents, first reported on by the New York Times Saturday, reveal the extent of Washington's discussions about using nuclear weapons to deter a Chinese invasion of Taiwan, including the acceptance by some US military leaders of possible retaliatory nuclear strikes on US bases. The new information was provided to the Times by Daniel Ellsberg, the whistleblower who in 1971 leaked the Pentagon Papers that detailed the US government's duplicity in its handling of the Vietnam War. "US first use of nuclear weapons should not be contemplated, prepared, or threatened anywhere, under any circumstances, including the defense of Taiwan," Ellsberg said in a post to his Twitter on Sunday. The Taiwan leak comes from previously classified sections of a 1966 report by think tank Rand Corporation on the 1958 Taiwan Straits crisis, written by M. H. Halperin for the Office of the then-Assistant Secretary of Defense. After the Communist Party took power in mainland China in 1949, following a brutal civil war, the Nationalist government fled to Taiwan. But Beijing viewed the island as part of its territory, and the two sides clashed intermittently over the following decades. The closest the US and China came to armed conflict was during the Taiwan Strait crisis in 1958, when the People's Republic of China fired artillery at Taipei's outlying islands. Washington worried the shelling could be a precursor to a full invasion. Soldiers stack artillery shells at the seaport on Quemoy Island in 1958 around the time of the Taiwan Strait crisis. Soldiers stack artillery shells at the seaport on Quemoy Island in 1958 around the time of the Taiwan Strait crisis. The shelling focused on the Quemoy and Matsu island groups, which lie between Taiwan and mainland China and are described by Rand Corporation as "the first line of defense" for Taipei. Although it is already public knowledge that the Eisenhower administration debated whether to use nuclear weapons to deter China from attacking Taiwan, the documents appear to reveal the extent of the planning for the first time. According to the leaked documents, some US Defense and State department officials were concerned the loss of the outlying islands in 1958 could lead to a full "Chinese Communist takeover of Taiwan." In the event of an air and sea attack on the islands, US Air Force Gen. Nathan Twining said the US would have to use nuclear weapons against Chinese air force bases "to prevent a successful air interdiction campaign," beginning with "low-yield ten to fifteen kiloton nuclear weapons." If this didn't lead to a break in the assault from mainland China, "the United States ... would have no alternative but to conduct nuclear strikes deep into China as far north as Shanghai." According to the documents, the Chairman of the Joint Chiefs acknowledged this would "almost certainly" lead to nuclear retaliation against Taiwan and the US military base at Okinawa in Japan. "But he stressed that if national policy is to defend the offshore islands then the consequences had to be accepted," the document said. Given China had yet to develop its own nuclear capabilities, any nuclear retaliation would have come from the Soviet Union, possibly sparking an even more devastating global conflict. The report said it isn't clear where the nuclear retaliation would have originated. The document said the US Joint Chiefs, and Twining in particular, saw the use of atomic weapons as "inevitable." In one section, Gen. Laurence S. Kuter, the top Air Force commander for the Pacific, "flatly" states that any US air action against a Chinese attack on the outlying islands "had no chance of success unless atomic weapons were used from the outset." In the end, Eisenhower was hesitant to use nuclear weapons and pushed for the US troops to stick to conventional arms. Joshua Pollack, editor of the Nonproliferation Review, said on Twitter Sunday that the idea the US would have risked a nuclear exchange with the Soviet Union over islands with "no military value" was "jarring." "It's no surprise the White House said no," he said. A ceasefire was reached in the Taiwan Strait on October 6, 1958, although there have been ongoing tensions between Beijing and Taipei. In January 2019 speech, Chinese President Xi Jinping warned he would take "all means necessary" and not "renounce the use of force" to rejoin Taiwan to the Chinese mainland. Beijing claims full sovereignty over Taiwan, a democracy of almost 24 million people located off the southeastern coast of mainland China, even though the two sides have been governed separately for more than seven decades. With military tensions rising again between the US and China, whistleblower Ellsberg said in his interview with the Times that he had supplied the documents due to his concerns over the possibility of a new war over Taiwan. On Sunday, Ellsberg took to Twitter to call for both sides to exercise restraint. "Note to @JoeBiden: learn from this secret history, and don't repeat this insanity," he said.

**That escalates to total nuclear war**

**Ratner 19**

Sam Ratner, Analysis: Is a US-China nuclear conflict likely? The World December 12, 2019 · 12:15 PM EST Sam Ratner writes Inkstick Media's Critical State newsletter. He is also a contributing editor Zitamar News and graduate a of Columbia University's School of International and Public Affairs. Sam writes about civil wars, statebuilding, southern Africa and progressive security policy. <https://www.pri.org/stories/2019-12-12/analysis-us-china-nuclear-conflict-likely> -CAT

Studying nuclear confrontations is a strange job. On one hand, it’s very difficult. Crises that could plausibly lead to nuclear weapons use are rare, which means there aren’t that many cases to study. When it comes to the nightmare scenario of two nuclear powers becoming embroiled in an escalatory spiral resulting in mutual, increasingly destructive nuclear strikes, the historical record is bare. The only time any country has launched a nuclear attack — the United States attacking Japan in 1945 — it did so with the impunity that came with knowing it was the only nuclear power on earth. It’s hard to draw conclusions about the likelihood of something that’s never happened. On the other hand, there are ways in which it’s quite straightforward. Control over how nuclear crises play out is shared by a very small group of people around the world. There are only a few countries that have nuclear weapons, and within those countries only a few people with meaningful power over whether and how nuclear arsenals are deployed, which means it’s relatively easy to know who you’re actually studying. Not only that, but to the extent that those people desire stability in their relationships with nuclear decision makers in other countries, they have an interest in speaking publicly about their approach to potential nuclear crises. When people are eager to tell you about their decision-making processes, you can learn a lot. Related: As landmark nuclear treaty fades, its Cold War authors ask ‘What next?’ In an article published in the latest edition of International Security, political scientists Fiona Cunningham and M. Taylor Fravel dug into how the Chinese government thinks about potential nuclear confrontations. They spoke to 24 members of China’s nuclear strategy community and read a range of official and unofficial documents to understand how likely Chinese strategists think it is that a conventional war between China and the US will escalate into a nuclear war. The message from Chinese experts was clear: They don’t think it’s very likely at all. Their confidence comes from their belief that limited nuclear war is basically impossible. Once one country uses one nuclear weapon, no matter the circumstance, the mainline Chinese view is that both countries will have strong incentives to escalate quickly, to avoid being caught in a position where their strategic nuclear arsenals would be destroyed. That quick escalation would mean mass destruction on both sides, making any nuclear use unlikely. Buttressing that belief is a confidence in both China and America’s ability to manage escalation of conventional conflicts, to ensure they don’t produce a move to nuclear strikes. Even in instances where nuclear powers have lost conventional wars, Chinese General Pan Zhenqiang wrote, “they still do not dare to use nuclear weapons to reverse a [losing] war situation.” If both sides believe that any nuclear escalation would be extremely dangerous, the mainline Chinese view is that both sides have every reason to seek deescalation in even the most dire conventional conflict situations. That all seems like good news for the future of US-China strategic competition. If the Chinese government isn’t concerned that the US is about to nuke China, then it probably won’t pursue the kinds of dangerous nuclear expansion policies that would protect China’s second strike capability from an American first strike. However, Cunningham and Fravel argue, the news isn’t all rosy. Though Chinese views reflect an instinct for safety in a potential nuclear crisis, many American policymakers don’t share those views. Instead, American nuclear doctrine assumes that nuclear escalation can be controlled, and that smaller, “tactical” nuclear strikes might **not** inherently result in massive “strategic” retaliation. **That asymmetry is dangerous**. If the US launches a tactical nuclear strike under the belief that China will respond in kind, but China sees that strike as tantamount to all-out nuclear war**, American policymakers are going to spend the last moments before a massive nuclear conflagration looking extremely stupid**.

### AT: OST Bans Private Appropriation

#### 1] The OST doesn’t extend to private entities

Gorove 69, Stephan [Professor of space law and director of space studies and policy at the University of Mississippi]. “Interpreting Article II of the Outer Space Treaty”; 1969; *Fordham Law Review* [https://ir.lawnet.fordham.edu/cgi/viewcontent.cgi?article=1966&context=flr]

Turning to the second question which involves the meaning of "national" appropriation, it has been suggested that only the United Nations acting on behalf of the world community as a whole, should be entitled to appropriate.3 While further developments in space law, by international custom or treaty, may eventually prohibit spatial appropriations by an individual or a chartered company or the European communities, the Treaty in its present form appears to contain no prohibition regarding individual appropriation or acquisition by a private association or an international organization, even if other than the United Nations. Thus, at present, an individual acting on his own behalf or on behalf of another individual or a private association or an international organization could lawfully appropriate any part of outer space, including the moon and other celestial bodies. Whether or not an ad hoc international organization could be created for the exclusive purpose of enabling it to appropriate.

#### 2] The OST can be nullified

Thomas 05, Jonathan [Brigham Young University]. “Privatization of Space Ventures: Proposing a Proven Regulatory Theory for Future Extraterrestral Appropriation”; August 16, 2005; *Brigham Young University International Law & Management Review* [https://digitalcommons.law.byu.edu/cgi/viewcontent.cgi?article=1006&context=ilmr]

The Vienna Convention on the Law of Treaties (1969) recognizes that states should not be bound by a treaty when there has been a fundamental change in circumstances. xo Aliicle 62 of the Vienna Convention explains the appropriate circumstances for states to terminate or withdraw from a treaty: A fundamental change of circumstances which has occuned with regard to those existing at the time of the conclusion of a treaty, and which was not foreseen by the parties, may not be invoked as a ground for terminating or withdrawing from the treaty unless: (a) the existence of those circumstances constituted an essential basis of the consent of the parties to be bound by the treaty; and (b) the effect of the change is radically to transform the extent of the obligations still to be perfonTIed under the treaty. States commonly regard this principle contained in the Vienna Convention as customary international law.x

#### That takes out their argument about violating the OST justifying violation of international law