## 1AC – Lunar Archaeology

### 1AC – Moon

#### Advantage one: Moon Base

#### The global moon rush coming now.

Ian Sample, PhD @ Queens Mary College, Writes for the Guardian, 7-19-2019, "Apollo 11 site should be granted heritage status, says space agency boss," Guardian, https://www.theguardian.com/science/2019/jul/19/apollo-11-site-heritage-status-space-agency-moon

But protecting lunar heritage may not be straightforward. On Earth, the United Nations Educational, Scientific and Cultural Organisation (Unesco) decides what deserves world heritage status from nominations sent by countries that claim ownership of the sites. Different rules apply in space. The UN’s outer space treaty, a keystone of space law, states that all countries are free to explore and use space, but warns it “is not subject to national appropriation by claim of sovereignty”. In other words, space is for all and owned by none.

Wörner is not put off and sees no need for troublesome regulations. “My hope is that humanity is smart enough not to go back to this type of earthly protection. Just protect it. That’s enough. Just protect it and have everybody agree,” he said. A no-go zone of 50 metres around Tranquility base should do the job, he added.

Martin Rees, the Cambridge cosmologist and astronomer royal, said there was a case for designating the sites so future generations and explorers were aware of their importance. “If there are any artefacts there, they shouldn’t be purloined,” he said. “Probably orbiting spacecraft will provide routine CCTV-style coverage which would prevent this from being done clandestinely.”

Beyond the dust-covered hardware that stands motionless on the moon, Lord Rees suspects future activity could drive calls for broader lunar protection. The Apollo 17 astronaut and geologist Harrison Schmidt has advocated strip mining the moon for helium-3, a potential source of energy.

The proposal, which Rees suggests has raised eyebrows in the community, could potentially provoke a backlash. “There might be pressure to preserve the more attractive moonscapes against such despoilation, and to try to enforce regulations as in the Antarctic,” he said.

Fifty years on from Apollo 11, the moon is still a place to make statements. In January, the Chinese space agency became the first to land a probe on the far side. On Monday, India hopes to launch a robotic probe, the delayed Chandrayaan-2 lander that is bound for the unchartered lunar south pole.

Far more is on the cards. Major space agencies, including ESA and Nasa, plan a “lunar gateway”, described by Wörner as a “bus stop to the moon and beyond”. His vision is for a “moon village”, but rather than a sprawl of domes, shops and a cosy pub, it is more an agreement between nations and industry to cooperate on lunar projects.

The private sector is eager to be involved. Between now and 2024, at least five companies aim to launch lunar landers. In May, Nasa selected three companies to design, build and operate spacecraft that will ferry scientific experiments and technology packages to the moon.

The coming flurry of activity may make protection more urgent. Michelle Hanlon, a space lawyer at the University of Mississippi, co-founded the non-profit organisation For all Moonkind to protect, preserve and memorialise human heritage on the moon. While she conceded that not all of the sites that bear evidence of human activity needed protection, she said many held invaluable scientific and archaeological data that we could not afford to lose. “These sites need to be protected from disruption if only for that reason,” she added.

The protection should be far wider, and more formal, than Wörner calls for, Hanlon argues. “It is astounding to me that we wouldn’t protect the site of Luna 2, the very first object humans crashed on to another celestial body, and Luna 9, the very first object humans soft-landed on another celestial body,” she said. The Soviet Luna programme sent robotic craft to the moon between 1959 and 1976.

“The director general has a much more optimistic view of human nature than I do,” Hanlon said. “I completely agree that the entities and nations headed back to the moon in the near future will take a commonsense approach and give due regard to the sites and artefacts. However, that is the near future. We have to be prepared for the company or nation that doesn’t care. Or worse, that seeks to return to the moon primarily to pillage for artefacts that will undoubtedly sell for tremendous amounts of money here on Earth.”

#### Corporate development, tourism, and looting will destroy scientifically rich Tranquility base artifacts.

Sophie Fessl, PhD King’s College London, BA Oxford, 7/10/19, “Should the Moon Landing Site Be a National Historic Landmark?” https://daily.jstor.org/should-the-moon-landing-site-be-a-national-historic-landmark/

When Neil Armstrong set foot on the moon on July 20, 1969, the pictures sent to Earth captured a historical moment: It was the first time that any human set foot on another body in our solar system. Fifty years later, experts are debating how to preserve humankind’s first steps beyond Earth. Could a National Park on the moon be the solution to saving Armstrong’s bootprints for future archaeologists?

Flags, rovers, laser-reflecting mirrors, footprint—these are just a few of the dozens of artifacts and features that bear witness to our exploration of the moon. Archaeologists argue that these objects are a record to trace the development of humans in space. “Surely, those footprints are as important as those left by hominids at Laetoli, Tanzania, in the story of human development,” the anthropologist P.J. Capelotti wrote in Archaeology. While the oldest then known examples of hominins walking on two feet were cemented in ash 3.6 million years ago, “those at Tranquility Base could be swept away with a casual brush of a space tourist’s hand.”

Fragile Traces

Just how fragile humankind’s lunar traces are was seen already during Apollo 12. On November 19, 1969, Charles “Pete” Conrad and Alan Bean manually landed their lunar module in the moon’s Ocean of Storms, 200 meters from the unmanned probe Surveyor 3, which was left sitting on the moon’s surface two years earlier, in 1967. The next day, Conrad and Bean hopped to Surveyor 3. As they approached the spacecraft, they were surprised: The spacecraft, originally bright white, had turned light brown. It was covered in a fine layer of moon dust, likely kicked up by their landing.

Harsh ultraviolet light has likely bleached the U.S. flag bright white.

Without Apollo 12 upsetting the moon dust, Surveyor 3 would likely have remained stark white. Unlike Earth, the moon has no wind that carries away the dust, no rain to corrode materials, and no plate tectonic activity to pull sites on the surface back into the moon. But the moon’s thin atmosphere also means that solar wind particles bombard the lunar surface, and harsh ultraviolet light has likely bleached the U.S. flag bright white. The astronauts’ first bootprints will likely be on the moon for a long time, and will almost certainly still be there when humans next visit—unless, by tragic coincidence, a meteorite hits them first. Had LunaCorp not abandoned the idea in the early 2000s, the company’s plan to send a robot to visit the most famous sites of moon exploration could have done a lot of damage. And with Jeff Bezos’ recent unveiling of a mock-up of the lunar lander Blue Moon, it is only a matter of time before corporate adventurers and space tourists reach the moon.

Historians and archaeologists are keen to avoid lunar looting. Roger Launius, senior curator of space history at the National Air and Space Museum in Washington, D.C., warned: “What we don’t want to happen is what happened in Antarctica at Scott’s hut. People took souvenirs, and nothing was done to try to preserve those until fairly late in the game.” On the other hand, there is a legitimate scientific interest in investigating how the equipment that’s on the moon was affected by a decades-long stay there.

#### Tranquility base research key to moon dust research.

Ceridwen Dovey, PhD Candidate, Anthropology @ NYU, B.A. Anthropology and Environmental Science @ Harvard, National Book Foundation Nominee, Contributor to Wired and The New Yorker, ’19, "Moondust Could Cloud Our Lunar Ambitions," Wired, https://www.wired.com/story/moondust-nasa-lunar-ambitions/

It's superfine. It's sharp. It sticks to everything. Before we return to the moon, we'll have to conquer one of the weirdest substances in the solar system.

In the public imagination, the American astronauts who landed on the moon five decades ago were square-jawed superhumans, not the types to worry about something as banal as housekeeping. But they did, obsessively. Each time they got back to the Apollo Lunar Module after a moonwalk, they were shocked at how much dust they'd tracked in and how hard it was to banish. This was no earthly grime; it was preternaturally sticky and abrasive, scratching the visors on the astronauts' helmets, weakening the seals on their pressure suits, irritating their eyes, and giving some of them sinus trouble. “It just sort of inhabits every nook and cranny in the spacecraft and every pore in your skin,” Apollo 17's Gene Cernan said during his post-mission debriefing.

Over the course of six moon landings, the so-called Dusty Dozen fought valiantly with their foe. They stomped their boots outside, then cinched garbage bags around their legs to stop the dust from spreading. They attacked it with wet rags, bristle brushes, and a low-suction vacuum cleaner, which Pete Conrad of Apollo 12 called “a complete farce.” (He finally stripped naked and stuffed his blackened suit into a pouch.) Cernan, upon returning from his last moonwalk, vowed, “I ain't going to do much more dusting after I leave here. Ever.” In the end, NASA couldn't find a foolproof solution. Years after John Young commanded Apollo 16, he still believed that “dust is the number one concern in returning to the moon.”

Now, with national space agencies and private corporations poised to do just that, the Apollo dust diaries are relevant once more. In January, China landed its Chang'e-4 probe on the far side of the moon, the latest step toward its stated aim of building a lunar research station. Two months later, the Japanese Aerospace Exploration Agency said it was partnering with Toyota to design a six-wheeled moon rover by 2029. Around the same time, Vice President Mike Pence announced plans to put American boots on the moon by 2024. According to NASA administrator Jim Bridenstine, the goal is “to go sustainably. To stay. With landers and robots and rovers—and humans.” India and Russia have missions planned too. Then there are the private ventures like Moon Express, whose Harvest Moon expedition will prospect for water, minerals, and other resources to mine. All of which raises a crucial question: What to do about that troublesome dust? An Australian physicist named Brian O'Brien may have the answer.

O'Brien became Earth's foremost authority on moondust almost by accident. In 1964, five years before Apollo 11 touched down in the Sea of Tranquility, he was a skinny, precocious young professor of space science at Rice University in Houston, specializing in the study of radiation. This was during the early phase of Apollo training, when the astronauts were taking crash courses in all manner of subjects—vector calculus, antenna theory, the physiology of the human nose. O'Brien's task was to teach them about the Van Allen belts, two regions of intense radiation that encircle the planet like a pair of inflatable pool tubes. He remembers the Apollo class of 1964, which included Gene Cernan and Buzz Aldrin, as the most “disciplined and alert” cohort of students he ever had.

In the lead-up to the Apollo 11 launch, O'Brien persuaded NASA to include a little something extra in the payload. It was a small box, about the size of a thick bar of soap, whose main function was to measure the accumulation of dust on the moon's surface. O'Brien describes it as “a hitchhiking, delightfully minimalist” device. He sketched it on the back of his drinks coaster on a flight from Los Angeles to Houston, and refined the design on a cocktail napkin. Named the Dust Detector Experiment, or DDE, it was perhaps the least impressive component of the Apollo 11 science package; NASA didn't even bother to mention it in press releases. But it worked well enough that the agency included modified versions of the original DDE on all subsequent Apollo flights. Four of them are still up there, and to this day they hold the record for longest continually operating experiments on the moon.

For many years, the data that the early DDEs sent back to Earth was thought to be missing or lost. Since its surprise rediscovery in 2006, those in the inner circle of outer space activities have slowly begun to realize that O'Brien's unassuming detectors have a lot more to tell us about moondust than anyone could have imagined—except, of course, for O'Brien himself. Now 85, still sprightly and living in Perth, he's been waiting half a century for the chance to share with the world what he knows about one of the solar system's most baffling substances.

#### Moon dust research key to moon basing.

Belinda Smith, Strategic Communications Advisor @ Department of Education and Training, Victoria, Graduate Diploma @ Royal Melbourne Institute of Technology, now writing for Australian Broadcasting Network 7/18/19, "Who protects Apollo sites when no-one owns the Moon?," ABC News, https://www.abc.net.au/news/science/2019-07-19/apollo-11-moon-landing-heritage-preservation-outer-space-treaty/11055458

It's not just about history Alongside heritage value, the bits and pieces left on the Moon have enormous scientific significance. Take moon dust. It's a real problem for moon-bound equipment because it's made of fine, super sticky and highly abrasive grains, which have a habit of clogging instruments and spacesuits. But as Armstrong and Aldrin trotted across the surface, the footprints they left behind gave us valuable information into the properties of moon dust, Flinders University space archaeologist Alice Gorman said. "The ridges on the boots were meant to measure how far they sank into the dust. "Then they used the light contrast between the ridges to measure the reflectance properties of the dust." A boot print in grey dust. This iconic photo of Buzz Aldrin's footprint is also a science experiment. (Supplied: NASA) It's data like this that will help if we want a long-term base on the Moon — we need to know how our gear will stand up to lunar conditions. Apart from the sticky, gritty dust, the lunar surface is also peppered with meteorites and cosmic rays. So, Dr Gorman said, one of the very few reasons to revisit a moon site is to collect some of the equipment left behind and see how it fared. "What has happened to this material in 50 years of sitting on the lunar surface? "This is going to be really interesting scientific information because it will help planning for future missions and get an understanding of long-term conditions." And NASA has already done this. The Apollo 12 mission, which landed on the Moon four months after Apollo 11, collected parts from the 1967 Surveyor probe and brought them back to Earth. An astronaut standing next to a piece of equipment on the lunar surface Along with rocks and soil samples, Apollo 12 astronauts collected pieces of the Surveyor 3 probe for analysis back on Earth. (Supplied: NASA) Another reason to preserve the equipment left on the Moon is to prove we really went there, Professor Capelotti said. "There's a lot of people out there who still don't believe it happened. "The stuff on the Moon is a testament to what we did and when we did it."

#### Moon base key to medical device innovation that solves the aging crisis.

David A. Green, Programme Director, Space Physiology & Health MSc @ Kings College London, PhD Neuroscience at London South Bank University, ’10, “How the UK Can Lead the Terrestrial Translation of Biomedical Advances Arising from Lunar Exploration Activities” Earth Moon Planets 107:127–146

Space-faring nations have accumulated much knowledge regarding the acute changes associated with microgravity in human and non-human organisms (Cle´ment and Slenzka 2006). Numerous methods and countermeasures have been devised to ameliorate such changes in an attempt to preserve astronaut and mission capability (Garshnek 1989; Williams 2003). Furthermore, research within the space environment has provided unique insights into areas as diverse as gene expression (e.g. Cogoli and Cogoli-Greuter 1997), immunology (Sonnenfeld and Shearer 2002; Borchers et al. 2002), wound healing (Davidson et al. 1999), bone physiology (e.g. Turner 2000; Vico et al. 2000), musculoskeletal (Narici and de Boer 2010) and cardiovascular regulation (reviews; Hargens and Richardson 2009; Hughson 2009), angiogenesis (Radek et al. 2008), circadian/sleep rhythm and performance (Mallis and DeRoshia 2005) in addition to sensory-motor function (e.g. Kalb and Solomon 2007; Souvestre et al. 2008). ISS studies have shown how fundamental gravity is for functional development (Temple et al. 2002), although most of the work refers to mammalian, or in a broader context, animal development, rather than that of humans, about which we know extremely little in a space environment. It has also provided insights into how we perceive the world around us, and ourselves within it (Lipshits et al. 2005). Intriguingly, whilst ‘normal’ earthbound physiology appears in the main to be negatively affected by a reduction in gravity, viral virulence of certain human pathogenic bacteria increases when compared to their ground based control groups (Wilson et al. 2007). Such findings are not only fascinating but provide a bridge between medicine and biomedical research, and also between space biomedicine and other areas of space biology, including astrobiology. Terrestrial applications of prolonged space environment exposure that the lunar surface offers insights for issues ranging from cardiovascular pathology, e.g. orthostatic intolerance, ageing/disuse/spinal cord (Edgerton et al. 2000; Pavy-Le Traon et al. 2007) pathology such as osteoporosis, falls risk (Cle´ment et al. 2005), radiation/cancer risk, psychology of the individual and the group, human factors and medical devices such as healthcare extension technologies. Space biomedicine has also helped and has the potential to further aid people living in developing countries, for example through telemedicine. Furthermore, space biomedicine has much to tell us about the major causes of mortality in the developed world (Mortimer et al. 2009), such as the metabolic syndrome and cardiovascular disease. It also provides useful models of individualised medicine (Kalow 2002), including pharmacogenetics and genetic-lifestyle interactions (Mattick 2003). In particular, the radiation environment of the Moon could provide unprecedented opportunities for fundamental research in the field of radiation biology (Gridley et al. 2009) and carcinogenesis (Rykova et al. 2008) not possible on Earth (ESA 1992).

Whilst ISS has been an undoubted geopolitical success, significant biomedical insights have only recently started to accrue. Key factors include the limited number of astronauts and the high degree of control individual Agency’s maintain, which often results in differential countermeasure adoption. As a consequence, determination of both the true nature of space-related physiological insults, and thus the optimal countermeasures that should be adopted is far from complete (e.g. Cavanagh et al. 2005). Issues surrounding partial gravity are even more unclear and potentially more enlightening than microgravity in terms of biological mechanisms. As such Lunar exploration is emerging as a potential destination to learn about life beyond Earth and to further explore the solar system via a combination of collaboration and competition among space-faring nations (Space report 2009). The Moon of today appears far more viable as a location than it appeared during Apollo missions. For instance, evidence of ice deposits have been discovered within polar craters, which may provide liquid water for colonists and their hydroponic crops and those constituents may be converted into rocket fuel. Such a tightly controlled (and controllable) environment (if sustainable) could be particularly useful in the investigation of countermeasure interaction such as diet/nutritional supplementation and exercise (Convertino 2002). Although subject numbers would initially be low, high levels of motivation and extensive remote monitoring (telemedicine) would facilitate excellent long-term adherence.

Space (and thus lunar) habitation has been suggested as a model of ‘accelerated’ ageing (Vernikos and Schneider 2010) and/or disuse pathology (Elmann-Larsen and Schmitt 2003) in view of the resultant similarities including loss of bone density, muscle volume/ strength and cardiorespiratory de-conditioning. As a society we have the moral, social and economic imperative to keep our citizens alive and functional. However, the number of over 60s is forecast to be 1.25 billion by 2025, of which most will suffer at least one chronic disease and 50% two or more, typically complex, challenging and resource intensive. For instance, the US expends 75% of its healthcare resources upon chronic, and 90% upon age-related conditions. Within Europe, 37% have at least one chronic condition, accounting for 77% of the total disease burden, 86% of all deaths, and 70% percent of total health expenditure, particularly expensive if poorly managed. Therefore, similarities to terrestrial medicine and their ‘accelerated’ nature renders lunar space biomedicine the opportunity to offer substantial terrestrial returns in terms of knowledge, health and wellbeing and economic development.

#### Aging crisis causes china war

Deborah Jordan Brooks et al, associate professor in the Department of Government at Dartmouth College, Stephen G. Brooks, professor in the Department of Government at Dartmouth College, Brian D. Greenhill, associate professor in the Department of Political Science at Rockefeller College at the University at Albany, State University of New York, Mark L. Haas, professor and Raymond J. Kelley Endowed Chair in International Relations in the Political Science Department at Duquesne University, ’19, The Demographic Transition Theory of War: Why Young Societies Are Conflict Prone and Old Societies Are the Most Peaceful. International Security, 43(3), 53–95. doi:10.1162/isec\_a\_00335 (edited)

Although the standard projections for China’s demographic future are dire, they may even be too optimistic. In an effort to boost its fertility rate and reduce the extent of its aging problem, China in 2015 ended its one-child policy in favor of a policy that allowed and even encouraged parents to have up to two children. This change, however, has not had the intended results.87 Findings from a 2015 census released by China’s government in October 2016 revealed that the country’s fertility rate was 1.05, making it the lowest in the world.88 This number is half a child (or 32 percent) lower than the figure provided by the United Nations. If the 2015 census data are accurate and this fertility level is sustained, then the extent and pace of China’s aging—in terms of increasing median age and shrinking working-age and military-age cohorts— will be considerably higher than currently predicted. This would be notable given that China already appears to be aging faster than any other state in history.

the world’s first old rising power. China is in a fundamentally different demographic position from all other previous rising powers; the frequent comparisons between its ascent and that of past rising states (e.g., Germany in the first half of the twentieth century) are thus inaccurate. Unlike these states, China is ascending at a time when its population is rapidly aging, which will hamstring it both economically and militarily. Breaking out of the so-called middle-income trap is extremely hard, and the relatively small number of countries that have done so in the post–World War II period have been comparatively young.89 Moreover, in the past, the leading state and the rising state have had similar demographic profiles. China, in contrast, will be rapidly aging just as it approaches economic parity with the United States, which is aging at a much slower rate. China’s rapid aging—in both absolute terms and especially relative to the United States—will result in arguably the swiftest change of demographic fortunes in history. Because China will become old before it can become a global peer of the United States, the likelihood of a dangerous power transition involving China and the United States is much lower than analysts often assert.90 Nevertheless, there is still cause for concern given the effects of closing window-ofopportunity dynamics. As the costs of China’s rapidly aging population begin to surge, China’s leaders may feel that they confront a shrinking demographic window of opportunity to achieve international objectives that are likely to require the use or threat of force.91 This dynamic may help to explain China’s recent move away from its “peaceful rise” grand strategy to a far more assertive posture—most notably, in the South China Sea.

#### US-China war goes nuclear.

Cunningham and Fravel 15 - Fiona Cunningham, Ph.D. candidate in the Department of Political Science and member of the Security Studies Program at the Massachusetts Institute of Technology, Taylor Fravel, Associate Professor of Political Science and member of the Security Studies Program at the Massachusetts Institute of Technology, Fall 2015("Assuring Assured Retaliation: China's Nuclear Posture and U.S.-China Strategic Stability," published by International Security, Available online at Vol. 40, No. 2 (Fall 2015), pp. 7–50, doi:10.1162/ISEC\_a\_00215, Accessed 9/2/2016)

In a recent article on the role of China’s secure second-strike and coercive leverage, Thomas Christensen draws attention to the danger of inadvertent escalation in a crisis between the United States and China. In particular, Christensen challenges the optimistic view that China’s secure second-strike capability will prevent escalation to the strategic nuclear level because each side would be able to impose unacceptable damage on the other after absorbing a ªrst strike.111 Drawing on the Cold War–era scholarship of Robert Jervis and Thomas Schelling, Christensen suggests that a conventionally weaker state with a secure second-strike capability could create a “threat that leaves something to chance,” whereby any conventional conflict could ultimately escalate to strategic nuclear war.112 The lack of a clear firebreak between conventional and nuclear operations enhances this risk of nuclear escalation. Conventionally weaker states may unintentionally increase the threat that leaves something to chance if their nuclear and conventional forces are integrated, and “ªghting can become blurred between conventional and nuclear war.”113

In a possible crisis between the United States and China, Christensen identifies how inadvertent escalation might occur. He suggests that China could be bolder in a conventional crisis with the United States because it believes it could counter U.S. threats of nuclear escalation.114 Complicating matters, some of China’s newly developed conventional systems overlap with its nuclear ones, especially land-based ballistic missiles and their attendant command and control infrastructure but also submarines and space-based assets. If a conflict between the United States and China occurred, Christensen notes that U.S. commanders could have strong incentives to attack China’s mobile missiles and related assets to defend U.S. forces and ultimately prevail in a conflict.115 If these strikes occurred, Beijing could mistakenly view them “as a conventional attack on its nuclear retaliatory capability or as a precursor to a nuclear first strike.” As a result, “even a China that generally adheres to a No-First-Use posture might escalate to the nuclear level.”116 Christensen also highlights sections from the Science of Second Artillery Campaigns to show that “China’s NFU [no-ªrst-use] doctrine still allows for blurring of the firebreak between conventional and nuclear warfare.”117 The book, for example, indicates that China’s nuclear forces create a means “by which to level the playing field with a stronger adversary” and suggests that China could lower its “nuclear deterrence threshold” under certain conditions, including “to compel the enemy to stop its war of invasion.”118

#### MAD doesn’t check

Wittner 11 – Lawrence S., Emeritus Professor of History at the State University of New York/Albany, 2011 ("Is a Nuclear War With China Possible?" *Huntington News*, November 28th, Available Online at [www.huntingtonnews.net/14446](http://www.huntingtonnews.net/14446))

While nuclear weapons exist, there remains a danger that they will be used. After all, for centuries national conflicts have led to wars, with nations employing their deadliest weapons. The current deterioration of U.S. relations with China might end up providing us with yet another example of this phenomenon. The gathering tension between the United States and China is clear enough. Disturbed by China’s growing economic and military strength, the U.S. government recently challenged China’s claims in the South China Sea, increased the U.S. military presence in Australia, and deepened U.S. military ties with other nations in the Pacific region. According to Secretary of State Hillary Clinton, the United States was “asserting our own position as a Pacific power.” But need this lead to nuclear war? Not necessarily. And yet, there are signs that it could. After all, both the United States and China possess large numbers of nuclear weapons. The U.S. government threatened to attack China with nuclear weapons during the Korean War and, later, during the conflict over the future of China’s offshore islands, Quemoy and Matsu. In the midst of the latter confrontation, President Dwight Eisenhower declared publicly, and chillingly, that U.S. nuclear weapons would “be used just exactly as you would use a bullet or anything else.” Of course, China didn’t have nuclear weapons then. Now that it does, perhaps the behavior of national leaders will be more temperate. But the loose nuclear threats of U.S. and Soviet government officials during the Cold War, when both nations had vast nuclear arsenals, should convince us that, even as the military ante is raised, nuclear saber-rattling persists. Some pundits argue that nuclear weapons prevent wars between nuclear-armed nations; and, admittedly, there haven’t been very many—at least not yet. But the Kargil War of 1999, between nuclear-armed India and nuclear-armed Pakistan, should convince us that such wars can occur. Indeed, in that case, the conflict almost slipped into a nuclear war. Pakistan’s foreign secretary threatened that, if the war escalated, his country felt free to use “any weapon” in its arsenal. During the conflict, Pakistan did move nuclear weapons toward its border, while India, it is claimed, readied its own nuclear missiles for an attack on Pakistan. At the least, though, don’t nuclear weapons deter a nuclear attack? Do they? Obviously, NATO leaders didn’t feel deterred, for, throughout the Cold War, NATO’s strategy was to respond to a Soviet conventional military attack on Western Europe by launching a Western nuclear attack on the nuclear-armed Soviet Union. Furthermore, if U.S. government officials really believed that nuclear deterrence worked, they would not have resorted to championing “Star Wars” and its modern variant, national missile defense. Why are these vastly expensive—and probably unworkable—military defense systems needed if other nuclear powers are deterred from attacking by U.S. nuclear might? Of course, the bottom line for those Americans convinced that nuclear weapons safeguard them from a Chinese nuclear attack might be that the U.S. nuclear arsenal is far greater than its Chinese counterpart. Today, it is estimated that the U.S. government possesses over five thousand nuclear warheads, while the Chinese government has a total inventory of roughly three hundred. Moreover, only about forty of these Chinese nuclear weapons can reach the United States. Surely the United States would “win” any nuclear war with China. But what would that “victory” entail? A nuclear attack by China would immediately slaughter at least 10 million Americans in a great storm of blast and fire, while leaving many more dying horribly of sickness and radiation poisoning. The Chinese death toll in a nuclear war would be far higher. Both nations would be reduced to smoldering, radioactive wastelands. Also, radioactive debris sent aloft by the nuclear explosions would blot out the sun and bring on a “nuclear winter” around the globe—destroying agriculture, creating worldwide famine, and generating chaos and destruction.

#### AND Russia war.

Deborah Jordan Brooks et al, associate professor in the Department of Government at Dartmouth College, Stephen G. Brooks, professor in the Department of Government at Dartmouth College, Brian D. Greenhill, associate professor in the Department of Political Science at Rockefeller College at the University at Albany, State University of New York, Mark L. Haas, professor and Raymond J. Kelley Endowed Chair in International Relations in the Political Science Department at Duquesne University, ’19, The Demographic Transition Theory of War: Why Young Societies Are Conflict Prone and Old Societies Are the Most Peaceful. International Security, 43(3), 53–95. doi:10.1162/isec\_a\_00335 (edited)

The third potential way to understand Russia’s recent military assertiveness is based on closing window-of-opportunity dynamics.102 The scale of population aging in Russia has not yet reached its most extreme levels, but analysts predict that it will soon. Nicholas Eberstadt summarizes the scope of Russia’s aging problem as follows: “There is a profound and fundamental difference between the depopulation underway in Russia today and the depopulation facing... affluent Western nations. Germany, Japan, and Italy commonly confront the prospect of population decline in the context of robust and steadily improving levels of public health. The Russian Federation, by contrast, has been seized by an extended mortality crisis—an affliction of historic and truly tragic dimensions.” The result, Eberstadt continues, is that “Russia today is in the grip of an eerie, far-reaching and in some respects historically unprecedented population crisis.”103

Russia’s leaders seem to recognize that their country’s aging problem is likely to soon become even more severe. In his first state-of-the-union address in 2000, for example, President Vladimir Putin warned that if current demographic trends continued, Russia faced “the threat of becoming a senile nation.”104 In 2006, he declared that demography was “Russia’s most acute problem” given the severity of the challenges associated with population aging.105 In an article published during his 2012 presidential campaign, Putin indicated that Russia’s demographic decline, had critical geopolitical consequences: “In a global sense we are facing the risk of turning into an ‘empty space’ whose fate will not be decided by us.” Putin vowed to take measures to reverse Russia’s population decline, and his government has supported pronatalist policies throughout his presidency and premiership.106 If Russia’s leaders understand the severity of their country’s aging problem and the constraints it is likely to create, they may seek to achieve at least some revisionist international objectives before these constraints become even more powerful.

#### Russian political dynamics ensure nuclear escalation.

Thompson 15 (Chief Operating Officer @ Lexington Institute, Former Deputy Director of the Security Studies Program @ Georgetown University, Why Putin's Russia Is The Biggest Threat To America In 2015, <https://www.forbes.com/sites/lorenthompson/2015/01/02/why-putins-russia-is-the-biggest-threat-to-america-in-2015/#711522f74636>)

A collapsing economy. Much of Putin's popularity within Russia is traceable to the impressive recovery of the post-Soviet economy on his watch. Since he came to power in 2001, the country's gross domestic product has grown sixfold, greatly increasing the size and affluence of the Russian middle class. But that growth has been based in large part on the export of oil and gas to neighboring countries at a time when energy prices reached record highs. Now the price of oil has fallen at the same time that economic sanctions are beginning to bite. The ruble lost nearly half its value against the dollar last year, and the economy has begun to shrink. Putin blames sanctions for 25-30% of current economic hardships. Many Westerns believe a prolonged recession would weaken Putin's support, but because he can blame outsiders, economic troubles might actually strengthen his hand and accelerate the trend toward authoritarian rule. A deep sense of grievance. Blaming outsiders for domestic troubles has a long pedigree in Russian political tradition, and it feeds into a deep-seated sense that Russia has been deprived of its rightful role in the world by the U.S. and other Western powers. Russia may have little past experience with democracy, but it was a major power for centuries prior to the collapse of communism. Like authoritarian rulers in other nations, Putin has built his political base by appealing to nationalism, fashioning a revisionist view of recent events in which Russia is the victim rather that the author of its own misfortunes. He has called the break-up of the Soviet Union a tragedy of epic proportions, and apparently really believes it. By tapping into a deep vein of resentment in Russian political culture, Putin has created a broad constituency for standing up to outsiders even if it means prolonged economic hardship and the danger of war. A vulnerable antagonist. Federal Reserve chair Janet Yellen says America faces little danger from Russia's current troubles, but that's because she thinks in economic terms. In a broader sense, America potentially is in great danger because Putin and his advisors really believe they are the target of a Western plot to weaken their country. The biggest concern is that some new move by Russia along its borders degenerates into a crisis where Moscow thinks it can improve its tactical situation by threatening local use of nuclear weapons, and then the crisis escalates. At that point U.S. policymakers would have to face the reality that (1) they are unwilling to fight Russia to protect places like Ukraine, and (2) they have no real defenses of the American homeland against a sizable nuclear attack. In other words, the only reason Washington seems to have the upper hand right now is because it assumes leaders in Moscow will act "rationally." The unspoken wisdom in Washington today is that if nobody gives voice to such fears, then they don't need to be addressed. That's how a peaceful world stumbled into the First World War a century ago -- by not acknowledging the worst-case potential of a crisis in Eastern Europe -- and the blindness of leaders back then explains most of what went wrong later in the 20th Century. If we want to avoid the risk of reliving that multi-generation lesson, then U.S. policymakers need to do something more than simply wait for Putin to crack. That day will never come. In the near term, Washington needs to work harder to defuse tensions, including taking a more serious look at the history that led to Moscow's move on Crimea. Over the longer term, Washington needs to get beyond its dangerous aversion to building real defenses against long-range nuclear weapons, because it is just a matter of time before some dictator calls America's bluff.

#### Its an existential risk

Bostrom 2 (Oxford philosophy professor, “Existential Risks: Analyzing Human Extinction Scenarios and Related Hazards”http://www.nickbostr...tial/risks.html)

A much greater existential risk emerged with the build-up of nuclear arsenals in the US and the USSR. An all-out nuclear war was a possibility with both a substantial probability and with consequences that might have been persistent enough to qualify as global and terminal. There was a real worry among those best acquainted with the information available at the time that a nuclear Armageddon would occur and that it might annihilate our species or permanently destroy human civilization.[4] Russia and the US retain large nuclear arsenals that could be used in a future confrontation, either accidentally or deliberately. There is also a risk that other states may one day build up large nuclear arsenals. Note however that a smaller nuclear exchange, between India and Pakistan for instance, is not an existential risk, since it would not destroy or thwart humankind’s potential permanently. Such a war might however be a local terminal risk for the cities most likely to be targeted. Unfortunately, we shall see that nuclear Armageddon and comet or asteroid strikes are mere preludes to the existential risks that we will encounter in the 21st century.

### 1AC – Treaties

#### Advantage two: Treaties.

#### International law can shift through customary interpretation. Customary international law requires *state practice* and *opinio juris*, or wide international acceptance.

Abigail D. Pershing, J.D. Candidate @ Yale, B.A. UChicago,’19, "Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today," Yale Journal of International Law 44, no. 1

Before delving into an examination of what customary international law relating to outer space used to be and indications of how it has changed, it is first helpful to briefly define customary international law. Broadly speaking, the United Nations has acknowledged that “[t]o determine the existence of a rule of customary international law and its content, it is necessary to ascertain whether there is a general practice accepted as law.”21 These two elements—(1) a general and consistent State practice that is (2) widely accepted as law (opinio juris)— constitute the basis for determining whether customary international law exists.22 This two-element approach is widely supported by State practice23 and has been accepted for the purposes of establishing evidence of customary international law in international tribunals.24 For instance, in the International Court of Justice’s (ICJ) decision in Nicaragua v. United States, the Court concluded that to determine whether a particular rule is entrenched as customary international law, “the conduct of the States should, in general, be consistent with such rule, and that instances of State conduct inconsistent with a given rule should generally have been treated as breaches of that rule, not as indications of the recognition of a new rule.”25

Often, in establishing the existence of customary international law, scholars and legal practitioners rely on a long history of State practice as a key component in demonstrating that the practice is general and consistent.26 Given the very recent development of space law, this condition clearly cannot apply to a discussion of customary international law of space. However, the lack of a longhistory does not necessarily preclude the existence of customary international law. The ICJ has suggested that “the passage of only a short period of time is not necessarily, or of itself, a bar to the formation of a new rule of customary international law.”27 Despite the novelty of the field, customary State action already plays a key role in maintaining the international legal order of outer space.28

Instead of relying on the length of time that States have treated a particular rule as customary international law, other potential sources of evidence that can support a claim of a customary international law include treaties, decisions of national courts and international tribunals, national legislation, diplomatic correspondence, opinions of national legal advisors, and the practice of international organizations.29 Because there is no long history to draw from in establishing the existence of customary international law in space, these other non-time-sensitive methods of establishing customary international law must replace a prolonged history of State practice.

The United Nation’s acknowledged two-part understanding of customary international law is referenced throughout the Note. With this basic definition and its specific application to space in mind, we now move to an examination of customary international law as it relates to the non-appropriation principle.

#### The Article 2 of the OST has undergone a first shift to allow appropriation of space resources, not appropriation of real, in-situ property.

Abigail D. Pershing, J.D. Candidate @ Yale, B.A. UChicago,’19, "Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today," Yale Journal of International Law 44, no. 1

II. THE FIRST SHIFT IN CUSTOMARY INTERNATIONAL LAW’S INTERPRETATION OF THE NON-APPROPRIATION PRINCIPLE

Since the drafting of the Outer Space Treaty, several States have chosen to reinterpret the non-appropriation principle as narrower in scope than its drafters originally intended. This reinterpretation has gone largely unchallenged and has in fact been widely adopted by space-faring nations. In turn, this has had the effect of changing customary international law relating to the non-appropriation principle. Shifting away from its original blanket application in 1967, States have carved out an exception to the non-appropriation principle, allowing appropriation of extracted space resources.53 This Part examines this shift in the context of the two branches of the United Nation’s customary international law standard: State practice and opinio juris.

A. State Practice

The earliest hint of a change in customary international law relating to the interpretation of the non-appropriation clause came in 1969, when the United States first sent astronauts to the moon. As part of his historic journey, astronaut Neil Armstrong collected moonrocks that he brought back with him to Earth and promptly handed off to the National Aeronautics and Space Administration (NASA) as U.S. property.54 Later, the USSR similarly claimed lunar material as government property, some of which was eventually sold to private citizens. 55 These first instances of space resource appropriation did not draw much attention, but they presented a distinct shift marking the beginning of a new period in State practice. Having previously been limited by their technological capabilities, States could now establish new practices with respect to celestial bodies. This was the beginning of a pattern of appropriation that slowly unfolded over the next few decades and has since solidified into the general and consistent State practice necessary to establish the existence of customary international law. Currently, the U.S. government owns 842 pounds of lunar material.56 There is little question that NASA and the U.S. government consider this material, as well as other space materials collected by American astronauts, to be government property.57 In fact, NASA explicitly endorses U.S. property rights over these moon rocks, stating that “[l]unar material retrieved from the Moon during the Apollo Program is U.S. government property.”5

The U.S. delegation’s reaction to the language of the 1979 Moon Agreement further cemented this interpretation that appropriation of extracted resources is a permissible exception to the non-appropriation clause of Article II. Although the United States is not a party to the Moon Agreement, it did participate in the negotiations.59 The Moon Agreement states in relevant part: Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or nongovernmental organization, national organization or nongovernmental entity or of any natural person.60

In response to this language, the U.S. delegation made a statement laying out the American view that the words “in place” imply that private property rights apply to extracted resources61—a comment that went completely unchallenged. That all States seemed to accept this point, even those bound by the Moon Agreement, is further evidence of a shift in customary international law.62

B. Opinio Juris: Domestic Legislation

Domestic law, both in the United States and abroad, provides further evidence of the shift in customary international law surrounding the issue of nonappropriation as it relates to extracted space resources.

Domestic U.S. space law is codified at Section 51 of the U.S. Code and has been regularly modified to expand private actors’ rights in space.63 Beginning in 1984, the Commercial Space Launch Act provided that “the United States should encourage private sector launches and associated services.”64 The goal of the 1984 Act was to support commercial space launches by private companies and individuals.65 It did not, however, specifically discuss commercial exploitation of space. The first such mention of commercial use of space appeared in 2004, with the Commercial Space Launch Amendments Act.66 This Act specifically aimed at regulating space tourism but did not explicitly guarantee any private rights in space.67

The most significant change in U.S. space law came with the passage of the Spurring Private Aerospace Competitiveness and Entrepreneurship (SPACE) Act in 2015. As incorporated into Section 51 of the Code, this Act provides: A United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States.68

Whereas the idea that private corporations might go into space may have seemed far-fetched to the drafters of the Outer Space Treaty, the SPACE Act of 2015 was the first instance of a government recognizing such a trend and officially supporting private companies’ commercial rights to space resources under law. With the new 2015 amendment to Section 51 in place, U.S. companies can now rest assured that any profits they reap from space mining are firmly legal—at least within U.S. jurisdictions.

Although the United States was the first country to officially reinterpret the non-appropriation principle, other countries are following suit. On July 20, 2017, Luxembourg passed a law entitled On the Exploration and Utilization of Space Resources with a vote of fifty-five to two.69 The law took effect on August 1, 2017.70 Article 1 of the new law states simply that “[s]pace resources can be appropriated,” and Article 3 expressly grants private companies permission to explore and use space resources for commercial purposes.71 Official commentary on the law establishes that its goal is to provide companies with legal certainty regarding ownership over space materials—a goal that the commentators regard as legal under the Outer Space Treaty despite the non-appropriation principle.72 The next country to enact similar legislation may be the United Arab Emirates (UAE). According to the UAE Space Agency director general, Mohammed Al Ahbabi, the UAE is currently in the process of drafting a space law covering both human space exploration and commercial activities such as mining.73 To further this goal, in 2017 the UAE set up the Space Agency Working Group on Space Policy and Law to specify the procedures, mechanisms, and other standards of the space sector, including an appropriate legal framework.74

C. Opinio Juris: Legal Scholarship

Other major space powers are also considering similar laws in the future, including Japan, China, and Australia. 75 Senior officials within China’s space program have explicitly stated that the country’s goal is to explore outer space and to take advantage of outer space resources.76 The general international trend clearly points in this direction in anticipation of a potential “space gold rush.” 7

Mirroring the shift in State practice and domestic laws, the legal community has also changed its approach to the interpretation of the nonappropriation principle. Whereas at the time of the ratification of the Outer Space Treaty the majority of legal scholars tended to apply the non-appropriation principle broadly, most legal scholars now view appropriation of extracted materials as permissible.78 Brandon Gruner underscores that this new view is historically distinct from prior legal interpretation, noting that modern interpretations of the Outer Space Treaty’s non-appropriation principle differ from those of the Treaty’s authors.79

In contrast to earlier legal theory that denied the possibility of appropriation of any space resources, scholars now widely accept that extracting space resources from celestial bodies is a “use” permitted by the Outer Space Treaty and that extracted materials become the property of the entity that performed the extraction.80 Stressing the fact that the Treaty does not explicitly prohibit appropriating resources from outer space, other authors conclude that the use of extracted space resources is permitted, meaning that the new SPACE Act is a plausible interpretation of the Outer Space Treaty.81

However, scholars have been careful to cabin the extent to which they accept the legality of appropriation. For instance, although Thomas Gangale and Marilyn Dudley-Rowley acknowledge the legality of private appropriation of extracted space resources, they nonetheless emphasize that “[o]wnership of and the right to use extraterrestrial resources is distinct from ownership of real property” and that any such claim to real property is illegal.82 Lawrence Cooper is also careful to point out this distinction: “[t]he [Outer Space] Treaties recognize sovereignty over property placed into space, property produced in space, and resources removed from their place in space, but ban sovereignty claims by states; international law extends this ban to individuals.”83 Although there remain some scholars who still insist on the illegality of the 2015 U.S. law and State appropriation of space resources generally,84 their dominance has waned since the 1960s. These scholars are now a minority in the face of general acceptance among the legal community that minerals and other space resources, once extracted, may be legally claimed as property. 85

Taken together, the elements described above—statements made in the international arena, de facto appropriation of space resources in the form of moon rocks, the adoption of new national policies permitting appropriation of extracted space resources, and the weight of the international legal community’s opinion— indicate a fundamental shift in customary international law. The Outer Space Treaty’s non-appropriation clause has been redefined via customary international law norms from its broad application to now include a carve-out allowing appropriation of space resources once such resources have been extracted.

#### A second shift is underway that allows real, in-situ property rights, risking property conflicts.

Abigail D. Pershing, J.D. Yale, B.A. UChicago,’19, "Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today," Yale Journal of International Law 44, no. 1 (Winter 2019): 149-[xiv]

III. IMPENDING SECOND SHIFT IN CUSTOMARY INTERNATIONAL LAW'S INTERPRETATION OF THE NON-APPROPRIATION PRINCIPLE

In contrast to Part II, which dealt with customary international law relating to property claims over materials that are extracted from space, this Part explores customary international law in relation to the idea of appropriation of in situ space property. Section II.A first establishes current customary international law norms that prohibit in situ space property ownership via an examination of State practice and opiniojuris. Section II.B then suggests that, mirroring the first shift in customary international law norms related to extracted space resources, a nascent second shift in the interpretation of the non-appropriation principle regarding in situ space property ownership is likely on the horizon.

The prospect of high profits from the extraction of space resources will likely incentivize private companies and individuals to pressure States to recognize and protect private in situ property rights-which, as previously discussed, is not expressly prohibited by Article II of the Outer Space Treaty. As increasing government openness to private commercial space activities suggests, States will likely buckle under this pressure and allow private companies or private entities under State control to exercise ownership rights. Unless the international community acts soon to clarify the meaning of the nonappropriation principle of the Outer Space Treaty, it is possible that a second organic shift in customary international law will develop and allow for private ownership of in situ space property in further contravention of the original intent of the Treaty.

A. Current Rejection ofIndividual Property Rights in Space

Although the internationally recognized scope of the non-appropriation principle has been pared back to allow for the ownership of space resources upon extraction, there is still currently a general acceptance in customary international law that the principle prohibits States, individuals, and private corporations from owning in situ property in space. State practice, domestic legislation, and legal scholarship all tend to support this conclusion.

1. State Practice

Currently, States act in accordance with the original understanding of the non-appropriation treaty insofar as they have not endorsed individuals' claims to in situ property in space (as distinct from endorsement of property rights to resources after extraction).

One anecdote that exemplifies the United States' unwillingness to acknowledge private individuals' in situ property rights in outer space comes from the case Nemitz v. United States.8 6 On February 12, 2001, NASA's Near Earth Asteroid Rendezvous Shoemaker became the first spacecraft to land on the surface of an asteroid when it touched down on Eros, a twenty-one-mile long asteroid in the sun's orbit.8 7 On February 16, 2001, NASA received a letter from Gregory Nemitz, in which Nemitz claimed ownership over Eros (effectively asserting in situ property rights over the asteroid) and attempted to charge NASA a twenty dollar "parking/storage fee" for NASA's use of the asteroid. NASA General Counsel Edward Frankle's eventual response, after a series of back-andforth exchanges, was to deny that Nemitz had any property rights to the asteroid as a celestial body because to acknowledge otherwise would be in contravention of Article II of the Outer Space Treaty. 8 9 The matter was settled in court, with the presiding judge relying on similar reasoning in finding for NASA. 90 Other challenges to the principle of non-appropriation of in situ space property, most notably in the BogotA Declaration of 1976, have also been struck down. 91 In the Declaration, eight equatorial nations, including Colombia, Congo, Ecuador, Indonesia, Kenya, Uganda, and Zaire (now the Democratic Republic of the Congo), with Brazil as an observer, claimed sovereignty over in situ space property in the form of geostationary orbits above their territories.9 2 Geostationary orbits, thirty-six thousand kilometers above Earth's equator, are particularly valuable because at this distance a satellite orbits the Earth at a speed equal to the Earth's rotation, allowing that satellite to remain over a fixed point on the Earth's surface. 9 3 However, the BogotA Declaration's attempted appropriation of geostationary orbits was rejected internationally as inconsistent with Article II of the Outer Space Treaty. 9 4

Since the BogotA Declaration, there have not been any significant challenges to the non-appropriation principle concerning appropriation of in situ space property.9 5 There are also no major persistent State objectors who claim the right of ownership of in situ property.96 Although customary international law has come to accept State and individual ownership of extracted space resources, current State practice supports the conclusion that appropriation of in situ space property (in the form of entire celestial bodies, as with Eros, or particular swaths of space or orbits, as in the Bogoth Declaration) remains impermissible under the non-appropriation clause of the Outer Space Treaty.

2. Opinio Juris: Domestic Legislation

The United States has ensured that its commitment to the nonappropriation principle (other than the exception discussed above concerning extracted resources) is codified in domestic law. Restricting its otherwise expansive language, the SPACE Act of 2015 reads: "It is the sense of Congress that by the enactment of this Act, the United States does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body."97

Other countries have also recognized this limitation to private ownership of space in customary international law. For instance, commentary to the new Luxembourg law emphasizes that

“[t]he scope of this law is . . . limited to space resources and does not apply to asteroids, comets and celestial bodies as such, whose appropriation is prohibited by the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, a.k.a. the 1967 Outer Space Treaty."

In their explicit compliance with international law, other States' outer space laws similarly reject private appropriation of space. 9

3. Opinio Juris: Legal Scholarship

Legal scholars also generally accept that the non-appropriation principle legally extends to private individuals as well as to States.100 Articulations of this position tend to follow one of three lines of reasoning: (1) Article II implicitly bans individual appropriation; (2) even if Article II does not itself ban individual appropriation, the de facto outcome of the explicit bar in Article II against State appropriation of space will necessarily also preclude meaningful individual ownership; or (3) regardless of the language of Article II, customary international law itself precludes private in situ appropriation of land or property in space. But cracks are emerging even in these three seemingly strong legal arguments.

Several scholars assert that the language of Article II itself implicitly bans individual appropriation. The most straightforward argument in this line of reasoning is that the Treaty precludes all sovereignty and ownership in space and over its celestial bodies, regardless of whether "the claim comes from nationstates, natural persons, or juridical persons," indicating a complete moratorium on in situ property rights in space.10 Other scholars conclude that Article II implicitly bans private appropriation as well as State appropriation because property ownership implies control over access: given that Article I guarantees universal free access to all celestial bodies, private appropriation of any celestial body cannot legally occur.1 0 2

The second approach to the private appropriation question is perhaps the most common: a recognition that Article II does not explicitly or implicitly ban individual appropriation, but that in the absence of State endorsement of these rights (which itself is prohibited), "individual property" as such has no meaning. This approach is exemplified in Fabio Tronchetti's work. He explains:

[T]here is a general consensus on the fact that both national appropriation and private property rights are denied under the Outer Space Treaty .... Private entities are allowed to carry out space activities but, according to Article VI of the Outer Space Treaty, they must be authorized to conduct such activities by the appropriate State of nationality. But if the State is prohibited from engaging in certain conduct, then it lacks the authority to license its nationals or other entities subject to its jurisdiction to engage in that prohibited activity."'

Other scholars make similar arguments. Virgiliu Pop, for instance, claims that "[a]ppropriation of land can exist outside the sphere of sovereignty, but its survival is dependent upon endorsement from a sovereign entity." 0 4 Because "the Outer Space Treaty prohibits the national appropriation of outer space and celestial bodies," he argues "a State endorsement would be interpreted as a means of national -appropriation, hence it would be unlawful."10 5 Finally, approaching the question from a customary international law perspective, Deva Prasad emphasizes that both State practice and opinio juris "clearly support the fact that the non-appropriation principle is a customary international law," noting "widespread acceptance [of the] non-appropriation principle by the States" as well as the absence of any persistent objectors.1 Thus, even if Article II does not ban private individuals from owning land in and of itself, customary international law in the aggregate is enough to condemn private appropriation of land in space as illegal.

B. Emerging Theories ofIn Situ Property Rights in Space

Despite the evidence that customary international law currently proscribes in situ appropriation of space property, I argue that a nascent second shift in the interpretation of the non-appropriation principle, which would allow for such in situ ownership, is likely on the horizon. The possibility of such a shift arises from the sheer magnitude of the economic incentives private corporations will have to urge such a recognition. And, if States seek to establish in situ ownership, they will have at their disposal emerging legal arguments pointing to cracks in the theories that the non-appropriation principle bars private ownership of in situ property. Although not yet the basis for any State action, the increasing momentum of these theories portends a second shift in customary international law to allow for in situ ownership of space property

1. Economic Incentives Portending a Second Shift in Customary International Law's Interpretation of the Non-Appropriation Principle

The economic incentives for nations with space-faring capabilities to push for a second shift in customary international law's interpretation of the nonappropriation principle are astronomical. The value of the iron in 16 Psyche alone, an asteroid NASA is planning to explore via spacecraft to be launched in 2023, tops $10,000 quadrillion. 107 Although NASA is planning the venture for purely scientific purposes,108 this sort of money creates enormous incentives for private corporations to pressure their governments to secure the international recognition of private property rights.

The current legal regime recognized by States (in which property ownership is recognized for extracted resources only) is likely not enough assurance for commercial enterprises that their investments will be protected. For instance, although the United States has claimed the right to resources once they are extracted from outer space, there would still be significant legal uncertainty as to the rights to outer space mines themselves. Under the current system, China or Russia could legally profit from a U.S.-operated mining facility without having invested any of the initial capital because the Outer Space Treaty prevents the United States from appropriating the land which harbors the mine. There would also be legal questions concerning the establishment of permanent space colonies, a goal several private companies have announced their intention of pursuing. 109 Establishing a system of in situ property ownership is therefore likely to be significantly more appealing than a system that allows only for appropriation of extracted resources.

2. Legal Theories Supporting the Right to In Situ Private Property in Space

If States decide to explore this avenue, they will have at their disposal the work of several legal theorists, who rely on appeals to both textual arguments and to the realities of the fragility of space law, to push back against the currently accepted norm that private individuals cannot own land or other property in space. These theorists have been described as a "minority of authors," 10 but their claims may lay the foundation for a second shift in customary law. When technology develops to the point that individual appropriation becomes possible, international norms may shift for a second time, relying on these theories to exclude private individuals and corporations from the ambit of the nonappropriation principle.

From a textual perspective, proponents of this view often rely on the doctrine of expressio unius est exclusio alterius."11 This canon of construction dictates that expressly including one thing implies the exclusion of the alternative. Some legal scholars have applied this canon to the Outer Space Treaty to interpret Article II's failure to expressly ban private appropriation as an explicit indication that private appropriation is legal. Among such scholars are Alan Wasser and Douglas Jobes, who argue that "if the framers of the Outer Space Treaty had intended to mean that States may not authorize their citizens to do anything which they themselves cannot do, they would have written such language into the Treaty explicitly." 1 l 2 Once private individuals or corporations have appropriated space, States would be within their rights to recognize these claims. Thus, for example,

the United States simply could state that it would recognize claims by United States nationals (and perhaps by others as well) who discover valuable deposits of minerals or other wealth . ... Recognition of these claims (and protection of them, if necessary, from third parties) would not constitute "national appropriation" or the exercise of sovereignty over territory, but rather the exercise of United States jurisdiction over its citizens and of its power to protect them against third parties in international common areas. 13

According to some of these theorists, a narrow interpretation of Article II would legally "allow other entities like private companies and non-governmental organizations to appropriate territory."' 14

Another textual argument scholars have advanced to support a narrower reading of the non-appropriation principle is that the clause is exceedingly vague, and therefore State parties are free to interpret the principle however each sees fit.115 Instead of waiting years for international consensus and change, the United States on its own authority could simply "ignore the 1967 Space Treaty's nosovereignty provision" 11 6 and instead act in accordance with whatever provisions it deemed internally desirable. Putting a finer gloss on what is essentially the same point, Wasser and Jobes' view is that the non-appropriation principle has proven itself to be ambiguous, and as such, "each signatory must interpret for itself what its obligations are." 117 They later imply that the United States should do what is best for itself-which may mean allowing private appropriation of in situ space property." 8 Furthermore, some of these same scholars have suggested that the development of customary international law may not rest solely State actions and may be developed by non-State actors' actions as well. 119 Given the incentives private companies have to promote the right to property ownership in outer space despite Article I of the Outer Space Treaty, this prospect should be particularly disquieting for those who hope for an equitable distribution of space resources.

Accompanying these textual arguments, some scholars have suggested that such a shift would not be difficult to accomplish given the fragility and malleability of customary international law as it relates to space. As Wasser and Jobes point out, the United States and the Soviet Union were able to establish the basis of the customary international law for private appropriation of extracted resources simply by asserting ownership over moon rocks they brought back from space.1 20 Similarly, as to the establishment of rights to ownership of physical territory in space under customary international law, all that is needed may be "an international private settlement simply landing on and taking possession of a hunk of Lunar land." 12 1 Although attempting to appropriate the moon would likely generate an international outcry, it is not clear that the appropriation of a distant asteroid would incite significant protest, even though it could lay the foundation for a shift in customary international law. Significantly, such a shift may occur in State practice even if the legal arguments to support this change are weaker than the arguments supporting a continuation of the prohibition of private appropriation. Should States buckle to private commercial pressures or independently recognize the economic benefits of domestic companies obtaining private property in celestial territory, States would have a newfound interest in recognizing and protecting in situ rights. The legal justifications for de jure or de facto cooperation in non-recognition would likely become subordinate to economic incentives-spurring the adoption of new legal arguments to support shifting State interests.

IV. THE NEED FOR A NEW LEGAL ORDER

Given these trends, the international community would do well to rethink the Outer Space Treaty-and soon. Without a clearer articulation of what the international community agrees is the meaning and scope of the nonappropriation principle, it is entirely possible that States will use legal arguments like the ones outlined above to reinterpret Article II to serve the commercial interests of their domestic companies. Even in this new era of extraterrestrial enterprise, many of the norms underlying the Outer Space Treaty, such as equitable access and peaceful use, would remain important goals shared by members of the international community. Without an internationally agreedupon principle to guide State and private practice, however, these norms could become unobtainable and the fundamental spirit of the Treaty would again be violated. As Fabio Tronchetti puts it:

[I]f any subject was allowed to appropriate parts of outer space, the basic aim of the drafters of the Treaty, namely to prevent a colonial competition in outer space and to create the conditions and premises for an exploration and use of outer space carried out for the benefit of all States, would be betrayed. 1 22

But this outcome is not inevitable. Although economic pressures may make this second shift unavoidable, the international community still has the chance to orchestrate the manner in which this change occurs and work to set up a legal order to preserve the original goals and purposes of the Outer Space Treaty. This Part first examines various proposals in the literature for property rights allocation systems then proposes a new leasing system modeled on the U.N. Convention on the Law of the Sea (UNCLOS).

#### Space property conflicts cause space war.

William R. Kramer, Hawaii Research Center for Futures Studies @ University of Hawaii, '17, In dreams begin responsibilities – environmental impact assessment and outer space development, ENVIRONMENTAL PRACTICE, VOL. 19, NO. 3, 128–138

Benefits of extraterrestrial environmental impact assessment Most publications regarding outer space resources maintain that those resources are nearly limitless, and many business models for exploitation do not imagine that resources on Mars, for example, will ever be exhausted (Lewis, 1996; Zubrin, 1996; Renstrom, 2016). Ever is a long time. While the statement may be figuratively true for some mineral ores that may last through an individual company’s project timeline, it is not necessarily true for long-term planning. There will likely be competition for the rarest (most valuable) minerals. Without some form of planning and regulation, they may be extracted in an inefficient and environmentally damaging manner and be **quickly depleted** (as exemplified by hydraulic mining for gold on Earth, which wasted much of the resource and resulted in extensive environmental damage) (Merchant, 1998).

How might resources be put to their highest and best use unless regulated? Both the Moon and Mars have water ice which will be crucial for human survival, but water also has lucrative industrial uses; it is potentially the raw material for manufacturing both rocket fuel and oxygen. Conflicts over resource allocation may be better addressed during an assessment process that seeks to balance highest and best use with discovery and first use. Who gains access to specific areas for mining becomes more problematic in that the Outer Space Treaty does not allow “ownership” of extraterrestrial territory; there is no guarantee that companies such as those listed previously will gain access to the most productive sites. The China National Space Administration is planning to place a crew on the Moon by 2024, so **competition for the best sites will be intense** (Kramer, 2015b; China Digital Times, 2012).

Space industries generally are not considering that their proposed actions may preclude alternative uses such as scientific research and human settlement. There will be a stream of not yet imagined uses that could be adversely affected or foreclosed. Many of the same conflicts between land use and human habitation experienced on Earth may emerge on extraterrestrial sites. On the Moon, for example, there are preferable sites for collecting solar energy. These “peaks of eternal light” are areas nearly always or constantly exposed to sunlight at the poles. They are very limited in both distribution and size (Elvis, Milligan, and Krolikowski, 2016). If a mining operation were to determine such areas suitable for their operations, or if mining created a constant plume of dust that would diminish the effectiveness of solar panels, how might such a situation be resolved?

#### Space war goes nuclear.

Joan Johnson-Freese, Professor and chair of space science and technology @ Naval War College, 17, *Space Warfare in the 21st Century*, Routledge, ISBN 978131552917, p 18-20.

Space warfare runs two untenable risks: the creation of destructive debris and escalation to terrestrial, even nuclear, warfare. Kinetic warfare in space creates debris traveling at a speed of more than 17,000 miles per hour, which then in itself becomes a destructive weapon if it hits another object—even potentially triggering the so-called Kessler Syndrome,86 exaggerated for dramatic effect in the movie Gravity. Ironically, both China and the United States learned the negative lessons of debris creation the hard way. In 1985, the United States tested a miniature homing vehicle (MHV) ASAT launched from an F-15 aircraft. The MHV intercepted and destroyed a defunct US satellite at an altitude of approximately 250 miles. It took almost 17 years for the debris resulting from that test to be fully eliminated by conflagration re-entering the Earth’s atmosphere or being consumed by frictional forces, though no fragment had any adverse consequences to another satellite—in particular, no collisions. China irresponsibly tested a direct-ascent ASAT in 2007, destroying one if its defunct satellites. That test was at an altitude almost twice that of the 1985 US test. The debris created by the impact added 25 percent to the debris total in low Earth orbit87 and will dissipate through the low Earth orbit, heavily populated with satellites, for decades, perhaps centuries, to come. Perhaps most ironically, because of superior US debris-tracking capabilities, the United States—even though not required to do so—has on more than one occasion warned China that it needed to maneuver one of its satellites to avoid a collision with debris China itself had likely created.88 In 2013, a piece of Chinese space junk from the 2007 ASAT test collided with a Russian laser ranging nanosatellite called BLITS, creating still more debris.89 The broader point is that all nations have a compelling common interest in avoiding the massive increase in space debris that would be created by a substantial ASAT conflict.

Gen. Hyten has said that not creating debris is “the one limiting factor” to space war. “Whatever you do,” he warns, “don’t create debris.”90 While that might appear an obvious “limiting factor,” preparing to fight its way through a debris cloud had been a Pentagon consideration in the past. Now, however, sustaining the space environment has been incorporated into Pentagon space goals. Beyond debris creation, MacDonald points out that as China becomes more militarily capable in space and there is more symmetry between the countries, other risks are created – specifically, escalation.

That is, the United States could threaten to attack not just Chinese space assets, but also ground-based assets, including ASAT command-and-control centers and other military capabilities. But such actions, which would involve attacking Chinese soil and likely causing substantial direct casualties, would politically weigh much heavier than the U.S. loss of space hardware, and thus might climb the escalatory ladder to a more damaging war that both sides would probably want to avoid.91

MacDonald isn’t alone in concerns about escalation. Secure World Foundation analyst Victoria Samson has also voiced apprehension regarding US rhetoric that does not distinguish between actions against unclassified and classified US satellites, stating that “things can escalate pretty quickly should we come into a time of hostility.”92

Theresa Hitchens explained the most frightening, but not implausible, risk of space war escalation in a 2012 Time magazine interview. Say you have a crisis between two nuclear-armed, space-faring countries, Nation A and Nation B, which have a long-standing border dispute. Nation A, with its satellite capability, sees that Nation B is mobilizing troops and opening up military depots in a region where things are very tense already, on the tipping point. Nation A thinks: “That’s it, they’re going to attack.” So it might decide to pre-emptively strike the communications satellite used by Nation B to slow down its ability to move toward the border and give itself time to fortify. Say this happens and Nation B has no use of satellites for 12 hours, the time it takes it to get another satellite into position. What does Nation B do? It’s blind, it’s deaf, it’s thinking all this time that it’s about to be overwhelmed by an invasion or even nuked. This is possibly a real crisis escalation situation; something similar has been played out in U.S. Air Force war games, a scenario-planning exercise practiced by the U.S. military. The first game involving anti-satellite weapons stopped in five minutes because it went nuclear – bam. Nation B nuked Nation A. This is not a far-out, “The sky’s falling in!” concern, it is something that has been played out over and over again in the gaming of these things, and I have real fears about it.93 While escalation to a nuclear exchange may seem unthinkable, in war games conducted by the military, nuclear weapons are treated as just another warfighting weapon.

Morgan also voiced concerns about escalation generally and nuclear escalation specifically in the 2010 RAND report, stating: The adversary would also likely be deterred from damaging U.S. satellite early-warning system (SEWS) assets to avoid risking inadvertent escalation to the nuclear threshold, but that firebreak would almost certainly collapse with the conclusion that such escalation is inevitable and that it is in the adversary’s interest to launch a preemptive nuclear strike.94

#### It’s not too late, now is key to prevent the formation of customary rules allowing in situ property.

Melissa J. Durkee, J. Alton Hosch Associate Professor of Law, University of Georgia, ’19, "Interstitial Space Law," Washington University Law Review 97, no. 2 423-482 \*italics in original

The concern is not entirely misplaced. The theory is meant to be descriptive, yet even description can have a constitutive effect. To clarify, it must be true that articulating the terms, parameters, or potential uses of a legal doctrine can facilitate use of it. However, drawing attention to this potential argument could also help officials anticipate it. Because the theory clarifies the law-making consequences of state responsibility for private sector activity, it also facilitates responses by nations. They can either proactively regulate domestically or internationally in a way that avoids these law-making consequences, or trump those consequences with clear evidence of state practice or opinio juris.

For example, in the space law context, the argument is *not* that private sector activity has fully resolved an interpretive debate or developed a customary rule through the doctrine of attributed lawmaking, and, therefore, that we now have a clear answer to the question about private appropriation of space resources. Rather, the assertion is more modest: private sector activity is relevant *evidence* when determining whether such a rule has emerged. It is useful to highlight this evidence because governments that may object to it now know that the onus is on them do so. These governmental objections will also be relevant to the emerging interpretation or rule and could bar the emergence of the rule for which private actors are advocating.

### 1AC – Commercial Space

#### Advantage one: commercial space

#### The 2015 Space act unilaterally confers property rights to obtained resources, not property rights to celestial bodies.

Melissa J. Durkee, J. Alton Hosch Associate Professor of Law, University of Georgia, ’19, "Interstitial Space Law," Washington University Law Review 97, no. 2 423-482

There is state practice that is relevant to the interpretation of the Outer Space Treaty. Specifically, legislatures in the United States and Luxembourg have tried to use national law to simply legislate away the international ambiguity. 2 1 1 In the United States, the U.S. Commercial Space Launch Competitiveness Act of 2015 (the Space Act) explicitly granted to private parties rights in asteroid resources:

A United States Citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States.2 12

Unsurprisingly, the Space Act was passed in response to urging by private companies, who were seeking legislative certainty that their business plans would pass legal muster.2 13 The Act nevertheless specified in a "Disclaimer of Extraterritorial Sovereignty"-seemingly passed in order to ensure the United States' compliance with its obligations in the Outer Space Treaty-that "by the enactment of this Act, the United States does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body." 2 14 It also maintained a caveat, conferring rights to asteroid resources so long as they are obtained "in accordance with applicable law," explicitly to include international law.215 If international law in fact prohibits commercial mining and use of outer space resources, then the caveat may swallow the rule. Thus, the Act offers some evidence that the United States interprets the Outer Space Treaty to permit commercial mining, but with some persistent ambiguity.

#### But the lack of international cooperation creates uncertainty for commercial space.

Melissa J. Durkee, J. Alton Hosch Associate Professor of Law, University of Georgia, ’19, "Interstitial Space Law," Washington University Law Review 97, no. 2 423-482

That exchange led to an even more explicit pitch by Bretton Alexander, Blue Origin's Director of Business Development and Strategy. Alexander affirmed industry's "interpretation" of the Outer Space Treaty, but also implicitly recognized that this U.S. private sector interpretation could be an international outlier, and urged the U.S. government to affirm it with foreign counterparts:

I think it's important for the U.S. government through the State Department to be talking internationally with its counterparts, particularly in the U.N. Committee on Peaceful Uses of Outer Space about what the Space Treaty, Outer Space Treaty, allows and how we're interpreting that. It's important for us as an industry to have the certainty that comes with, like you said, with the 2015 law but also that it's founded in the Outer Space Treaty, which basically say[s] that those resources are available to everybody so that when we go, let's say, to the Moon and discover water ice there, we're not saying now we own every piece of resource on the Moon and every bit of water ice on the Moon; we're saying, you know, we are able to utilize what we are able to extract and be able to sell that and have property rights over that but not rights to the entire Moon. So I think it's important from a government perspective that we go out and explain what our interpretation of the treaty is and the framework that we're establishing and lead by example.2 36

The argument these companies are making is that they are on solid legal footing in their appropriation-permissive interpretation of the Outer Space Treaty, though they would prefer that the U.S. government take a more proactive role in asserting this interpretation internationally.

#### Business uncertainty poses an existential risk to the commercial space industry.

Melissa J. Durkee, J. Alton Hosch Associate Professor of Law, University of Georgia, ’19, "Interstitial Space Law," Washington University Law Review 97, no. 2 423-482

When Jeff Bezos, Elon Musk, and Google get behind a new idea, the world takes notice. All three are now entrants in the new commercial space race.' The result is Blue Origin, SpaceX, and the Lunar X Prize, and, according to Morgan Stanley, space may soon be a $1.1 trillion industry.2 Yet much of the planned commercial activity may be technically illegal. The legal question is whether companies may make commercial use of outer space resources. The answer depends on the proper interpretation of a ColdWar-era international treaty called the Outer Space Treaty, whose meaning is contested at crucial junctures.3 The debate about how to interpret this treaty is unfolding around the world at international institutions, think tanks, legislatures, and in the popular press.4 Industry presses for a resolution in favor of commercial use, claiming that uncertainty leeches investment dollars,' strangles weaker entrants,6 and stymies innovations that could solve critical problems on Earth.7 [\*\*Start Footnote 7\*\*See Richard B. Bilder, A Legal Regime for the Mining of Helium-3 on the Moon: US. Policy Options, 33 FORDHAM INT'L L.J. 243, 243, 246 (2010) (noting that the major spacefaring nations are exploring whether they can mine and bring to Earth Helium-3, thought to be present in large amounts in lunar soil; He-3, light enough to carry in a space shuttle, "is theoretically an ideal fuel for thermonuclear fusion power reactors, which could serve as a virtually limitless source of safe and non-polluting energy"

and eliminate Earth's dependence on fossil fuels for centuries). Yet others argue that international space law unequivocally prohibits extending capitalist resource appropriation to outer space.8 The debate is entrenched and, for the burgeoning space industry, existential.

#### He-3 mining key to nuclear fusion – creates unlimited energy.

Robert Zubrin, PhD Nuclear Engineering @ U of Washington and President of the Mars Society, ’19, The Case for Space: How the Revolution in Spaceflight Opens Up a Future of Limitless Possibility. Rowman & Littlefield.

The other proposal, that of University of Wisconsin professors Jerry Kulcinski and John Santarius and Apollo astronaut Harrison Schmitt, is far more interesting. 7 These gentlemen propose to mine the lunar regolith for its helium-3 and then export this unique substance to Earth for consumption in terrestrial fusion reactors. Now, one obvious and frequently noted flaw in this plan is that fusion reactors do not exist. However, that fact is simply an artifact of the mistaken priorities of the ladies and gentlemen in Washington, DC, and similar places who have been controlling scientific research and development for the past few decades. While, driven by international rivalry, the world's national fusion programs did advance forcefully between 1960 and 1990, the decision to consolidate all of them into a unified global effort to build the International Tokamak Experimental Reactor (ITER) has caused nearly all progress to screech to a halt since the 1990s. Lack of funding and drive, not any insuperable technical barrier, has blocked the achievement of controlled fusion in the years since. The total budget for fusion research in the United States currently stands at about $400 million per year— in real dollars, about one-third of what it was in 1980—and no new major experimental machines have been built by the US Department of Energy for thirty years. Under these circumstances, the fact that the fusion program has continued to creep forward and now is approaching ignition is little short of remarkable.

But now, in large part as a result of SpaceX's demonstration that it is possible for a hard-driving entrepreneurial organization to achieve things that previously it was believed only the governments of major powers could attempt, several very promising and creative start-up companies have received substantial funding from venture capitalists. Just as with space launch, a very dynamic private fusion power race is now underway, giving us every reason to expect success. All atomic nuclei are positively charged and therefore repel each other. In order to overcome this repulsion and get nuclei to fuse, they must therefore be made to move very fast while being held in a confined area where they will have a high probability of colliding at high speed. Superheating fusion fuel to temperatures of about 100,000,000°C gets the nuclei racing about at enormous speed. This is much too hot to confine the fuel using a solid chamber wall—any known or conceivable solid material would vaporize instantly if brought to such a temperature. However, at temperatures above 100,000°C, gases transition into a fourth state of matter, known as plasma, in which the electrons and nuclei of atoms move independently of each other. (In school, we are taught that there are three states of matter: solid, liquid, and gas. These dominate on Earth, where plasma exists only in transient form in flames and lightning. However, most matter in the universe is plasma, which constitutes the substance of the sun and all the stars.) Because the particles of plasma are electrically charged, their motion can be affected by magnetic fields. Thus, various kinds of magnetic traps (such as tokamaks, stellarators, and magnetic mirrors) have been designed that can contain fusion plasmas without ever letting them touch the chamber wall. At least, that is how it is supposed to work in principle. In practice, all magnetic fusion confinement traps are leaky, allowing the plasma to gradually escape by diffusion. When the plasma particles escape, they quickly hit the wall and are cooled to its very low (by fusion standards) temperature, thereby causing the plasma to lose energy. However, if the plasma is producing energy through fusion reactions faster than it is losing it through leakage, it can keep itself hot and maintain itself as a standing, energy-producing fusion fire for as long as additional fuel is fed into the system.

The denser a plasma is, the faster it will produce fusion reactions, while the longer individual particles remain trapped, the slower will be the rate of energy leakage. Thus, the critical parameter affecting the performance of fusion systems is the product of the plasma density (in particles per cubic meter) and the average particle confinement time (in seconds) achieved in a given machine. The progress that the world's fusion programs have had in raising this parameter, known as the Lawson parameter, is remarkable. Over the past forty years, it has been raised by a factor of ten thousand to reach the 10 20 s/m3 required for “breakeven,” a condition in which the power produced by the reaction is equal to the external power being used to heat the plasma. If we can increase it another factor of three, we will reach ignition, in which, once started, the plasma produces enough energy to heat itself. At that point, the energy return of the system becomes unlimited.

#### Solves waste dumping and warming

Damian Carrington, Environmental Editor for the Guardian, ‘16, "After 60 years, is nuclear fusion finally poised to deliver?," Guardian, https://www.theguardian.com/environment/2016/dec/02/after-60-years-is-nuclear-fusion-finally-poised-to-deliver

Even if things go well, getting real fusion power plants online before 2050 would be a triumph, raising an awkward question: what if fusion comes too late? Climate change is driving an accelerating transformation to low-carbon energy and drastic cuts in emissions are needed by 2050. If these are achieved, will there be a need for fusion power, which will be expensive at the start?

“It is certainly not going to be too cheap to meter,” says Campbell. But it’s a question of timescale, he says: “In the long term there are very few available options: renewables, fission and fusion.”

For Schwemmer, there is only one long-term option. “You would have to cover whole continents with wind turbines to produce the energy needed for 10 billion people,” he says. “And if our children’s children are not to sit on piles of [fission] nuclear waste, we have to make fusion work. Even if it takes till 2100, we should still do it.” Nuclear fission is also limited by uranium supplies, perhaps to a few decades if it were to play a large role.

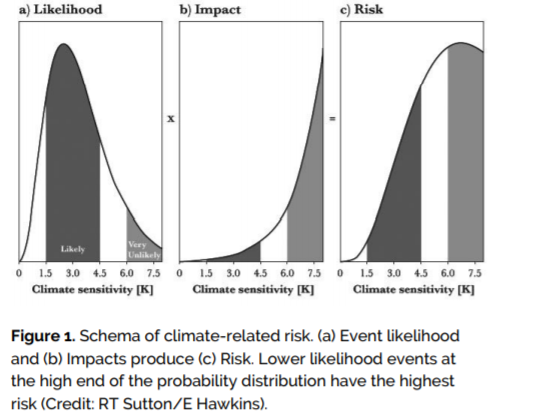
Bigot said: “People have to realise, if we want a breakthrough [that could provide energy] for millions of years, 10 or 20 years is nothing.” He thinks fusion may still come in time to meet the need to move the world to zero emissions in the second half of the century to defeat global warming.

#### Warming causes extinction.

David Spratt, Research Director for Breakthrough National Centre for Climate Restoration, Melbourne, and co-author of Climate Code Red: The case for emergency Action, and Ian Dunlop, member of the Club of Rome. Formerly an international oil, gas and coal industry executive, chairman of the Australian Coal Association, chief executive of the Australian Institute of Company Directors, and chair of the Australian Greenhouse Office Experts Group on Emissions Trading 1998-2000, ’19, “Existential climate-related security risk: A scenario approach,” Breakthrough - National Centre for Climate Restoration, BT Policy Paper.

EXISTENTIAL RISK

An existential risk to civilisation is one posing permanent large negative consequences to humanity which may never be undone, either annihilating intelligent life or permanently and drastically curtailing its potential. With the commitments by nations to the 2015 Paris Agreement, the current path of warming is 3°C or more by 2100. But this figure does not include “long-term” carbon-cycle feedbacks, which are materially relevant now and in the near future due to the unprecedented rate at which human activity is perturbing the climate system. Taking these into account, the Paris path would lead to around 5°C of warming by 2100. 7 Scientists warn that warming of 4°C is incompatible with an organised global community, is devastating to the majority of ecosystems, and has a high probability of not being stable. The World Bank says it may be “beyond adaptation”. But an existential threat may 8 also exist for many peoples and regions at a signifi- cantly lower level of warming. In 2017, 3°C of warming was categorised as “catastrophic” with a warning that, on a path of unchecked emissions, low-probability, high-impact warming could be catastrophic by 2050. 9 The Emeritus Director of the Potsdam Institute, Prof. Hans Joachim Schellnhuber, warns that “climate change is now reaching the end-game, where very soon humanity must choose between taking unprecedented action, or accepting that it has been left too late and bear the consequences.” He says 10 that if we continue down the present path “there is a very big risk that we will just end our civilisation. The human species will survive somehow but we will destroy almost everything we have built up over the last two thousand years.” 11 Unfortunately, conventional risk and probability analysis becomes useless in these circumstances because it excludes the full implications of outlier events and possibilities lurking at the fringes.12 Prudent risk-management means a tough, objective look at the real risks to which we are exposed, especially at those “fat-tail” events, which may have consequences that are damaging beyond quantification, and threaten the survival of human civilisation. Global warming projections display a “fat-tailed” distribution with a greater likelihood of warming that is well in excess of the average amount of warming predicted by climate models, and are of a higher probability than would be expected under typical statistical assumptions. More importantly, the risk lies disproportionately in the “fat-tail” outcomes, as illustrated in Figure 1.



This is a particular concern with potential climate tipping-points — passing critical thresholds which result in step changes in the climate system that will be irreversible on human timescales — such as the polar ice sheets (and hence sea levels), permafrost and other carbon stores, where the impacts of global warming are non-linear and difficult to model with current scientific knowledge. Recently, attention has been given to a “hothouse Earth” scenario, in which system feedbacks and their mutual interaction could drive the Earth System climate to a point of no return, whereby further warming would become self-sustaining. This “hothouse Earth” planetary threshold could exist at a temperature rise as low as 2°C, possibly even lower.13

#### Waste dumping causes extinction

MaryOlson**,** Director of the Southeast Office for the Nuclear Information & Resource Service, B.A. from Reed College, with a double major in Biology and History of Science, and subsequent study in chemistry and biochemistry at Purdue University, ‘95 NIRS publications – http://www.nirs.org/radiation/nwisolation\_zeroradioactivity.pdf

Reports of increased incidence of human cancers and diseases, particularly in children, as well as reproductive impacts in the effluent pathways of **nuclear facilities** undercut conclusions drawn primarily from study of external doses of gamma radiation. We are still in the process of describing the effects of chronic low doses of ionizing radiation on diverse populations. A number of new studies that sound an alarm about low doses of radiation were reviewed by Resnikoff and Fairlie (1997) and also Gofman (1997). Epidemiological studies, including the work of Wing et al (1991), Morgenstern et al (1997), Burlakova (1996) and others deliver findings that low doses of ionizing radiation cause more harm per unit of dose than higher exposures, calling into question standard dose-response ratios. These findings were anticipated by an independent analysis of data from Japanese atomic bomb survivors by Gofman (1990). **Genetic impacts are discussed less frequently than cancer.** A recent review by Edwards (1997) reports that ionizing radiation can cause **genetic impacts** that are not displayed for several generations. This genomic instability is an issue for all forms of life. Latent genetic damage not yet displayed, **is** like **a time bomb**. We should think of this as the committed dose to the biosphere, and our job as limiting the total body-burden of Earth. Each time some relatively low dose is approved, it allows levels of radiation or release of radioactivity that may become persistent- Radionuclides with a long half-life are cumulatively loaded into the environment and may result in impacts on health or long-term damage to the gene pool. Both entail loss and cost not only to the individual, but also to the systems they are part of. Genetic effects may be persistent within the population generation after generation. It is interesting to note that non-persistent radionuclides may also engender persistent effects within a population this way. Exposure standards which allow the release of radioactivity are based on the Law of Concentrated Benefit Over Diffuse Injury (Gofman 1993). This is not sustainable. What matters biologically is the sum of all these relatively small doses. The "just a little" paradigm does not remember that it is **the straw** that **breaks the camel's back**. The loading of the environment with releases of radioactivity from multiple sites - in the US alone, it is thousands of sites - violates the principle of precaution. Altering the collective gene pool of life on Earth is not an experiment that is reversible. In this case we can't wait until we are sure adverse effects are attributable to this cause and then adjust our programs. We must, from now on decide that zero is the only acceptable level, and allow no further increase in background radiation levels. People of the future have an equal right to a sustainable biosphere. They deserve the chance to continue to isolate our wastes. Anything we do with our radioactive waste must not preclude the possibility for them to maintain radioactive waste containment. The International Committee on Radiological Protection (ICRP) makes recommendations to regulatory bodies for radiation standards. ICRP advocates defining a justification for radioactive practices. This is then used to justify the exposures that the standard will allow. However, the exact opposite is what happens today (at least in the U.S.). If a set of assumptions can be given to show that a radioactive practice will meet the set regulation, it is automatically justified. The affected parties have little or no recourse. We must note that the vast majority of the involuntarily affected parties can't intervene because they have not yet been born, or they are not homo sapiens. There is also a large group of people out there now who would be banging down the door if they knew what was happening. They simply do not know because their governments and schools do not tell them. The informed public does not tolerate any level of involuntary and uninformed radiation dose. The only real cure for radiation health effects is prevention, and infomred people know this. In examining the "permissible dose" levels recommended by the ICRP for practices which result in the wastes we are concerned with, it is easy to see that ICRP privileges radioactivity when compared to the regulation of other harmful materials. The recommended standard of 100 millirems annual exposure for the public translates, using ICRP's dose - response assumptions, to a risk of 3.5 fatal cancers in 1000 people exposed annually over a lifetime of 70 years. ICRP uses a linear, quasi-no-threshold model. Doing the math, this is a lifetime **fatal cancer risk of 1 in 286.** By comparison, the regulation of toxic substances in the U.S. looks very protective. These also permit a lethal risk to those exposed, but the limit is set at only 1 fatal cancer in 1,000.000 or in some cases, 1 in 100,000 or 1 in 10,000. The nuclear industry is enjoying a tremendous privilege. That's a nice way to say it. The honest way to say this is that the nuclear industry has been granted a generous "bag limit" on the local populations. This bag limit is 35 times higher than the least protective toxic standards. Some think that these numbers don't mean anything. They share a collegial assumption that the linear, no-threshold model is conservative, designed to err on the side of safety. This is based on the idea that we have no data about low-dose exposures. Indeed we do. If ICRP were only to incorporate conclusions from the Hiroshima survivors (Preston 1987), they would multiply the risk factor by 3.4 —substantially increasing the acknowledged risk associated even with 100 mr dose levels to a 1 in 84, lifetime risk of fatal cancer. Other studies already cited place this factor even higher. Permissive radiation standards result in a subsidy to the nuclear industry. Those subject to lax regulation don't have to spend as much to prevent exposures and environmental contamination, or reduce waste production. Instead, the real cost is bora by those who receive the "allowable" dose. In fact, many of these people get a higher dose, since standards set an average allowable dose, but radioactivity is not known to distribute itself evenly in the environment. Communities in the effluent pathways suffer far more than the projected average. It is important to note that ICRP and national regulators who adopt their recommendations are under attack for the use of a linear, no-threshold model. Boosters for an industry that depends upon irradiating people, are saying that there is a huge threshold of exposure before any harm occurs. Some take the radical position that radiation is healthful. Decades of data do not support this, to the contrary, there is no safe dose. Nonetheless, ICRP's model, is not truly a linear, no-threshold equation. The use of the Standard Man, the ICRP's non-conservative Dose, Dose-Rate Effect Factor, adoption of "effective dose equivalent," and the use of averages create an effective threshold in their model. The public, and certainly other species, do not fit ICRP's assumptions in calculating the risk. There are layers of impact that are invisible to this model stemming from the greater sensitivity of the fetus, children and elders to radiation, and other factors. The resulting underestimation of harm becomes yet another cost to society and bonus to the **nuclear waste generators**. Those who suggest that these more sensitive groups might "skew" the results of study of low-dose radiation health effects are signing a death warrant for our species, and others as well. After all, Standard Men are not known to reproduce alone. "Effective dose equivalent" is a pernicious revision to radiation regulation. Any mechanism that permits a regulator to say that a dose has gone down while allowing radioactivity releases to go up is clearly serving those who contaminate the biosphere, not those that work to protect it. In my work with communities in the path of discharges from nuclear facilities that are ostensibly in compliance with so-called acceptable limits, it is clear that there is already a level of sacrifice of health and life that is not acceptable. One is reminded of other societies (who we might view as bizarre) sacrificing humans to their Sun God. Yet, here we are in the 20th century, living with regulations that condone the deaths of people who are in the communities that host nuclear sites.

### 1AC – Plan

#### United States federal government should form an international agreement with Russia to the effect that each will not interfere with property or equipment of the other nations on the moon, distinguishing property and equipment, such as flags and scientific instruments, from the territory they occupy.

### 1AC – Solvency

#### Only bilateral cooperation solves fast enough.

Henry R. Hertzfeld, PhD, Temple University; JD, George Washington University, MA, Washington University, BA University of Pennsylvania, Research Professor at Space Policy Institute, Elliott School of International Affairs, The George Washington University, and Scott N. Pace, Executive Director of the National Space Council, Former Director of the Space Policy Institute at the Elliott School of International Affairs at George Washington University, ‘13 “International Cooperation on Human Lunar Heritage” SCIENCE VOL 342 29

Finally, section 8 of the bill requires the Secretary of the Interior to submit the Apollo 11 lunar landing site to the United Nations Educational, Scientifi c, and Cultural Organization (UNESCO) for designation as a World Heritage Site. This violates Article II of the OST. All current World Heritage Sites are located on sovereign territory of nations. The only exception is a separate treaty that allows UNESCO to designate underwater sites (such as sunken ships) as protected cultural sites ( 7). These designations are very limited, and although the convention has been ratifi ed by 43 nations, the United States, Russia, and China are not among them. Thus, any new treaty of this type specifi cally for outer space would have little chance of being ratifi ed by the major space-faring nations.

A Proposal to Protect Lunar Sites

Although a new U.N. treaty for space artifacts of signifi cant cultural and historic importance may be reasonable someday, this would start a very long process with unknown outcomes. Such a treaty could be delayed to a point beyond the time when nations and/or companies may be active on the Moon ( 8).

Our suggested alternative is to create a bilateral agreement between the United States and Russia, offered as a multilateral agreement to other nations with artifacts on the Moon. This would be more legally expedient, politically sustainable, and would more likely meet and exceed the stated goals of the bill. It would also emphasize the important role of national laws to implement and enforce these international space agreements. Any nation with assets on the lunar surface will endeavor to protect those assets. This creates a situation where those nations have a timely, current, and common interest incorporating important implications for peaceful uses of outer space; scientific research and the advancement of knowledge; and cultural and heritage value, either presently or in the foreseeable future.

#### Unilateral action violates international law. Bilateral action creates follow on.

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Although the bill acknowledges treaty obligations of the United States, it would create, in effect, a unilateral U.S. action to control parts of the Moon. This would create a direct conflict with international law and could be viewed as a violation of U.S. commitments under the OST. It would be an ineffective way of protecting historical U.S. sites, and it fails to address interests of other states that have visited and will likely visit the Moon. It is legally flawed, unenforceable, and contradictory to our national space policy and our international relations in space (4).

There is a better way for the United States to protect its historic artifacts and equipment on the Moon. The first step is to clearly distinguish between U.S. artifacts left on the Moon, such as flags and scientific equipment, and the territory they occupy. The second is to gain international, not unilateral, recognition for the sites upon which they rest.

Aside from debris from crash landings (by Japan, India, China, and the European Space Agency), there are only two nations with “soft-landed” equipment on the lunar surface: the United States and Russia. China has plans to soft-land Chang'e 3 on the Moon in December 2013. All three nations (and any others wishing to participate) have much to gain and little or nothing to lose from a multinational agreement based on mutual respect and mutual protection of each other's historical sites and equipment.

#### The plan reinforces the OST and creates predictability for business quickly without touching sensitive issues.

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The United States, Russia, and China all engage in multilateral cooperative space programs. They share many economic and trade dependencies adding to the international importance of promoting cooperation in space and commerce. In spite of today’s charged political environment, an agreement of the type we propose may still be possible to negotiate because it focuses on the culture of space, the use of space to benefi t humankind, and the archaeological record of our civilization. It specifi cally would not touch sensitive issues of real property rights, export controls, human rights, or the weaponization of outer space. Cooperation on recognizing and protecting each other’s interests in historical sites and on equipment and artifacts also has no significant security, prestige, or technological impediments. It reinforces the basic principles of the existing space treaties, avoids declarations of sovereignty on the Moon, and encourages multilateral cooperation resulting in a more stable and predictable environment for private activities on the Moon.

#### Unilateral artifact protection doesn’t solve foreigninterference and violates the OST. Cooperative treaty clarifications key.

Beth O’Leary, Professor of Anthropology, New Mexico State University, ’15, "To Boldly Go Where No Man [sic] Has Gone Before:" Approaches in Space Archaeology and Heritage, Chapter 1 in *Archaeology and Heritage of Human Movement in Space*

What is the future for lunar preservation? In 2011, NASA issued recommendations to space faring entities on how to protect and preserve the historic and scientific value of U.S. Government artifacts when other commercial enterprises or nations return to the Moon (NASA 2011). NASA (2011) recommends a higher level of protection for Apollo 11 and 17 than the other US sites on the Moon and they make no recommendations for lunar sites belonging to other countries. The U.S. government, according to the Outer Space Treaty (OST) ratified in 1967, still owns the artifacts placed on the Moon, while prohibiting the ownership of the Moon or other celestial bodies and emphasizing the importance of access to space and international cooperation (Hertzfeld and Pace 2013: 1049). However, the OST does not address preservation issues of significant sites at a time when there are new players such as China and private entities such as Google, who is supporting a competition called the Google Lunar X prize where groups compete to be the first commercial venture to place robotics on the Moon.

The NASA (2011) recommendations are only guidelines that essentially seek ways to avoid damage to US property on the lunar surface. They are very important in that they recognize that future lunar visits could damage and destroy the historic and scientific values of artifacts and sites from the earlier space age.

On July 8, 2013 two U.S. Congresswomen introduced into the US Congress H.R. 2617, The Lunar Landing Legacy Act which proposed to designate the Apollo Programs landing sites and artifacts as a U.S. National Park under the U.S. Department of Interior (U.S. Congress 2013). This action follows an earlier attempt in 2000 to designate the Apollo 11 lunar landing site as a National Historic Landmark which was not supported by NASA or the U.S. Keeper of the National Register of Historic Places (O'Leary 2009a: 763) H.R. 2617 has been deemed legally flawed because it fails to address interests of other nations that have visited or will visit the Moon and it is perceived as a unilateral U.S. action to control parts of the Moon (Hertzfeld and Pace 2013: 1049). In effect, it can be perceived as a claim of sovereignty over the lunar surface.

H.R. 2617 has not been passed but it does show Congressional interest which acknowledges the importance of preserving and providing safeguards for its property, outside of simply declaring "ownership" of the American cultural material on the Moon. The treatment of these sites as well as the early Luna sites on the Moon put there by the former Soviet Union should not be based solely on what is owned but what humanity as a whole thinks should be protected from damage and destruction because the sites represent a series of extraordinary events that brought the human race for the first time to another celestial body. The idea of multilateral or international agreements, like the treaties for Antarctica, among the major players with material on the Moon: the U.S., Russia and China is ranked as superior to H.R. 2617 (Hertzfeld and Pace 2013: 1050). There is certainly the necessity to build cooperation in recognizing each nation's interest in the lunar sites and artifacts. An international agreement would reinforce the basic principles of existing space treaties and may be more expedient than amending the OST. What is valuable for scientific investigation, archaeological investigation and the public who wants to buy space objects and at some time visit the moon as tourists? Today's robotic X Prize competition by the Google affords the opportunity for commercial space exploration, and other nations such as China are currently involved in space. As in remote places like Antarctica, when it became available for tourism, the potential for the damage and destruction of sites increased. If commercial development follows the colonization of all parts of the world, it certainly will be the same for space. There may one day be a Starbucks on the Moon if it follows the same trends of tourism on Earth at those previously inaccessible places like the Forbidden city in China, war torn zones in Afghanistan, and late 19th and early 20th century polar exploration camps on Antarctica. In the absence of a strong international legal framework for space preservation and heritage, we are bound to lose significant objects and sites.