# 1AC vs. Rhys

## Plan

#### We affirm: The appropriation of outer space through asteroid mining by private entities is unjust.

#### We’ll defend a leasing regime operationalized by the UN Committee on Peaceful Uses of Outer Space (COPUOS) which should establish an International Outer Space Authority (IOSA). Forbidding appropriation through the end of permanent and exclusive claim over asteroids allows the streamlining and regulation of exploitation that provides the secure foundation for private space activities – the alternative is an ad-hoc CIL regime that decks legal certainty.

**Pershing 19** [Abigail D. Pershing, J.D., Yale, “Interpreting the Outer Space Treaty’s Non-Appropriation Principle: Customary International Law from 1967 to Today,” 2019, *The Yale Journal of International Law*, Vol. 44, https://openyls.law.yale.edu/bitstream/handle/20.500.13051/6733/Pershing.pdf?sequence=2&isAllowed=y, EA]

B. A New Property Rights Proposal: Leasing Space One promising proposal that does not appear to have received much attention in the literature is the concept of leasing space to nations, private individuals, or companies rather than allocating it as permanently-owned property. It appears that the only authors who have even tangentially considered the possibility of leasing property rights in space beyond rights to mineral extraction are Marcel Williams and G.S. Sachdeva. Williams’ writing is limited to a thought experiment in which he imagines renting out up to one percent of the moon’s surface. This property would be directly leased to national governments, which in turn would be vested with the power to sublease sections of this territory to private companies or individuals.134 This proposal is not elaborated any further and is left as a broad-strokes outline. The second mention of leasing or renting space comes from G.S. Sachdeva, who argues that a U.N. Space Superintendence Authority could grant leases to those able to pay.135 Yet this theory is limited to a discussion of renting property rights in particular orbits to allow for hovering geostationary space hotels and does not delve into questions of renting land on celestial bodies. The concept of leasing outer space deserves greater consideration by space law scholars. This Section sketches a brief outline of how such a system might operate via an internationally-run space property rental system modeled on UNCLOS. Although UNCLOS itself is deeply problematic in its potentially devastating environmental consequences and negative impacts on indigenous peoples as it regulates deep-sea mining,136 the UNCLOS model may nonetheless be the best option for preserving non-space-faring nations’ rights with regard to outer space, given its success in providing developing nations with a voice in the regulation of the high seas and the seabed beyond national jurisdiction.137 It is worth noting that although very few scholars appear to have considered the possibility of renting space, several have examined the similarities between UNCLOS and space law.138 The approach advanced here differs from the conventional approach to this comparison in that it suggests that the international community move beyond merely authorizing nations or individuals to extract a certain quantity of minerals and instead consider the possibility of leasing out actual tracts of space land. Opened for signature on December 10, 1982, UNCLOS establishes the international rules that govern the use of the world’s oceans and their resources. An examination of UNCLOS is especially apt because it deals with resources— the high seas—that, like space, are not subject to national appropriation. In language strikingly similar to Article II of the Outer Space Treaty, Article 137 of UNCLOS reads: No State shall claim or exercise sovereignty or sovereign rights over any part of the Area [resources of the seabed and ocean floor beyond the limits of national jurisdiction] or its resources, nor shall any State or natural or juridical person appropriate any part thereof.139 Although there are clear similarities between the two treaties, there are substantial differences as well, many of which would be useful in informing an update to the Outer Space Treaty. In addition to extending the prohibition on sovereignty to individuals as well as to nations, UNCLOS goes far beyond the Outer Space Treaty in detailing the limits of the non-appropriation principle. All of Part XI of UNCLOS, totaling fifty-eight Articles, gives a detailed description of how States can negotiate within the bounds of the non-appropriation principle to exploit ocean resources. Of particular relevance for purposes of crafting a parallel space law proposal is UNCLOS Part XI, Section 4, which lays out the rules governing the International Seabed Authority—the main mechanism through which States and private companies can legally exploit ocean resources, including mining of the deep seabed.140 Using UNCLOS as a model, a similar system may prove promising for the evolution of space law. However, the new space system should allow for rental of space land instead of merely allowing for the extraction of space resources. As with UNCLOS, any such space leasing system should be run through the United Nations. Situating such a system in this forum would help the international community stay true to the intentions of the Outer Space Treaty, which provides, in the words of one author, a “philosophical roadmap for the future development of the outer space legal regime.”141 Although a new committee within the United Nations could be formed for this purpose, the existing Committee on the Peaceful Uses of Outer Space (UNCOPUOS) would be an ideal environment for the creation and operation of such a system. UNCOPUOS is composed of eighty-seven geographically and economically diverse member States (including all the major space-faring States). Additionally, intergovernmental organizations and non-governmental organizations have observer status.142 Given its central mission to maintain space as a peaceful arena of international cooperation, as well as its representative composition,143 it would be an ideal body to bring a space leasing system to fruition. UNCOPUOS, in turn, should operationalize the leasing system by establishing a new International Outer Space Authority. This Outer Space Authority should parallel the International Seabed Authority described above.144 There should be similar provisions for the International Outer Space Authority relating to the makeup and functioning of the Authority (with each country getting one vote and decisions made by a two-thirds majority);145 the power of the Outer Space Authority to exercise control over space generally;146 the ability to decide how much rent to charge nations or individual corporations;147 and how to use these funds,148 among other provisions. For this proposed Outer Space Authority to be useful as well as operational, it is critical that it have jurisdiction over property rights in space beyond mining rights. Having rights to property in addition to rights to extracted minerals would add an extra layer of legal security for companies considering venturing into space for mining purposes. And, although businesses currently seem most interested in the possibilities of mining space resources, in the long term, questions of space tourism and the potential development of space colonies may arise. Having a flexible system in place that can adequately handle these concerns is therefore desirable. Instead of just focusing on mining, an Outer Space Authority with broader jurisdiction will have longer staying power and will require less reworking in the near future. Part of the appeal of this rental model is that it works so seamlessly with the current Outer Space Treaty. Turning again to the language of the Treaty and beginning with the non-appropriation principle, Article II lays out that “[o]uter space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”149 Because no State or individual would ever own land in space under a leasing system, this proposed leasing regime would not be in contravention to Article II. And yet, despite this, a leasing regime would establish enough legal security that exploitation of space resources would not be impeded—the main rationale for those who argue that the Treaty (or at least Article II) should be rescinded. Moreover, the principle established in Article I of the Outer Space Treaty, that “[t]he exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind,” is also upheld under this leasing regime.150 Leasing not only allows nations and private companies to exploit space resources and reap the benefits of their labor, but also directly benefits developing countries not yet able to tap into the resources of space by redistributing some of the space-going nations’ profits via a leasing fee and a tax on extracted resources. A potential argument against this rental system, as well as any other international legal system that would seek to regulate property rights in space, is that the United States never signed on to UNCLOS and there is nothing different about this situation that would cause the United States to join an international treaty regulating property in space either. However, space law has a fairly different history than the law of the sea. These differences make it more likely (though unfortunately not certain) that a proposal for an International Outer Space Authority would be adopted by the United States despite the fact that the facially similar UNCLOS proposal failed to garner a two-thirds majority vote in the Senate. The major difference between UNCLOS and this proposed International Outer Space Authority is that the United States has self-interested reasons for supporting an International Outer Space Authority, whereas it did not have similar reasons to join UNCLOS. The United States has maintained that under customary international law, deep seabed mining is already permissible.151 Since the United States does not recognize limitations of deep seabed mining established in UNCLOS, it may legally undertake deep sea mining under customary international law—a right that is codified in domestic U.S. law in the Deep Seabed Hard Mineral Resources Act: [I]t is the legal opinion of the United States that exploration for and commercial recovery of hard mineral resources of the deep seabed are freedoms of the high seas subject to a duty of reasonable regard to the interests of other states in their exercise of those and other freedoms recognized by general principles of international law . . . .152 The United States therefore already has access to what it wants without having to join UNCLOS. As an additional point, there is also not much pressure from American companies to ratify UNCLOS, in part because the American Exclusive Economic Zone (recognized by the United States under customary international law)153 and the continental shelf is hugely rich in the resources companies might otherwise have hoped to gain by joining the Treaty and gaining access to minerals from deep sea mining in other areas. Finally, not only does the United States stand to gain very little by ratifying the Treaty, there is an argument that ratification would disadvantage the United States. Under UNCLOS, “coastal States are required to make payments to the International Seabed Authority based on a percentage of revenues derived from the exploitation of the resources found within the continental margin beyond two hundred miles from the coast.”154 Notably, customary international law creates no such obligation.155 In stark contrast to UNCLOS, the new rental system proposed would directly benefit the United States. Unlike with deep sea mining, the United States and its citizens currently are bound by a treaty that prohibits appropriation of space: the Outer Space Treaty. Unlike the UNCLOS analogy, the United States has already relinquished rights in this arena. Agreeing to a leasing amendment would expand the scope of its rights, not infringe upon them. Additionally, the United States does not have access to an outer space “exclusive economic zone” in the same way that it does for the sea. Without some sort of agreement, the United States simply may not legally appropriate any in situ property in outer space. One final consideration increases the likelihood that the United States would in fact become a signatory to an amendment to the Outer Space Treaty. Such an amendment would likely have the support of businesses, environmental groups, and the military, an unlikely combination of key constituencies that would help push an amended treaty forward. Businesses would advocate for the change because it would provide a clearer mechanism for establishing property rights.156 Environmental groups might push for the amendment’s ratification because of the environmental protections that could be included in such an agreement.157 Finally, the military would also likely be a proponent of the system because having access to property in space gives strategic advantages158 and because it is likely that certain Cold War-era concerns that prompted spacefaring nations to sign the original Outer Space Treaty remain relevant—most notably, concerns over the weaponization of space.159 CONCLUSION The brief history of outer space law since the adoption of the Outer Space Treaty in 1967 highlights the ease with which customary international law shifts in this arena. Despite an original broad interpretation of the non-appropriation principle during the Treaty’s drafting, customary international law has since carved out an exception to this principle for extracted space resources. A second shift could be similarly underway. Driven by economic incentives, States may reinterpret the non-appropriation principle to allow for private appropriation of space property. Currently, States have an incentive to cooperate to establish a new international agreement concerning the use of outer space because international law, as it is presently understood, prohibits private property rights in space. A new amendment could broaden these rights, providing an enticing carrot to encourage State cooperation. But this enticement may soon disappear. Given the flexibility of the current outer space legal regime, customary international law could easily shift to interpret the non-appropriation principle as allowing private appropriation of property in space. Whatever the international community decides is the optimal solution regarding outer space property rights, it is vital that action be taken now to preserve the principles advanced by the Outer Space Treaty, such as equitable access and peaceful use of outer space. As the original drafters of the Outer Space Treaty recognized, these principles are best protected through a formal agreement and not merely through customary international law, which is often driven by the most powerful States. Regardless of whether a rental system similar to the one described above is established or some other method is used, the international community will have to act quickly if it wants to maintain shared international control over space. Pursuing an amendment to the Treaty as described also provides certainty and timeliness, two elements that would likely appeal to constituencies that might otherwise be supposed to be content with waiting for customary international law to shift.

#### That’s comparatively better for private entities than unlimited appropriation.

**Pastorius 13** [Claudia Pastorius, J.D., Barry University School of Law, “Law and Policy in the Global Space Industry's Lift-Off,” 2013, *Barry Law Review*, Vol. 19, Issue 1, https://lawpublications.barry.edu/cgi/viewcontent.cgi?article=1007&context=barrylrev, EA]

Two successful applications of the public trust principles that could influence the management of outer space resources are the International Telecommunications Union (ITU) and the United States Bureau of Land Management (BLM).298 The ITU issues licenses for orbital allocations of satellites and the use of radio frequencies.299 By necessity, the nation-states of the world have peaceably participated in the licensing regime.300 A true tragedy of the commons would result if our telecommunications channel appropriations were chaotic, and, if entities placed satellites into orbit unilaterally with no precautionary coordination.301 Without coordination and commitment to the rules, the overlapping noises would prevent people from hearing each other on the radio, and millions of dollars of satellite equipment, as well as our communication systems, would be at risk.302 The BLM raises an incredible amount of revenue for the government by selling leases of publicly managed lands for oil and natural gas exploration and exploitation to the United States.303 The BLM raised $233 million through leases of public lands in 2012 alone.304 Methods the BLM employs that could be adopted for use with outer space leaseholds are: (1) the auctioning of leases; (2) relative pricing per acre of lease payments depending on whether or not the land is producing; (3) imposing environmental resource management limits on resource exploitation, and (4) issuing fixed term leases with conditions for renewal.305 Some space law academics have noted that United Nations’ treaties and other space law accords will need to distinguish surface property rights on celestial bodies and extraction rights.306 Some even argue that asteroids should be treated as chattel and not land.307 The BLM legal property rights management is an excellent model to look to for establishing the legal property rights that will be needed in outer space for mining minerals, extracting water, and harvesting Helium-3. If leasehold estates held in trust were conferred in outer space, then measures could be taken to ensure optimal and equitable allocation of outer space leaseholds, and rules could be imposed to manage the sustainable exploitation of space resources.308 Problems such as space debris pollution could be avoided by reviewing development plans to ensure measures to prevent pollution, exit strategies of endeavors, or plans of relative permanence are in place before the projects take-off.309 Controversies regarding planned celestial land use and competing claims to more lucrative territories could be arbitrated and resolved on Earth. From an economic perspective, even though the possibility of “free” appropriation of outer space resources might encourage more space exploration initiatives, development with consistent and reliable rules would provide the stronger incentive of protecting the commercial investments in space exploration.310

#### The plan grants UNCOPUOS new authority in line with its existing mandates – any other process fails through circumvention and conflict

**Qizhi 86** [He Qizhi, member of the Governing Board of the Chinese Society of International Law, “On strengthening the role of COPUOS: Maintaining outer space for peaceful uses,” 1986, *Space Policy*, Vol. 2, Issue 1, https://www.sciencedirect.com/science/article/abs/pii/0265964686900032, EA]

The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) is the first and foremost among multinational organs working for the promotion of peaceful uses of space science and technology. COPUOS has become the forum for elaborating internationally accepted legal principles governing space activities. It has produced five international conventions on the exploration and peaceful uses of outer space, constituting the fundamental body of international space law. A number of other legal items - such as the draft principles on remote sensing from space, the elaboration of rules concerning the use of nuclear power sources in outer space, the definition and delimitation of outer space, and the principles on the use of geostationary orbit- remain on the agenda of the Legal SubCommittee, one of the two subordinate bodies. All of these questions have important bearing on the interests of every country. The most advanced question is establishing the principles of remote sensing; these discussions have entered a final stage and consensus may be reached in the near future, if a spirit of compromise and cooperation continues to prevail among the negotiating states. In the field of technical cooperation in space affairs, COPUOS and its other subordinate body, the Scientific and Technical Sub-Committee, have also done much work and achieved considerable successes. The United Nations Space Application Programme has greatly contributed to the dissemination and exchange of space technology for economic and social development. A series of training seminars and workshops on applications of space technology has been held under its auspices for participants from developing countries. Through this programme, technical advice is available on request. Viewed as a whole, the historic role of COPUOS is significant; however, there are deficiencies in its work and effectiveness. In order to maintain outer space for peaceful uses in the interests of all countries, particularly the developing countries, the Committee should be further strengthened to play a more productive and important role in expanding international cooperation. Legal framework It is useful here to provide a summary of the general legal regime upon which the peaceful uses of outer space have functioned. Its basic principles and rules are enshrined in the 1967 Outer Space Treaty - the main space law instrument of our times - and further developed in the four additional international treaties. All these documents were negotiated and concluded by COPUOS, and contain the following general provisions relating to the maintenance of outer space for peaceful uses. The exploration and use of outer space shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all humankind. Outer space shall be free for exploration and use by all states without discrimination, and is not subject to national appropriation by claim of sovereignty, by means of use or occupation or by any other means. Activities in the exploration and use of outer space shall be carried out in accordance with international law, including the Charter of the United Nations, in the interests of maintaining international peace and security and promoting international cooperation and understanding. Astronauts shall be rendered all possible assistance in the event of accident, distress or emergency. This provision was further elaborated by the 1968 Agreement on the Rescue of Astronauts and the Return of Objects Launched into Outer Space. States shall bear international responsibility for national space activities, whether carried out by governmental or non-governmental entities. This provision was further developed as the 1972 Covention on International Liability for Damage Caused by Space Objects. The launching state shall inform the Secretary-General of the United Nations of the required information concerning the space objects, and the state of registry shall retain jurisdiction and control over such objects and any personnel thereof. In support of this provision, the 1975 Convention on Registration of Objects Launched into Outer Space was elaborated. The fifth legal instrument, the 1979 Agreement Governing the Activities of States on the Moon and other Celestial Bodies (the Moon Agreement), is largely an elaboration of the general provisions of the 1967 Outer Space Treaty in the specific context of the Moon and other celestial bodies. It contains a new and important principle, that the Moon and its natural resources are the "common heritage of mankind', and that states party to the agreement shall establish an international regime to govern the exploitation of the natural resources of the Moon as such exploitation is about to become feasible'. These are the general principles and rules relevant to the peaceful uses of outer space. For instance, the principle of common benefit, though requiring further specification, constitutes a duty upon each member not to misuse outer space in a way which would lead to the detriment of the interests of humankind. So do the principle that international law (including the United Nations Charter) applies to space, and other principles. All of these contribute to the satisfactory functioning of peaceful activities in outer space. Two-pronged approaches To ensure outer space for peaceful uses, it is necessary not only to elaborate general principles as mentioned above, but also to make specific provisions directly involved with the protection of a peaceful environment in outer space which is the province of humankind. With regard to the destructive possibilities in outer space, foremost among them is the growing danger of militarization. This has deeply concerned the international community, even more than other possible harmful developments such as contamination, pollution and space debris. The 1967 Outer Space Treaty took a two-pronged approach in dealing with these direct dangers. First, foreseeing that outer space might become a battleground of the major space powers, the treaty lays down certain restrictions on military activities in outer space, thus providing some degree of arms control and disarmament. Paragraph I of Article IV stipulates: "states parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies or station such weapons in outer space in any other manner'. Paragraph II provides for general demilitarization of the Moon and other celestial bodies, and declares that they shall be used exclusively for peaceful purposes. The 1979 Moon Agreement makes further and far-reaching provisions for demilitarization of the Moon and other celestial bodies. It came into force in 1984, but has not been ratified by either of the two major space powers. It is clear from the existing provisions that, although prohibitions are placed on nuclear weapons and weapons of mass destruction, there is no express prohibition on the introduction of other kinds of weapons in outer space. It is generally held that this is a lacuna of the Outer Space Treaty which should be further discussed in the United Nations and eventually be filled. Second, in dealing with other potential dangers, Article IX of the Outer Space Treaty obliges its members (1) to conduct their space activities with due regard to the corresponding interests of all other states; (2) to avoid harmful contamination and adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter; (3) to undertake international consultations if such activities would cause potential harmful interference with activities of other states. Thus the Outer Space Treaty lays down principles of a general nature establishing as international obligation not to undertake activities which would adversely affect the space environment, while leaving concrete and detailed measures and provisions to be further elaborated in additional legal instruments. Considerations and conclusion The COPUOS, as the major United Nations organ dealing with space matters, has a key role to play in preserving outer space for peaceful uses. The following considerations could be raised with a view to increasing the contribution of COPUOS to the achievement of this lofty goal. One: strengthening and expanding the role of COPUOS in accordance with its mandate. In a resolution in 1961, the United Nations General Viewpoint Assembly decided that COPUOS should provide a focal point for international cooperation in the peaceful exploration and use of outer space. Thus, it is vital not to bypass COPUOS, nor to weaken its function by entrusting what falls within its terms of reference to a new forum or other organs. Two: reviewing the existing internationally accepted legal document by COPUOS and its Sub-Committees, with a view to supplementing or expanding the relevant principles to meet new developments. It has been pointed out that there are weaknesses and loopholes in the existing treaties. The best way to deal with these seems to be to retain the provisions covering related matters in the existing treaties as general principles, while elaborating supplementary rules by additional instruments. In this way, the original treaty could remain intact, with additional protocols being concluded consistent with the aim and principles of the main treaty. Three: reviewing the working method of COPUOS and its two Sub-Committees in order to find the best way to make them more effective. New relevant items, both technical and legal, could be placed on the agenda of COPUOS and the two Sub-Committees through consultation and discussion by the parties. This would help to keep COPUOS in accordance with its mandate as the only intergovernmental body exclusively concerned with all aspects of the peaceful uses of outer space. Four: involvement of COPUOS and its Legal Sub-Committees in the demilitarization of outer space, which is an essential condition for maintaining outer space for peaceful uses. COPUOS, while focusing its attention on peaceful uses, cannot but touch upon the other side of the question: the prevention of an arms race in outer space. Although the primary role of space arms control was entrusted to the Conference on Disarmament, COPUOS as the parent body of the Outer Space Treaty could also play a supportive role in the negotiations on space weapons. This would in turn add new impetus to international cooperation in the peaceful uses of outer space and progressive development of space law. In conclusion, the role of COPUOS should be strengthened in order to establish further the conditions essential for maintaining peaceful uses of outer space. In addition to general basic conditions, there are issues of control and elimination of destructive interferences: foremost among these is the growing danger of militarization of outer space. The issues of contamination, pollution and space debris have also to be dealt with. Only by properly solving these issues can the peaceful uses of outer space really be ensured.

#### No PICs – decks the whole regime.

**Hickman 2** [John Hickman and Everett Dolman, \* associate professor in the Department of Government and International Studies at Berry College, “Resurrecting the Space Age: A State-Centered Commentary on the Outer Space Regime,” 2002, *Comparative Strategy*, Vol. 21, Issue 2, https://www.tandfonline.com/doi/abs/10.1080/014959302317350855]

Is the collectivization of all of outer space under international law a permanent disability? Fortunately, the answer is no. Under international law, state parties to a treaty may withdraw from its obligations through negotiation, novation, substitution, cancellation, or, rebus sic stantibus, when events overcome the intent of the original treaty, such as when one or more of the other state parties has ceased to exist. Moreover, Article 17 of the OST articulates a straightforward mechanism for withdrawal: “Any state party to this treaty may give notice of its withdrawal from the treaty one year after its entry into force by written notification to the Depositary Governments. Such withdrawal shall take effect one year from the date of receipt of this notification.” Thus a state party need merely announce its intention to withdraw and then wait one year. Withdrawal of a single state party to the treaty, however, would not necessarily terminate the treaty between the other state parties. Yet, the decision of an important state not to be bound by a regime–creating treaty obviously endangers the entire treaty. The decision of the United States or China to withdraw from the OST would have far greater implications for the survival of the international space regime than the same decision by Bangladesh, Burkina Faso, or Papua New Guinea—the equality of states under international law remains nothing more than a useful fiction. For the OST to remain good international law, it must be accepted as such by the major space faring states of the 21st Century: the United States, Russia, the European Union, Japan, and China. One defection from the regime by a member of this group would no doubt lead to its effective collapse, as the remaining space faring states are unlikely to use the kind of coercion necessary to enforce the regime. A more likely response to such a defection is a scramble to make similar claims to sovereignty, based on historical precedent and effective occupation. Similar rushes to stake claims for territory sovereignty in other celestial bodies might follow.

## Advantage – Mining

#### Space mining coming now – lack of regulations makes conflicts likely.

**Zeisl 19** [Yasemin Zeisl, MSc in International Relations and Affairs from the London School of Economics and Political Science (LSE), “Three Salient Risks of Mining in Space,” 05/03/19, *GlobalRiskIntel*, https://www.globalriskintel.com/insights/three-salient-risks-mining-space, EA]

The harvesting of natural resources from space objects is the goal of numerous companies such as Planetary Resources or Deep Space Industries in the United States, Asteroid Mining Corporation in Scotland, or iSpace in Japan. While some companies such as iSpace are focusing on resources inside the Moon, others are developing strategies to identify and extract resources from asteroids and extinct comets. Given that calculations evaluate space mining as a highly lucrative business with potential profits amounting to trillions in U.S.-dollars, it is unsurprising that investment into space mining rose from 534 million USD in 2014 to 3.1 billion USD in 2018. Research institutions such as the Center for Near-Earth Object Studies (CNEOS) — which cooperates with the National Aeronautics and Space Administration (NASA) — detects, traces, and assesses risks of objects moving close to the Earth. Such calculations are relevant for future ventures into space mining, which will focus on metals such as platinum, gold, iron, rhodium, zinc, cobalt, and nickel, as well as water and carbon found in asteroids and extinct comets. Celestial ice would be particularly useful for generating rocket fuel by splitting it into hydrogen and oxygen. This may facilitate long space travel to destinations such as Mars. The usage of extinct comets as gas stations may bring engineers and scientists one step closer to the goal of colonizing Mars. While rocket fuel extraction may be a relatively feasible project for the near future, it is expected that harvesting metals from space may require several more decades to realize. Spotting the potential profitability of space mining, the United States passed the Commercial Space Launch Competitiveness Act in 2015 to grant U.S. citizens the right to harvest natural resources from celestial bodies. Similarly, Luxembourg established a space mining law and provided investment opportunities in August 2017. In January 2019, Russia started negotiating a bilateral cooperation arrangement with Luxembourg. The fact that there is no clearly defined international treaty on space mining poses a major risk. Although the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies of 1984 may provide some detail on the issue by asserting that no state, organization, or natural person can lay claim to any object in space, the fact that only 18 countries have committed to this multilateral treaty leaves the majority of states unbound by this regulation. An inconsistent legal landscape in regard to resource extraction of celestial bodies could lead to legal clashes between different countries and potential disadvantages for companies or organizations from certain countries. Mining in space could turn into a fierce competition among various private businesses and states. Therefore, licensing regulations will also have to be clearly defined. Licenses will help to clarify both ownership of yields and the relationships among miners, investors, and governments in order to avoid conflict in the future.

#### It’s feasible–best studies prove

Leonard **David**, 4-24-**2012**, "Is Asteroid Mining Possible? Study Says Yes, for $2.6 Billion," Space,<https://www.space.com/15405-asteroid-mining-feasibility-study.html> //SR

The prospect of mining asteroids may sound like science fiction, but that's exactly what the ambitious new company Planetary Resources, Inc. plans to do — and a recent study by NASA, university and private groups says it's actually possible. The in-depth study of the feasibility of asteroid mining was prepared for the Keck Institute for Space Studies (KISS) at the California Institute of Technology in Pasadena. It was released April 2, three weeks before today's unveiling by Planetary Resources of its billionaire-backed plan to tap into the riches locked inside near-Earth asteroids. While Planetary Resources is still years away from actually snatching up an asteroid and staking a cosmic claim, the KISS asteroid retrieval study details in extreme detail exactly how such a project could work. Two participants in the study were former Mars mission manager Chris Lewicki, now CEO of Planetary Resources, and former astronaut Tom Jones, who is advising the new company. The Asteroid Capture and Return mission — the central focus of the KISS study — blueprints the technological know-how to moving an asteroid weighing about 1.1 million-pound (500,000 kilograms) to a high lunar orbit by the year 2025. The mission's cost is expected to be $2.6 billion. Is asteroid mining really possible today? The top conclusions from the KISS study are that it appears feasible to identify, capture and return close to Earth an entire asteroid that is roughly 23 feet (7 meters) wide. This so-called near-Earth asteroid (NEA) would weigh in the neighborhood of 500 tons, according to the study. This feasibility rests on three major advances, Brophy told SPACE.com: Development of a ground-based observation campaign to discover and characterize potential target asteroids for return; Development of a sufficiently powerful solar electric propulsion system necessary to transport the asteroid back to lunar orbit in a reasonable time; Establishment of a human presence in lunar orbit to investigate and exploit this resource. Using current or soon-to-be technology, the asteroid could be fetched, and then deposited into high lunar orbit using a containerlike robotic spacecraft powered by a solar electric propulsion system. Moreover, such an endeavor "may be essential technically and programmatically for the success of both near-term and long-term human exploration beyond low-Earth orbit," the report says. Planetary Resources plans to build swarms of low-cost robotic spacecraft to extract resources from near-Earth asteroids.

#### Mining is coming now, but it’s shrouded by the space race

**Tosar 20** [(Borja Tosar, reporter) “Asteroid Mining: A New Space Race,” OpenMind BBVA, May 18, 2020, https://www.bbvaopenmind.com/en/science/physics/asteroid-mining-a-new-space-race/] TDI

This is not science fiction. There are now space mining companies, such as Planetary Resources, which has already launched several mini-satellites to test several of its patents. Other companies like Asteroid Mining Corporation or Trans Astronautica Corporation, although still far from their goal, are already attracting millions of dollars of private investment interested in being on the front line of a possible future space business. Is asteroid mining possible? This new space race already began back when the Hayabusa missions successfully returned a few grams of an asteroid’s regolith, so the technology to harvest asteroid material exists, we just have to change the scale. It is no longer a technological problem. Is it economically viable? We are increasingly dependent on rare elements (such as those in the palladium group), which are expensive to exploit on Earth and come with a high environmental cost, so the sum of these two factors could make it profitable to travel to the asteroids to extract these raw materials. Astrophysicist Neil deGrasse argues that the planet’s first trillionaire will undoubtedly be a space miner.

#### Successful mining unlocks crucial rare earth metal supplies for renewables and space colonization BUT legal uncertainty makes investment unviable.

**Doshi 16** [Priyank D. Doshi, J.D., Notre Dame Law School; B.A., University of Illinois Urbana-Champagne, “Regulating The Final Frontier: Asteroid Mining and The Need For A New Regulatory Regime,” 2016, *Notre Dame Journal of International & Comparative Law*, Vol. 6, Issue 1, https://scholarship.law.nd.edu/cgi/viewcontent.cgi?article=1055&context=ndjicl, EA – OCR used]

C Benefits of Asteroid Mining While Part I sought to show that asteroid mining is possible and will soon be a reality, it also raised the question of why asteroid mining might be something the international stage needs to pursue collectively and aggressively. The simple answer is two-fold: the need for the resources and future space exploration. C.i The Need For Resources Scientists posit that the key natural resources we will need to fuel and develop the modern economy will run out within the next fifty to sixty years.51 Key resources like platinum, zinc, copper, phosphorus, lead, gold, and indium, could become depleted on Earth very soon.52 As the push for more environmentally friendly solutions to things like energy surges, the actual replacement materials to support that dream grow more and more scarce. Wind turbines and solar panels use rare earth metals in their very construction, and the future of renewable energy will demand more of these resources.53 Even everyday items like batteries, jewelry, and computer chips use platinum, gold, and nickel, which are starting to become more and more expensive as their supplies decrease. The scarcity problem is exacerbated by the fact that a lot of these elements have no readily available alternative on Earth. Asteroid mining is the solution to the coming scarcity issues. Mining the asteroids isn’t just a capitalist dream; it is the average man’s necessity. Most of the minerals being mined on Earth, including gold, iron, platinum, and palladium, originally came from the many asteroids that hit the Earth after the crust cooled during the planet’s formation.54 Asteroids are suspected to be filled with an abundance of natural resources like gold, cobalt, iron, manganese, molybdenum, nickel, osmium, palladium, platinum, rhenium, rhodium, ruthenium, and tungsten that are worth billions to trillions of dollars.55 Speaking to just one of the many examples, Some of these Near-Earth Asteroids (NEAs) are metallic, composed of metals like iron and nickel, similar to the center of the Earth. One of these asteroids is 1986 DA, a metallic NEA 1.2 miles wide that is likely composed primarily of iron and nickel with significant amounts of gold and platinum. Estimates show 1986 DA contains approximately 10,000 tons of gold and 100,000 tons of platinum, which if completely recovered would be valued on today’s market at $460 billion and $5.6 trillion, respectively. Including the value of the iron and nickel, 1986 DA could be worth between $6 and $7 trillion.56 These NEAs are close enough to be mined and harvested for the development of human technology. John S. Lewis, professor of planetary science at the University of Arizona and author of Mining the Sky: Untold Riches from the Asteroids, Comets, and Planets, estimates that asteroid 3554 Amun is worth $20 trillion. Composed of platinum, iron, nickel, and cobalt, it has enough resources to pay off the U.S. national debt.57 It is estimated that there are about one to two million asteroids in the solar system that are large enough to consider for mining projects:58 Each of these asteroids is projected to weigh roughly two billion tons and “contain 30 million tons of nickel, 1.5 million tons of metal cobalt, and 7,500 tons of platinum.” The value of these items, for both private companies and governments around the world could be significant with the dollar value being somewhere in the trillions or higher. With nickel selling for $14,575 per ton, cobalt selling for $26,600 per ton, and platinum at $1,454 per ounce, mining one single asteroid could be more than profitable.59 Though these numbers presuppose that prices of the various resources would stay the same, they provide a telling picture of the potential wealth in wait and its ability to drastically alter the shape of the future.60 Providing more than a fix for natural resource shortages, asteroids also contain other elements that are scarce or practically nonexistent on Earth. One of these, helium-3, could be used as a low-cost, efficient energy source that gives only a fraction of the polluting effect of current practices.61 Helium-3 could potentially light the future, and that is just the beginning of the possibilities reaped from asteroid mining. C.2 Future Space Exploration The societal good that could be achieved from mining asteroids, which contain both rare-Earth minerals and scarce and/or non-existent resources, is self-explanatory. Similar is the resultant financial gain from these mining activities. There is extensive scholarship surrounding the potential value of asteroids, and this Note only scratches their proverbial surface. A large share of asteroids’ benefits is derived from their position in outer space. They will allow us to push further in space exploration and space colonization by drastically bringing down the cost of travel. To those still reading this with an eye of incredulity about space, this section may seem the most unnerving, but it is by far the important use for asteroid mining. The largest barriers to space exploration and space colonization are the cost of shipping materials from Earth, and the fuel limitations inherent in travel. Asteroid mining has the potential to help with both of these problems and act as the catalyst for the modern space age. The mining of NEOs will yield great quantities of hydrogen, helium, and water.62 These materials could be used to fuel human spacefarers, untying them from the need to be refueled or resupplied from Earth. More specifically, mined water could be extremely useful as rocket fuel or as a fuel for other power and propulsion systems.6’ If water can be found on asteroids (as many believe it can be) the water could also be broken down into its hydrogen and oxygen components, which can then be used to form the basic building blocks of rocket fuel.64 Mining water alone makes both space colonization and space exploration cheaper and consequently more feasible. Furthermore, sources of water have been identified: a 2006 announcement by the Kech Observatory claimed that 617 Patroclus, a Jupiter Trojan, was essentially an extinct comet that consists largely of ice. Similarly, Jupiter-family comets, and possibly NEAs that are extinct comets, might also economically provide water which through the process of in-situ resource utilization— using materials native to space for propellant, tankage, radiation shielding, and other high-mass components of space infrastructure—could lead to radical reductions in its cost for space exploration.65 Fuel tends to make up the greatest weight of rockets; the ability to produce fuel in space would provide much needed flexibility to survive in outer space and explore the depths of the solar system.66 Part I addressed the technology that is being developed by Planetary Resources and DSI for asteroid mining; that technology will help realize the benefits of asteroid mining for space travel. Launches from Earth could be cheaper if the shuttles were able to refuel at a DSI Propellant Refinery. Planetary Resources’ ARKYD- 300 could scout ahead for possible colonization sites on both asteroids and planets. Imagine a scenario where a DSI Harvestor mines the minerals needed to create a colony, and then the shuttle takes those materials, along with a DSI Microgravity Foundry, to build the colony itself.67 Fuel for spaceships to go further and resources to build and re-equip space colonies unburdened by the high costs of Earth-to-colony transport could be the stepping stone we need to begin the new age space race. Lastly, in addition to mining for supplies, we could also use asteroids as space stations. An asteroid-based space station could be highly beneficial to research and development. It has the potential to provide conditions that cannot easily be replicated on Earth, such as zero-gravity environments, freedom from atmospheric interference, and nearly continuous sunlight for solar power.68 While on the surface this may not seem like a large benefit, it will be invaluable as a place to test some of the radiation shielding problems that have historically stalled many long-term space exploration plans.69 Many people dismiss asteroid mining positing that the benefits are primarily financial ones that will do nothing more than further line already rich pockets. But the reality is far more layered than that simple assertion. Asteroid mining is a societal necessity for global advancement. Modern technology relies increasingly on rare and scarce resources; we will need to find a new source to continue the advancement. Any future with space exploration has to be grounded in the understanding that we will need a cheaper way to deliver materials in space. Asteroid mining is the answer. D Problems Surrounding Asteroid Mining While the significant benefits described above show the impending need and the rewards of asteroids mining, many problems must be addressed before asteroid mining becomes a certain fixture of the future. The main issues confronting asteroid mining are the needs for a massive upfront investment and the economic and political implications of mining asteroids in the future. The most obvious roadblock to asteroid mining is the high required upfront investment needed to participate. While Part I spoke to some of the plans that the NASA is supporting and the goals the agency has set, it omits an important point: the funding for NASA has decreased drastically over the last twenty years. Currently, it operates using the lowest percentage of the federal budget since I960.70 Just when we are on the cusp of cracking open the final frontier, the government is bowing out. According to a Collaborative Modeling for Parametric Assessment of Space Systems (COMPASS) team at NASA’s Glenn Research Center in Cleveland, the estimate for a successful asteroid capture endeavor is in the ballpark of $2.6 billion/1 while the government’s grant to NASA for its capture project is only around $100 million. 2 Private companies will have to take the lead and absorb the large costs associated with asteroid mining and space exploration. The costs only continue to increase beyond the creation of asteroid capture technology—from the harnessing technology, or the costs required for the transport and process of raw asteroidal material to Earth for use (on Earth or elsewhere). In this assessment, the administrative costs of running a company are not even taken into account. While the discussion of technology in Part I of this Note highlights a few successfully funded companies, the high costs operate as a roadblock for others. Even though the potential profits are massive, the initial risks of asteroid mining come close to swallowing the benefits. While both Planetary Resources and Deep Space Industries have been very tight-lipped about their costs, the list of big name investors and the ambitious plans insinuate investments in the hundreds of millions of dollars, at a minimum. As it stands today, mining asteroids is too theoretical and not yet profitable enough to ask the private industry to continue to dump billions into the endeavor. It will require more relative financial certainties, rather than mere mirages of wealth, to propel the industry. The current legal framework that is in place, as is described in the next section, is not adequate to incentivize investors for such a risky endeavor. These businesses want to be sure that the technology, funding, and efforts they put toward the development of space will be rewarded, and so a properly crafted property law regime, unique to outer space, must be developed to ensure that private space industry continues to invest in cosmic ventures and technologies.7’ The law needs to create a level of predictability and incentive structure that will actually make investors overlook the long path still ahead of them and see the end goal. Assuming the substantial financial roadblocks that exist are overcome and private money pours into the industry, there are still other economic and political considerations that are sources of serious concern before asteroid mining can become a reality. The central problem is the issue of control. Once private companies get into space, after investing their own money and bearing all the risk, they will want to control how things operate. To have them take all the risk and then expect corporations to willingly subordinate themselves from their spoils is a fool’s dream. So far, the government has had a limited response. On July 10, 2014, two Congressmen proposed the Asteroids Act, intended to facilitate the commercial exploration and utilization of asteroid resources to meet national needs and to promote the right of US commercial entities to explore and utilize resources from asteroids.74 The Act seeks to create property rights in resources extracted from asteroids, stating: “Any resources obtained in outer space from an asteroid are the property of the entity that obtained such resources, which shall be entitled to all property rights thereto, consistent with applicable provisions of Federal law.”75 The legislation, while noting that no state can lay claim to the asteroids, and giving corporations some protections on their investments, is still the beginning of a scary trend; a trend where national governments are granting and recognizing property rights subject to their own rule. This bill essentially sets the stage for a showdown for when an American company and a foreign company (with their country’s support) lay claim to the same asteroid. What happens when a Chinese company subject to Chinese laws starts to mine an asteroid that an American company has rights to under American law? What happens to any company not based in a major superpower, do they just cede their rights when a company backed by a more powerful nation intervenes? Individual governments’ respective abilities to regulate, as seen by the Asteroids Act, will lead to conflicting laws and conflicting claims that have the potential to create serious political and military ramifications. Putting aside the political chaos this could cause in the global system, the question of why corporations would even cede any control comes into question. With practically no governmental involvement in the initial stages of asteroid mining, why would corporations allow the government to share the benefits of something that they, in reality, have no jurisdiction over? Building on the conflict over control, who would control how much of the resource could be brought back? Markets already exist for a lot of the natural resources that would be mined on asteroids; bringing back a large load of the resource could wreak economic havoc on those existing markets and the political systems that rely on them. The social costs to resource-based countries alone would be catastrophic. Will the corporations care? Can any government really curb the corporation’s ability to flood the market? What stops them from creating a false market due to their ability to monopolize an asteroid? Is there a state interest in miner safety and other environmental considerations involved in extra-terrestrial mining? Who can really enforce any safety and protection regulations with only claimed jurisdiction? This non-exhaustive catalog of questions is asked in an attempt to understand the wide breadth of problems that will arise under the current regulatory regimes that are in place. The problems surrounding asteroid mining are more than just the high costs of investment; there are also questions about control and global cooperation over corporate activities in space. E Current Law The problems posed in the last section rise in part due to lack of legal clarity in this area. The international community has no policy that directly speaks to asteroid mining. It has instead relied on the interpretation of a series of tangentially connected treaties and agreements to address the burgeoning industry. This section is focused on briefly introducing some of the international agreements and treaties that try to govern space. The phrase “space law” draws a blank on most faces, as very little is actually known about the practice area. Still, despite the lack of public knowledge around international space law, there are quite a few guiding documents for asteroid mining, namely: the Outer Space Treaty of 1967, the Registration Convention of 1975, and the Moon Treaty of 1979. E.i The Outer Space Treaty of 1967 The Outer Space Treaty of 1967 was the first real international agreement dealing with space. Created in the midst of the Space Race and the Cold War, it was drafted to ensure that space did not become the next battleground. Its legacy has long outlived that original purpose, and almost 50 years later, it still stands as the primary agreement on international space law, serving as the foundation for all agreements and treaties that followed. The most marked and deliberate feature of the agreement was its rejection of the traditional concept of res nullius, or treating outer space as unclaimed territory that, since unclaimed, was open for conquest by anyone.76 The policy laid out in the Treaty opted for the res communis theory, there by all entities, individual or corporate, and nations have common or open access to the resources that are contained within its realm and are precluded from making any claims of ownership.77 The strong tone of the document and the widespread agreement of the treaty has led some to assert that celestial bodies are res extra commercium as whole, and cannot be owned.78 This treaty stands at the center of international space law today, making a breakdown of its relevant articles essential. Article I of the Treaty covers its general purpose. It states that, “the exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and interests of all countries...and shall be the province of all mankind.”79 It is important to recognize the lofty language in this international consensus, as it is the result of concessions given to developing nations. The developed, space-faring nations would have much preferred the open space principle to allow for them to stake their claim. However, they recognized that any international consensus had to take the opinions of developing countries into account, and developing nations refused any agreement that would impede their future rights to space exploration. That understanding still holds today, and any international cooperative agreement on space has to make some concession to the developing and non-space faring states to be workable long-term. Article II reiterates the underlying purpose of the agreement by stating that outer space “is not subject to national appropriation by claim of sovereignty.” But its broad language in this article has created a large and very controversial loophole: nowhere in prohibiting claims of ownership does the treaty mention corporations, private entities, or individuals.80 In fact, the treaty lacks [A]ny explicit mention of property rights. It does not, however, specifically reject individual or corporate property in space. The treaty only prohibits “national appropriation” of space by claim of sovereignty, use, occupation, or other means. The drafters of the Outer Space Treaty chose to limit this prohibition to nations, even though scholars at the International Institute of Space Law had suggested that the Treaty should prohibit “national and private appropriation.”81 This large loophole becomes extremely relevant given that the Outer Space Treaty is the only space-related treaty onto which the majority of the world has signed.

#### Huge REM shortage coming–acting now is key

**Cnn**, 5-5-**2021**, "Shortage of rare earth metals could hinder climate efforts, report warns," WRAL TechWire,<https://wraltechwire.com/2021/05/05/shortage-of-rare-earth-metals-could-hinder-climate-efforts-report-warns/> //SR

The world won’t be able to tackle the climate crisis unless there is a sharp increase in the supply of metals required to produce electric cars, solar panels, wind turbines and other clean energy technologies, according to the International Energy Agency. As countries switch to green energy, demand for copper, lithium, nickel, cobalt and rare earth elements is soaring. But they are all vulnerable to price volatility and shortages, the agency warned in a report published on Wednesday, because their supply chains are opaque, the quality of available deposits is declining and mining companies face stricter environmental and social standards. MORE COVERAGE: Read the full report online Limited access to known mineral deposits is another risk factor. Three countries together control more than 75% of the global output of lithium, cobalt and rare earth elements. The Democratic Republic of Congo was responsible for 70% of cobalt production in 2019, and China produced 60% of rare earth elements while refining 50% to 70% of lithium and cobalt, and nearly 90% of rare earth elements. Australia is the other power player.

#### Renewables remove leverage – staves off global conflict.

Roman **Vakulchuk 20**, PhD in economics, senior research fellow at the Norwegian Institute of International Affairs, and adjust professor at Nord University, “Renewable energy and geopolitics: A review,” 1/07/2020, Renewable And Sustainable Energy Reviews, [https://www.sciencedirect.com/science/article/pii/S1364032119307555#](https://www.sciencedirect.com/science/article/pii/S1364032119307555)!, cc

By contrast, the reduced conflict camp sees geopolitical tensions as less likely in a world that has renewables as its main source of energy (Peters [91], Verrastro et al. [92], Lacher and Kumetat [93], Kostyuk et al. [94], Escribano et al. [95], Johansson [96], Hoggett [97], Sweijs et al. [70], Månsson [72], Paltsev [98], Scholten and Bosman [54], Smith Stegen [99], Escribano [84], Freeman [85]). This camp emphasises that it is more difficult to control, cut the supply or manipulate the price of renewable energy than of fossil fuels and the expansion of renewables will therefore lead to greater energy self-sufficiency and less conflict. It shifts the focus from the external to the internal supply of energy, reducing the scope for conflict among states. An argument frequently used by this camp is that renewables are more difficult than fossil fuels to manipulate as they are less dense and more evenly distributed geographically. Månsson [72] holds the view that due to its geographic and technical characteristics, renewable energy creates few geopolitical motivations for states to start conflicts in order to control it. Peters [91], Tsao et al. [100] and Kostyuk et al. [94] similarly note that developing renewable energy would lead to a more equitable energy distribution and energy-based economic power, in turn leading to reduced geopolitical tensions. Also Overland et al. [101] found that geopolitical power will be more evenly distributed after a complete transition to renewable energy. In a related vein, Krewitt et al. [61] argue that the creation of international solar energy partnerships would have geopolitical advantages because they could “reduce economic imbalances between the North and the South and create global markets for future-oriented energy technologies without having to fear conflicts over scarce resources” (p. 23). The application of a resource scarcity perspective to the geopolitics of oil triggers energy-insecurity anxiety among states and implicitly or explicitly justifies aggressive behaviour in resource conflicts (Jaffe and Soligo [102], Stern [103]). This perspective is not simple to transpose onto renewables, as they are both non-exhaustible and abundant, except for the critical materials used in the production of renewable energy technologies (see Section 3.4 for more on this). Fischhendler et al. [104,105] exemplify how geopolitical arguments have been used to convince Israeli decision-makers to adopt renewable energy to reduce the country's energy dependence and improve its security. These arguments have led others to draw further conclusions. Compared to an energy system based on fossil fuels, in a system dominated by renewables, access to resources is less important than distribution and infrastructure management (Scholten and Bosman [54]). Escribano [84] implies the same when he writes that “[e]nergy dependence and security of supply lose geopolitical relevance, whereas technical and regulatory aspects gain weight” (p. 7). Many publications share an understanding that the location of renewable energy resources is as important as that of fossil fuels (Skeet [106], Criekemans [67], Criekemans [107]). However, location as a geopolitical concern is mainly relevant for the large-scale and not for the small-scale domestically-oriented production and transmission of electricity from renewable energy. O'Sullivan et al. [75] argue that if renewable energy is deployed on a large scale and cross-border trade in electricity grows, then the principle of territorial control will be similar to that for oil and gas pipelines: “[c]ountries like Algeria, Mexico or Morocco, or transit countries, or actors such as the Islamic State, could still try to leverage their geographical position and in case of conflict they could threaten to interrupt electricity supplies” (p. 41). Several authors also ask whether an external supply of electricity can be used as an “energy weapon” (e.g. Escribano et al. [95]). Renewable energy infrastructure, such as the ambitious but failed Desertec project, can also be an easy target for terrorists (Smith Stegen et al. [108]). The same logic can be applied to the location of biofuels. On the other hand, if countries produce electricity from domestic renewable energy sources, geopolitical tensions and risks might recede due to falling energy imports and reduced interdependence between countries (Strunz and Gawel [66]). Escribano et al. [95] and Scholten and Bosman [54] argue that the geopolitical risks associated with domestically produced renewable energy are close to zero if we apply the energy-security standards of IEA. Hoggett [97] similarly notes that small-scale photovoltaics (and nuclear power) technologies are likely to promote a secure low-carbon transition with reduced geopolitical risks. Some believe that it is likely that the consumption of renewable energy at the location of production will prevail over large-scale regional production and distribution as it is seen as much more efficient and cost-effective when compared to the long-distance distribution of electricity (Proedrou [109], Sovacool [110]). These authors therefore see geographical location as less important for renewable energy resources than for fossil fuels from a geopolitical perspective. Nevertheless, there is a risk of local conflicts involving non-state actors that could potentially be caused by increased global competition for the land required for renewable energy installations (Capellan-Perez et al. [82], Månsson [72], Johansson [96], Walker [111]). One issue seems to be stuck between the two camps: new interdependencies among states as a result of electricity interconnectors. Hache [81] discusses the possible emergence of new and unfamiliar inter-state interdependencies. Similarly, Westphal and Droege [64] argue that more electricity interconnectors between countries will lead to greater interdependence, which may translate into reduced international security. Pierri et al. [112] examine this question in the context of the European Union. Konstantelos et al. [113] discuss the division of costs and benefits among members of an integrated North Sea grid, making it similar to the difficulties caused by major pipeline projects. By contrast, Smith Stegen [99] argues that international affairs should benefit from renewables in many ways because their distribution will not be exposed “to the political and strategic dilemmas wrought by dependence on hydrocarbons” (p. 92). In a similar vein, IRENA [76] notes that electricity cut-offs and the use of hegemonic power to cut off transport bottlenecks will be greatly reduced due to increased rerouting possibilities, decentralised power generation and the absence of global electricity connections. But Smith Stegen [99] acknowledges that some tensions are possible due to increased interdependencies in such areas as high-voltage direct current (HVDC) transmission lines, biofuels and rare earth elements. Similarly, Verrastro et al. [92] and Lacher and Kumetat [93] see that renewable energy may strengthen energy security while facilitating the emergence of new interdependencies among states.

#### Also solves smart cities and critical infrastructure security.

**Konstantinou 21** [Charalambos Konstantinou, Senior Member, IEEE, “Towards a Secure and Resilient All-Renewable Energy Grid for Smart Cities,” 2021, *arXiv*, https://arxiv.org/pdf/2101.10570.pdf, EA]

Electric energy systems constitute the backbone of critical infrastructure. National security and economic vitality rely on a safe, secure, and resilient power system. The American electric grid, once considered a marvel of 20th century engineering, has become obsolete in the face of 21st century threats. Our energy grid has numerous shortcomings and can no longer deliver (cyber) secure and (disaster) resilient electric power to businesses and households, leading to an urgent and enormous threat to our society and economy. Vertical power systems with rigid transmission and distribution system control hierarchy have failed repeatedly during extreme threats. Recent studies by the Federal Energy Regulatory Commission (FERC) found that knocking out as 9 of the 55,000 power substations could result in U.S. coast-to-coast blackouts lasting 18 months or more [1]. For example, the Hurricane Michael resulted in 1.7 million power outages along the U.S. Gulf and Atlantic coasts [2]. During June – September 2007, heat waves and forest fires occurred in Greece causing extensive damages to the medium-voltage distribution network and knocking out power in many areas of the country [3]. Recovery from such disasters also costs tens of billions of dollars including time, manpower, and lost economic productivity, and deepen social inequalities. These failures have taught utilities, regulators, and stakeholders that faults cascade across national and continental electric grids, and exacerbating a local phenomenon into a socioeconomic catastrophe. Traditional power systems are prone to such cascading power outages that last long periods of time and are complex and time-consuming to recover – in other words, not secure and resilient. Continuing to operate the electric energy system critical infrastructure using the traditional model is a well-recognized security and resiliency threat and the main barrier for the development of future smart cities. The integration of photovoltaic (PV) solar systems and wind farms together with other renewable energy sources (RES) into the electric grid, as shown in Fig. 1, helps towards improving security and reliability of the power system during normal operations and enhancing resiliency during and after extreme events. In the first quarter of 2018, solar accounted for 55% of all new generating capacity brought online in the U.S. [4], and Florida alone is expected to add over 8.6 GW of solar generation by 2025. The inclusion of such distributed resources in the form of solar PV, battery-based storage, and demand resources can increase the resiliency to catastrophic events once research efforts would be able to address open system design questions. Examples include how to strategically locate and operate these resources to sustain smart cities infrastructure by guaranteeing continuity or rapid restoration of power to vital loads following large-scale disturbances by formation of adhoc self-contained microgrids in outage situations. In addition, as more and more RES are integrated into power systems, it is projected that offshore oil and gas platforms will be re-used at end-of-life stage for the production of renewable energy (e.g., offshore wind, wave and tidal energy, ocean current energy, ocean-based solar energy, deep-water source cooling, etc.). To thwart the existing problems, a transformational development approach needs to be established, able to develop and build a secure and resilient electric grid for future smart cities. Such development will lead to an electric energy system immune to extreme phenomena while supporting the integration of RES and reducing the dependency on oil drilling into power systems, such as those at the North Sea as well as the Gulf of Mexico and its coastal zone.

#### Smart cities solve sustainable development goals.

**İkizer 22** [İhsan İkizer, Faculty of Economics, Administrative and Social Sciences, Nişantaşı University, “Smart Cities, Citizen Welfare, and the Implementation of Sustainable Development Goals | Do Smart City Solutions Contribute to the Achievement of the Sustainable Development Goals?: Case of Istanbul,” 2022, IGI Global, EA]

Sustainable development has been an indispensable concept in many disciplines ranging from economics to public administration nearly in the last thirty years. As the years pass, the destructive effects of climate change and environmental degradation are being felt more than ever, and especially policy makers realize that it is not a conceptual or theoretical issue far from the practical life, but a bitter reality. Many important steps have been taken till now in order to ensure that our economic development does not endanger the needs of the future generations, and it does not harm social and cultural development of communities. Among these steps, maybe the most significant one is the Sustainable Development Goals (SDGs), which were adopted by the Heads of States and Governments in the United Nations (UN) in 2015. Although there is no mandatory mechanism that enforces the implementation of the SDGs, the central governments have pledged to achieve them, and some of them have presented their national reviews that indicate their progress. The problems that are referred in the 17 SDGs have not been caused by just one country, or different levels of governments, or business community, or consumers. Multiple actors in multiple countries have carried the stones that have led to the gigantic challenges that we face today. Therefore, the solution, or in other words the achievement of these 17 SDGs requires joint and coordinated action of the entire world, which means local, regional, national and global partnership among all stake holders, i.e. statutory bodies, NGOs, business community and science community. Partnerships organised at different levels are expected to ensure the participation of people, who are also responsible actors as consumers. After all, these goals have been set for the peace and prosperity of people of this generation and next generations, and awareness among people about the SDGs is a key factor to the success. Among these actors, local governments emerge as extremely eminent actors for two reasons: more than half of the world population live in cities, and they are the closest statutory bodies to people. It is not realistic to expect full achievement of the SDGs without the active engagement of local governments, as nearly two third of the 169 targets of the SDGs fall directly under the realm of local governments (Sustainable Development Goals and Habitat III: Opportunities for a successful New Urban Agenda, 2015). Although, it is central governments that have designed the SDGs, and monitoring the progress of countries is conducted by the representatives of central governments at ‘High-level Political Forum on Sustainable Development (HLPF)’, local governments are expected to be active actors in the implementation of the SDGs, next to central governments, together with other stake holders. In order for local governments to be effective actors in this challenging task, principles of good governance as well as translation of the SDGs and the targets into local context seem to be essential. Different cities with different size, development level, needs and features naturally have different strategies to achieve the localised SDGs. However, smart city technologies emerge as significant tools to be integrated into localised strategies for accelerating the achievement of the SDGs, especially the SDG 11, which is on sustainable cities and communities. The need for more effective and efficient use of information and communication technologies in cities has been better comprehended during the Covid-19 pandemic. Today, in many large urban areas, local governments use these technologies in various fields from transportation to waste management, in order to make their cities smarter, healthier and more sustainable. Istanbul, the largest city in Turkey, and a city that is bigger than more than 130 countries in the world, with a population of around 16 million, is among the cities where smart city technologies are being increasingly used day by day. In this chapter, the case of Istanbul will be analysed in terms of its smart city applications, and the contribution of these applications to the SDGs will be analysed. The chapter will start by setting the context of the SDGs and the concept of smart city, which will be followed by the discussion on the positive correlation between smart city technologies and sustainable development. The final part will concretize the discussion on the link between these two concepts through the case of Istanbul.

#### SDGs are leverage points that solve extinction BUT failure causes cascading risks that cumulatively outweigh any single risk, causing extinction

**Cernev 20** [Tom Cernev and Richard Fenner “The importance of achieving foundational Sustainable Development Goals in reducing global risk,” 2020, *Futures*, Vol. 115, https://doi.org/10.1016/j.futures.2019.102492]

4. Risks from failure to meet the SDGs 4.1. Cascading failures Fig. 3 demonstrates that cascade failures can be transmitted through the complex inter-relationships that link the Sustainable Development Goals. Randers, Rockstrom, Stoknes, Goluke, Collste, Cornell, Donges et al. (2018) have suggested that where meeting some SDGs impact negatively on others, this may lead to “crisis and conflict accelerators” and “threat multipliers” resulting in conflicts, instability and migrations. Ecosystem stresses are likely to disproportionately affect the security and social cohesion of fragile and poor communities, amplifying latent tensions which lead to political instabilities that spread far beyond their regions. The resulting “bad fate of the poor will end up affecting the whole global system"(Mastrojeni, 2018). Such possibilities are likely to go beyond incremental damage and lead to runaway collapse. The World Economic Forums’ Global Risks Report for 2018 shows the top five global risks in terms of likelihood and impact have changed from being economic and social in 2008 to environmental and technological in 2018, and are closely aligned with many SDGs (World Economic Forum, 2018). The report notes “that we are much less competent when it comes to dealing with complex risks in systems characterised by feedback loops, tipping points and opaque cause-and-effect relationships that can make intervention problematic”. The most likely risks expected to have the greatest impact currently include extreme weather events natural disasters, cyber attacks, data fraud or theft, failure of climate change mitigation and water crises. These are represented in Fig. 3 by the following exogenous variables. “Climate change” drives the need for Climate Action (SDG 13), “Cyber threat” may adversely impact technology implementation and advancement which will disrupt Sustainable Cities and Communities (SDG 11); Decent Work and Economic Growth (SDG 8) and the rate of introduction of Affordable and Clean Energy (SDG 7), with reductions in these goals having direct consequences in also reducing progress in the other goals which they are closely linked to. “Data Fraud or Threat” has the capacity to inhibit innovation and Industrial Performance (SDG 9), reducing competitiveness (and having the potential to erode societal confidence in governance processes). “Water Crises” (linked with climate change) have a direct impact on Human Health and Well Being (SDG 3) as well as reducing access to Clean Water and Sanitation (SDG 6) and reducing agricultural production which increases Hunger (SDG 2). The causal loop diagram also highlights “Conflict” as a variable (driven by multiple environmental-socio-economic factors) which together with regions most impacted by climate degradation will lead to an increase in migrant refugees enhancing the spread of disease and global pandemic risk, thus impacting directly on Human Health and Well Being (SDG 3) 4.2. Existential and catastrophic risk The level and consequences of these risks may be severe. Existential Risks (ER) have a wide scope, with extreme danger, and are “a risk that threatens the premature extinction of humanity or the permanent and drastic destruction of its potential for desirable future development” (Farquhar et al., 2017,) essentially being an event or scenario that is “transgenerational in scope and terminal in intensity” (Baum & Handoh, 2014). With a smaller scope, and lower level of severity, global catastrophic risk is defined as a scenario or event that results in at least 10 million fatalities, or $10 trillion in damages (Bostrom & Ćirković, 2008). Global Catastrophic Risk (GCR) events are those which are global, but they are durable in that humanity is able to recover from them (Bostrom & Ćirković, 2008; Cotton-Barratt, Farquhar, Halstead, Schubert, & Snyder-Beattie, 2016) but which still have a long-term impact (Turchin & Denkenberger, 2018b). Achieving the Sustainable Development Goals can be considered to be a means of reducing the long-term global catastrophic and existential risks for humanity. Conversely if the targets represented across the SDGs remain unachieved there is the potential for these forms of risk to develop. This association combined with the likely emergence of new challenges over the next decades (Cook, Inayatullah, Burgman, Sutherland, & Wintle, 2014) means that it is of great value to identify points within the systems representations of the Sustainable Development Goals that could both lead to global catastrophic risk and existential risk, and conversely that could act as prevention, or leverage points in order to avoid such outcomes. This identification in turn enables sensible policy responses to be constructed (Sutherland & Woodroof, 2009). Whilst existential threats are unlikely, there is extensive peril in global catastrophic risks. Despite being lesser in severity than existential risks, they increase the likelihood of human extinction (Turchin & Denkenberger, 2018a) through chain reactions (Turchin & Denkenberger, 2018a), and inhibiting humanity’s response to other risks (Farquhar et al., 2017). It is necessary to consider risks that may seem small, as when acting together, they can have extensive consequences (Tonn, 2009). Furthermore, the high adaptability potential of humans, and society, means that for humanity to become extinct, it is most likely that there would be a series of events that culminate in extinction as opposed to one large scale event (Tonn & MacGregor, 2009; Tonn, 2009). Whilst the prospect of existential risk, or global catastrophic risk can seem distant, the Stern Review on the Economics of Climate Change estimated the risk of extinction for humanity as 0.1 % annually, which accumulates to provide the risk of extinction over the next century as 9.5 % (Cotton-Barratt et al., 2016). With respect to identifying these risks, it is known that in particular, “positive feedback loops… represent the gravest existential risks” (Kareiva & Carranza, 2018), with pollution also having the potential to pose an existential risk.

#### Grid security is an impact filter.

**Denkenberger 21** [David Denkenberger, Anders Sandberg, Ross John Tieman, and Joshua M. Pearce, \* assistant professor of mechanical engineering at University of Alaska Fairbanks, “Long-term cost-effectiveness of interventions for loss of electricity/industry compared to artificial general intelligence safety,” 2021, *European Journal of Futures Research*, Vol. 9, Issue 1, https://doi.org/10.1186/s40309-021-00178-z, EA]

Civilization relies on a network of highly interdependent critical infrastructure (CI) to provide basic necessities (water, food, shelter, basic goods), as well as complex items (computers, cars, space shuttles) and services (the internet, cloud computing, global supply chains), henceforth referred to as industry. Electricity and the electrical infrastructure that distributes it plays an important role within industry, providing a convenient means to distribute energy able to be converted into various forms of useful work. Electricity is one component of industry albeit a critical one. Industry provides the means to sustain advanced civilization structures and the citizens that inhabit them. These structures play a critical role in realizing various futures by allowing humanity to discover and utilize new resources, adapt to various environments, and resist natural stressors. Though industry is capable of resisting small stressors, a sufficiently large event can precipitate cascading failure of CI systems, resulting in a collapse of industry. If one does not temporally discount the value of future people, the long-term future (thousands, millions, or even billions of years) could contain an astronomically large amount of value [18]. Events capable of curtailing the potential of civilization (existential risks, such as human extinction or an unrecoverable collapse) would prevent such futures from being achieved, implying reducing the likelihood of such events is of the utmost importance [100]. Reducing the prevalence of existential risks factors; events, systemic structures, or biases which increase the likelihood of extinction but do not cause extinction by themselves is also highly valuable. Complete collapse or degraded function of industry would drastically reduce humanity’s capacity to coordinate and deploy technology to prevent existential risks, representing an existential risk factor. Consequently, interventions preventing loss of industry, reducing the magnitude of impacts, or increasing speed of recovery could be extremely valuable. Existential risk research is, by nature, future focused, requiring the investigation of events that have not yet occurred. Futures studies methodologies are often applied to uncover salient trends or events, and explore potential causal structures [54, 123]. Probabilistic modeling techniques can then be used to determine the likelihood of such events occurring, including adequate treatment of uncertainty [101]. The cost-effectiveness modeling approach outlined in this paper is an example of this, attempting to assess the marginal utility of losing industry interventions on improving the long-term future. This approach could guide future efforts to assess the relative cost-effectiveness of interventions for different risks, existential or otherwise. More practically, this research can inform prioritization efforts of industrialized countries by providing estimates of the cost of global industrial collapse, and the utility of resilience interventions. This is relevant to the European Union which has a highly industrialized economy, providing $2.3 Trillion USD of the $13.7 Trillion USD global total of value add manufacturing [122]. The EU has shifted toward a more proactive foresight approach about natural and man-made disasters, noting the importance of rare high-impact events, systemic risks, and converging trends requiring better data and forecasting to drive a more ambitious crisis management system [47]. Still, it is clear that most academic and institutional emphasis has been on “ordinary” rather than extreme disasters, and risks from industry to the public and environment rather than widespread failures of industrial services causing harm. The integrated nature of the electric grid, which is based on centralized generation makes the entire system vulnerable to disruption.1 There are a number of anthropogenic and natural catastrophes that could result in regional-scale electrical grid failure, which would be expected to halt the majority of industries and machines in that area. A high-altitude electromagnetic pulse (HEMP) caused by a nuclear weapon could disable electricity over part of a continent [16, 48, 66, 93]. This could destroy the majority of electrical grid infrastructure, and as fossil fuel extraction and industry is reliant on electricity [49], industry would be disabled. Similarly, solar storms have destroyed electrical transformers connected to long transmission lines in the past [117]. The Carrington event in 1859 damaged telegraph lines, which was the only electrical infrastructure in existence at the time. It also caused Aurora Borealis that was visible in Cuba and Jamaica [70]. This could potentially disable electrical systems at high latitudes, which could represent 10% of electricity/industry globally. Though solar storms may last less than the 12 h that would be required to expose the entire earth with direct line of sight, the earth’s magnetic field lines redirect the storm to affect the opposite side of the earth [117]. Lastly, both physical [6, 8, 69, 89, 111] and cyber attacks [3, 63, 90, 96, 118, 128, 130] could also compromise electric grids. Physical attacks include traditional acts of terrorism such as bombing or sabotage [130] in addition to EMP attacks. Significant actors could scale up physical attacks, for example by using drones. A scenario could include terrorist groups hindering individual power plants [126], while a large adversary could undertake a similar operation physically to all plants and electrical grids in a region. Unfortunately, the traditional power grid infrastructure is simply incapable of withstanding intentional physical attacks [91]. Damage to the electric grid resulting in physical attack could be long lasting, as most traditional power plants operate with large transformers that are difficult to move and source. Custom rebuilt transformers require time for replacement ranging from months and even up to years [91]. For example, a relatively mild 2013 sniper attack on California’s Pacific Gas and Electric (PG&E) substation, which injured no one directly, was able to disable 17 transformers supplying power to Silicon Valley. Repairs and improvements cost PG&E roughly $100 million and lasted about a month [10, 102]. A coordinated attack with relatively simple technology (e.g., guns) could cause a regional electricity disruption. However, a high-tech attack could be even further widespread. The Pentagon reports spending roughly $100 million to repair cyber-related damages to the electric grid in 2009 [57]. There is also evidence that a computer virus caused an electrical outage in the Ukraine [56]. Unlike simplistic physical attacks, cyber attackers are capable of penetrating critical electric infrastructure from remote regions of the world, needing only communication pathways (e.g., the Internet or infected memory sticks) to install malware into the control systems of the electric power grid. For example, Stuxnet was a computer worm that destroyed Iranian centrifuges [73] to disable their nuclear industry. Many efforts are underway to harden the grid from such attacks [51, 63]. The U.S. Department of Homeland Security responded to ~ 200 cyber incidents in 2012 and 41% involved the electrical grid [103]. Nations routinely have made attempts to map current critical infrastructure for future navigation and control of the U.S. electrical system [57]. The electric grid in general is growing increasingly dependent upon the Internet and other network connections for data communication and monitoring systems [17, 112, 118, 127, 135]. Although this conveniently allows electrical suppliers management of systems, it increases the susceptibility of the grid to cyber-attack, through denial of webpage services to consumers, disruption to supervisory control and data acquisition (SCADA) operating systems, or sustained widespread power outages [3, 72, 118, 120]. Thus global or regional loss of the Internet could have similar implications.

#### Cyberattacks trigger nuclear retaliation.

**Klare 19** [Michael T. Klare, professor emeritus of peace and world security studies at Hampshire College, “Cyber Battles, Nuclear Outcomes? Dangerous New Pathways to Escalation,” November 2019, *Arms Control Today*, https://www.armscontrol.org/act/2019-11/features/cyber-battles-nuclear-outcomes-dangerous-new-pathways-escalation, EA – ability edited]

Yet another pathway to escalation could arise from a cascading series of cyberstrikes and counterstrikes against vital national infrastructure rather than on military targets. All major powers, along with Iran and North Korea, have developed and deployed cyberweapons designed to disrupt and destroy major elements of an adversary’s key economic systems, such as power grids, financial systems, and transportation networks. As noted, Russia has infiltrated the U.S. electrical grid, and it is widely believed that the United States has done the same in Russia.12 The Pentagon has also devised a plan known as “Nitro Zeus,” intended to ~~immobilize~~ the entire Iranian economy and so force it to capitulate to U.S. demands or, if that approach failed, to pave the way for a ~~crippling~~ air and missile attack.13 The danger here is that economic attacks of this sort, if undertaken during a period of tension and crisis, could lead to an escalating series of tit-for-tat attacks against ever more vital elements of an adversary’s critical infrastructure, producing widespread chaos and harm and eventually leading one side to initiate kinetic attacks on critical military targets, risking the slippery slope to nuclear conflict. For example, a Russian cyberattack on the U.S. power grid could trigger U.S. attacks on Russian energy and financial systems, causing widespread disorder in both countries and generating an impulse for even more devastating attacks. At some point, such attacks “could lead to major conflict and possibly nuclear war.”14

#### Any nuclear war causes extinction – ice age and famine.

Steven **Starr 15** [Director of the University of Missouri’s Clinical Laboratory Science Program, as well as a senior scientist at the [Physicians for Social Responsibility](http://www.psr.org/). He has worked with the Swiss, Chilean, and Swedish governments in support of their efforts at the United Nations to eliminate thousands of high-alert, launch-ready U.S. and Russian nuclear weapons. “Nuclear War: An Unrecognized Mass Extinction Event Waiting To Happen.” Ratical. March 2015.<https://ratical.org/radiation/NuclearExtinction/StevenStarr022815.html>] TG

A war fought with 21st century strategic nuclear weapons would be more than just a great catastrophe in human history. If we allow it to happen, such a war would be a mass extinction event that [ends human history](https://ratical.org/radiation/NuclearExtinction/StarrNuclearWinterOct09.pdf). There is a profound difference between extinction and “an unprecedented disaster,” or even “the end of civilization,” because even after such an immense catastrophe, human life would go on. But extinction, by definition, is an event of utter finality, and a nuclear war that could cause human extinction should really be considered as the ultimate criminal act. It certainly would be the crime to end all crimes. The world’s leading climatologists now tell us that nuclear war threatens our continued existence as a species. Their studies predict that a large nuclear war, especially one fought with strategic nuclear weapons, would create [a post-war environment in which for many years it would be too cold and dark to even grow food](http://climate.envsci.rutgers.edu/pdf/RobockToonSAD.pdf). Their findings make it clear that not only humans, but most large animals and many other forms of complex life would likely vanish forever in a nuclear darkness of our own making. The environmental consequences of nuclear war would attack the ecological support systems of life at every level. Radioactive fallout, produced not only by nuclear bombs, but also by the destruction of nuclear power plants and their spent fuel pools, would poison the biosphere. Millions of tons of smoke would act to [destroy Earth’s protective ozone layer](https://www2.ucar.edu/atmosnews/just-published/3995/nuclear-war-and-ultraviolet-radiation) and block most sunlight from reaching Earth’s surface, creating Ice Age weather conditions that would last for decades. Yet the political and military leaders who control nuclear weapons strictly avoid any direct public discussion of the consequences of nuclear war. They do so by arguing that nuclear weapons are not intended to be used, but only to deter. Remarkably, the leaders of the Nuclear Weapon States have chosen to ignore the authoritative, long-standing scientific research done by the climatologists, research that predicts virtually any nuclear war, fought with even a fraction of the operational and deployed nuclear arsenals, will leave the Earth essentially uninhabitable.

#### Space col prevents otherwise inevitable extinction.

**Green 21** [Brian Patrick Green, director of technology ethics at the Markkula Center for Applied Ethics, Santa Clara University, “Space Ethics,” 2021, Rowman, pp. 5, EA]

Another reason that humans may want to explore space would be to create a “backup Earth” to hedge against global catastrophic and existential risks (risks that may cause widespread disaster or human extinction, respectively) on our home planet. 8 Earth has always been a dangerous place for humans, with asteroid impacts, supervolcanic eruptions, pandemic disease, and other natural hazards threatening civilization. Now, in addition to these natural threats, human-made hazards such as nuclear weapons, climate change, biotechnology, nanotechnology, and artificial intelligence may threaten not only the viability of technological civilization but perhaps the survival of human life itself. A serious global-scale catastrophe could set back civilization many decades or centuries, and the worst disasters could cause human extinction. In one scenario, in which 100 percent of humanity dies, all of human effort for all of history would be for nothing. However, were the same global catastrophe to happen to Earth, yet humans were a multiplanetary species with just one self-sustaining settlement off-Earth, it would not result in the end of human civilization or human extinction. Instead while the same unimaginable fate would befall the Earth (certainly no mere triviality, with perhaps the deaths of 99.999 percent of all humans and possibly the destruction of the ecosphere and everything in it), at least all of human and planetory history would not be for nothing. Human life and culture would go on elsewhere, as well as other Earth species. This is a dire fate, but less terrible than the first.

#### Immeasurable expected value outweighs.

**Baum 16** [Seth D. Baum, Executive Director of the Global Catastrophic Risk Institute, “The Ethics of Outer Space: A Consequentialist Perspective,” 2016, Springer, pp. 115-116, EA]

Space colonization is notable because it may be able to bring utterly immense increases in intrinsic value. Early colonies might start small, given that other planets and moons have inhospitable environments. However, it may be possible to build large indoor colonies or create more hospitable outdoor environments (i.e., terraforming). Even just on other planets and moons in the Solar System, space colonies could multiply the total area available for human habitation. And there are many more planets around other stars, as ongoing research on exoplanets is now learning. One recent study estimates 22 % of Sun-like stars have Earth-like exoplanets (Petigura et al. 2013), implying billions to tens of billions of potentially habitable planets across the galaxy. Opportunities at any given star may also be quite a bit greater than those available only on planets. Earth only receives about one two-billionth of the Sun’s radiation. To collect all the Sun’s radiation, humanity would need a Dyson swarm (named after Dyson 1960), which is a series of structures that surrounds a star, collecting its radiation to power a civilization. A Dyson swarm around the Sun could potentially enable a civilization a billion times larger than is possible on Earth. Likewise, Dyson swarms around one billion stars would bring humanity approximately 1018 (one billion–billion) times more energy per unit time. Space colonies could also increase the amount of time available for human civilization. Earth will remain habitable for a few billion more years (O’Malley-James et al. 2014). Stars will continue shining for about 1014 more years (Adams 2008). That gives us an additional 105 times more energy, for a total of 1023 times more energy than is available on Earth. After the stars fade, other energy sources may be available. And even if our current universe eventually becomes uninhabitable, it may be possible to move to other universes (Kaku 2005). The physics here is speculative, but it cannot be ruled out, and hence there is a nonzero chance of a literally infinite opportunity for space colonization (Baum 2010a). Whether the opportunity is infinite or merely, say, 1023 times larger than what can be done on Earth, the opportunity is clearly immense. As long as space colonization is an improvement (Sect. 8.3.1), then it would seem that the consequentialist should prioritize space colonization. The sooner space colonization begins, the more of its immense opportunity can be gained. Indeed, Ćirković (2002) estimates 5 × 1046 human lifetimes are lost for every century in which space colonization is delayed. There can also be large value for space colonization under ecocentric intrinsic value. It is sometimes argued that Earth would be better off without humans. For example, the Voluntary Human Extinction Movement states that “Phasing out the human race by voluntarily ceasing to breed will allow Earth’s biosphere to return to good health” (http://vhemt.org, accessed 25 October 2015). However, this makes sense only if extraterrestrial locations are not intrinsically valued. Otherwise, exterminating humanity ruins the opportunity for humans to bring flourishing ecosystems into outer space. Terraforming other planets or bringing ecosystems into Dyson swarms could bring immense amounts of ecosystem flourishing.

#### Confusion over space licensing causes resource wars.

**Renstrom 15** [Joelle Renstrom, Lecturer of Rhetoric at Boston University, “Will Mining Celestial Bodies Ruin Space?,” 12/09/15, WBUR, https://www.wbur.org/cognoscenti/2015/12/09/asteroid-mining-joelle-renstrom, EA]

We could certainly use these resources on Earth — especially water, if catastrophic drought predictions are accurate. Of course, asteroid mining companies that sell water to the rest of the world would need to be regulated, but that’s not really a new proposition. As with oil and gas companies, extracting, processing and selling water could promote worldwide competition and boost the economy. But how, exactly, would that competition work? Planetary Resources might be the first asteroid mining company, but it won’t be the last. Once the technology and resources are in place, other companies from the U.S. and elsewhere will join them in the hunt for viable, resource-rich asteroids. And then what? Earth has a history of oil crises, embargoes and conflicts. What’s to prevent similar clashes from arising in space? Perhaps enough asteroids exist to keep companies from various countries out of each other’s way if they can’t share. But the situation could get tricky, especially because the asteroids themselves would remain sovereign territory, as dictated by the 1967 Outer Space Treaty. The new law makes clear its consistency with this Treaty: “the United States does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body.” So no one would own the asteroids, but people would own the spoils. Would other countries recognize that? Would we recognize it if a Chinese or Russian company found a stockpile of platinum on an asteroid? Would asteroid mining become a first-come, first-served proposition? The Asteroid Resources Property Act also paves the way for resource exploitation on planets, such as Mars. One of the primary arguments made for colonizing the Red Planet is its resources. Mars Society founder and colonization advocate Robert Zubrin argues that Mars “is endowed with all the resources needed to support not only life but the actual development of a technological civilization.” These resources include water, carbon, nitrogen, hydrogen, oxygen and deuterium, a rare (on Earth) and valuable hydrogen isotope used to make rocket fuel. As such endeavors become more feasible, their implications raise some slippery-slope fears -- namely, that in addition to lifeless asteroids, planets with the potential for microbial life such as Mars may become competitive mining stations.

#### Resource wars go nuclear.

**Cribb 17** [Julian Cribb, Fellow of the Australian Academy of Technological Sciences and Engineering, “Surviving the 21st Century,” 2017, Springer, pp. 73-75, EA]

While the media tendency to dramatise war invariably throws the spotlight on the ideological, religious, racial or political factors propelling the combatants, in reality disputes over resources have underlain or exacerbated most conflicts historically. Were we able to interview the combatants in that stone-age Gwion Gwion rock painting, it is likely they would tell us it was an argument over hunting rights or a water hole, that led to that historic discharge of weapons. In the case of World War II, more mythologised that any conflict (Weber 2008), resources played a central role in precipitating war. As early as the 1920s, Hitler telegraphed his intention of taking large areas of Eastern Europe as ‘lebensraum (living space for German farmers) in response to a feeling common among Germans at the time that there was a national overpopulation crisis. Subsequent histories concluded that for the Hitler and the Nazis, lebensraum was in fact their most important foreign policy goal (Messerschmidt 1990). German military strategy was also significantly dictated by the need to acquire oil and coalfields as well as farms in Russia, Romania and elsewhere. Japan—as an industrial and military economy—was also critically short of oil, depending for most of its needs on imports from the US. Acquiring its own oil supplies formed a central plank in its motivation for war and military planning, and led to its invasion of Indochina. When America countered with a total trade and oil embargo on Japan in July 1941, war between the two became inevitable, as the Roosevelt Administration duly recognised at the time (Children in History 2012). The pattern of Japanese conquest of southeast Asia and the Pacific islands was strategically driven by its need to acquire and defend oil, rubber, food and other resources from Indonesia, Malaya, southern China and the Philippines. Up to half of all inter-state wars since 1973 have been linked to oil, says Jeff Colgan of the Harvard Kennedy School. “Although the threat of‘resource wars’ over possession of oil reserves is often exaggerated, the sum total of the political effects generated by the oil industry makes oil a leading cause of war. Between one-quarter and one-half of interstate wars since 1973 have been connected to one or more oil-related causal mechanisms. No other commodity has had such an impact on international security,” he says. Colgan identifies eight different ways in which oil helps precipitate, stoke or underpin conflict and warns that the number of security concerns is multiplying as new oil exporters enter the global market (Colgan 2013). It follows that ceasing to use oil will remove a major driver of conflict. In 1999 the Oslo Peace Research Institute issued a ground-breaking paper by Indra de Soysa and Nils Gleditsch which drew attention to the fact that, in the first decade of the post-Cold War era, most conflicts began with development failure and contests between the different players over those fundamental resources for life: food, land and water. “The new internal wars, extremely bloody in terms of civilian casualties, reflect subsistence crises and are largely apolitical,” they said (De Soya and Gleditsch 1999). This represented a challenge to the long-held academic view that scarcity is a product of war—rather than war a being product of scarcity. In fact, humans have always contested key resources vi et armis—and politics, religion, patriotism and ethnicity are just the way we tend to marshal ourselves into opposing groups around them. Peter Gleick’s work on water conflicts lends substance to the warnings of two UN chiefs, Boutros Boutros-Ghali and Ban Ki-Moon, of the increased danger of wars breaking out over this indispensable resource as scarcity takes hold. ‘Food wars’ (including so-called ‘fish wars’) have erupted on numerous occasions in Africa—where the Rwandan genocide and drawn-out bloody conflicts in Darfur and the Horn of Africa are particular examples—but also in Central America and Asia (Messer et al. 1998). These fights are almost always over the fundamentals of human survival and tend to originate as civil conflicts, which then spiral out of control to embroil neighbour states and even the superpowers. From the depth of his experience as both a farmer and an international statesman, former US president Jimmy Carter observed that modern wars almost invariably begin in poor countries where resources and people are stressed— seldom in rich ones or in democracies. Writing in the International Herald Tribune, he said “The message is clear. There can be no peace until people have enough to eat. Hungry people are not peaceful people” (Carter 1999a). In the emerging era of resource instability, described in Chap. 3, the risk of war is liable to increase in proportion to the scarcity of essential resources, be they water, farm land, food itself, oil, gas or strategic minerals. The possibility that some of these conflicts will involve the discharge of chemical, biological or nuclear weapons cannot be discounted. For example, in their Age of Consequences report, Kurt Campbell and colleagues at the US Center for Strategic and International Studies (CSIS) foreshadowed that with the famines and global disruption arising out of severe climate change (2.6 °C, in their scenario) “It is clear that even nuclear war cannot be excluded as a political consequence. Moreover, so-called “limited nuclear war” in any part of the world can escalate to a full-scale nuclear exchange among the big nuclear powers.” With catastrophic change of 5° or more, “The probability of conflict between two destabilized nuclear powers would seem high.” Furthermore “Armed conflict between nations over resources and even territory, such as the Nile and its tributaries, is likely, and nuclear war is possible” (Campbell et al. 2007).

#### That turns good mining – only reclassifying space property solves.

**Yan 18** [Laura Yan, citing Ramin Skibba, an astrophysicist, ”Should We Really Be Mining in Space?,” 05/05/18, *Popular Mechanics*, https://www.popularmechanics.com/space/a20195040/should-we-be-really-be-mining-in-space/]

Imagine, for instance, an asteroid that contains as many platinum-group metals as all reserves on Earth. Businesses will compete for the precious resource, and the competing may soon turn into battle by armed satellites, which can lead back to conflicts on Earth. The act of mining itself could also be dangerous: if space-mining break up asteroids, it could harm other satellites, spacecrafts and astronauts. Commerical space mining could lead to conflicts between profitability and public interest. "Once you’re on board with the commercial space industry, then you as a researcher must accept, if not support, everything that comes with it," Skibba writes. "To succeed, these businesses will seek profitable missions, while science, exploration, and discovery—goals that stimulate public interest—will inevitably have lower priority," The solution, according to Skibba, is to treat outer space as we do Antarctica: a place to encourage scientific investigation and discourage territorial claims. It's a commendable idea, but is it likely? Last week, President Trump has already suggested the idea of adding a "Space Force" to the military. According to The Independent, "experts have warned that space will be increasingly contested in years to come, as increasingly complex weapons are built and more opportunities are opened up for exploring the area outside the Earth."

#### Unregulated mining independently causes massive debris

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

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

#### Debris from mining destroys satellites

**Scoles 15** Sarah Scoles [Freelance science writer, and a contributing writer at WIRED Science, with articles in places like Popular Science, the New York Times, Scientific American, Vice, Outside, and others.], 5-27-2015, "Dust from asteroid mining spells danger for satellites," New Scientist,<https://www.newscientist.com/article/mg22630235-100-dust-from-asteroid-mining-spells-danger-for-satellites/> DD AG

IF THE gold mine is too far from home, why not move it nearby? It sounds like a fantasy, but would-be miners are already dreaming up ways to drag resource-rich space rocks closer to home. Trouble is, that could threaten the web of satellites around Earth. Asteroids are not only stepping stones for cosmic colonisation, but may contain metals like gold, platinum, iron and titanium, plus life-sustaining hydrogen and oxygen, and rocket-fuelling ammonia. Space age forty-niners can either try to work an asteroid where it is, or tug it into a more convenient orbit. NASA chose the second option for its Asteroid Redirect Mission, which aims to pluck a boulder from an asteroid’s surface and relocate it to a stable orbit around the moon. But an asteroid’s gravity is so weak that it’s not hard for surface particles to escape into space. Now a new model warns that debris shed by such transplanted rocks could intrude where many defence and communication satellites live – in geosynchronous orbit. According to Casey Handmer of the California Institute of Technology in Pasadena and Javier Roa of the Technical University of Madrid in Spain, 5 per cent of the escaped debris will end up in regions traversed by satellites. Over 10 years, it would cross geosynchronous orbit 63 times on average. A satellite in the wrong spot at the wrong time will suffer a damaging high-speed collision with that dust. The study also looks at the “catastrophic disruption” of an asteroid 5 metres across or bigger. Its total break-up into a pile of rubble would increase the risk to satellites by more than 30 per cent (arxiv.org/abs/1505.03800). That may not have immediate consequences. But as Earth orbits get more crowded with spent rocket stages and satellites, we will have to worry about cascades of collisions like the one depicted in the movie Gravity.

#### Satellite destruction causes nuclear war

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“Amid increased tensions, perhaps even an imminent military confrontation between two nuclear-armed adversaries, a high-value (for example, early-warning or strategic communication) satellite stops functioning or communicating instantly and inexplicably. SSA sensors do not pick up any anomalies. This may be the outcome of a technical malfunction or a natural phenomenon, such as the impact of a collision with a meteoroid or piece of space debris small enough to have evaded detection. Alternatively, the satellite perhaps becomes the victim of a deliberate, undetected attack. Earth-to-space kinetic, electronic, or directed energy attacks would leave behind some trails. A cyberattack, which is harder to detect and attribute, is a strong possibility. So is a stealthy attack by hostile spacecraft. In fact, the adversary is known to have experimented with ominous small spacecraft that could easily conceal or disguise themselves until conducting a final maneuver to neutralize their targets. The victim would also be aware that, especially at distant GEO and HEO altitudes, SSA is not sufficiently comprehensive to detect and give warning of all suspicious or threatening movements as they happen. As suspicions abound, decision makers are faced with hard choices. Could this perhaps be the harbinger of a wider nuclear or nonnuclear first strike, along with which the attacker is seeking to eliminate the possibility of retaliation by degrading the defender’s capacity to command, control, and communicate with its forces? Should the defender react immediately before the remaining space-enabled NC3 elements are also compromised and its control over nuclear and nonnuclear forces degrades even further? In the absence of a clear-cut picture of what actually has happened, there is a risk that impending decisions will be made on the basis of insufficient and potentially erroneous information, and the climate will be ripe for unfounded presumptions and predispositions. The resulting ultimatums, responses, or counteractions could set off a dangerous cycle of escalation and tit-for-tat actions, whereby reactions and overreactions between adversaries lead to potentially catastrophic consequences. At a minimum, heightened tension in orbit would have the outcome of spilling down to Earth so as to further aggravate an already tense situation.?”

#### Independently, controls the internal link to solving every existential crisis–warming, disease, food, etc

Dylan **Taylor**, 5-11-**2020**, "Space technologies can help solve Earth's challenges (op-ed)," Space, <https://www.space.com/space-technologies-help-solve-earth-challenges.html> //SR

Many people may not recognize that the development of space exploration technologies has already helped benefit Earth in many ways, especially when it comes to communications, Earth observation and even fostering economic growth. Space technologies are surprisingly critical in impacting government, industry and personal daily decision-making. However, with more planetary-wide troubles such as climate change, humanitarian crises, mass migration and others on the horizon, how effectively can we rely on space technologies to sustain our own Earth and life on it? Combating climate change Climate change is altering environments across the globe, causing harsh superstorms and weather patterns that are an ever-increasing threat to the sustainability of life on Earth. However, space satellites can do much more than simply predict daily weather forecasts. Space systems can save thousands of lives from extreme weather each year. Before satellite technology, major disaster incidents like the 1900 Galveston, Texas, hurricane killed from 6,000 to 12,000 people because there were no early-warning systems allowing people to get out of harm's way. NASA's satellite data was the first to reveal a massive hole in the ozone layer over the South Pole. Just over a decade ago, we weren't yet using weather apps or online mapping applications to get to where we're going in efficient ways. Earth-observation satellites monitor greenhouse gases and other climate indicators, while also allowing us to analyze Earth's ecosystem health more effectively. For example, technologies adapted from space use, like GPS and semiconductor solar cells, have dramatically reduced greenhouse gas emissions. GPS navigation reduces fuel use on sea, land and in the air by up to 15 to 21 percent, which is more than what more efficient engines or fuel changes have offered. Solar photovoltaic power, which was first used by NASA on projects like the International Space Station, has led to massive improvements in solar energy performance. In the future, orbital space power stations could continuously send down clean power day or night through targeted radiation, whatever weather conditions on Earth may be. Free from atmospheric events, solar power would be more efficient than current solar technology. Additionally, sending solar power generation to space would free up land and cultural resources from huge panel arrays, and it would also save landfills from discarded solar panel waste. Climate change's impact is also harming agriculture production, fisheries management, freshwater sources and forestry. Earth-observation satellites, however, allow us to track, monitor and identify environmentally harmful activities like illegal logging, animal poaching, fires and mining. The closer we monitor these incidents, the better we can offer early and immediate action to help stop these events. Without these systems in place, we would have no way to assess and deal with climate change in a scientific capacity. Confronting humanitarian crises Not only can using space observations help protect society from climate change, but it can also improve society in the commercial, public health and national safety sectors. World hunger, for instance, is one of the leading humanitarian crises in the world. But satellite imagery can identify crop yield through a magnified view of each pixel, allowing farmers to understand when to water, fertilize and harvest crops. Imaging the land using special spectral bands like near infrared, we can create a vegetation index that represents crop yield productivity. And satellites are uniquely able to capture and collect data on agricultural areas, which make up 37 percent of Earth's landmass. What's more, big data applications of space technology are instrumental to developing nations, which are especially susceptible to natural disasters due to their limited resources. The United Nations Office for Outer Space Affairs (UNOOSA) even has a platform for space-based information for disaster management and emergency response (UN-SPIDER), which uses big data and satellite technology to respond to natural disasters in African countries. With an increasing amount of data from Earth-observation tech, social media, crowdsourced geolocation, virtual tools and internet access, big data can help generate insights that allow us to make better decisions in emergencies while sticking to sustainability goals. The future benefits of space activities In the next 5 to 20 years, we will see a huge transformation in more advanced space technologies. It's expected that satellite megaconstellations, fast point-to-point suborbital transport (which will save on fuel emissions) and asteroid impact prevention (although the technology is still in its infancy) will all make their mark. Megaconstellations are emerging with great promise. These satellite groups can enhance efficiency, capacity and safety to a variety of Earth-based services and business users in the maritime, energy, banking, government and telecommunications sectors. By using big data, megaconstellations will create more latent, higher-speed internet with increased throughput and global coverage that will benefit billions of everyday internet users. Currently, SpaceX, Amazon, Telesat and Samsung all aim to loft huge satellite networks. Space technologies are an integral part of our evolution as a society. As we further explore the cosmos, the level of innovation and exploration needed to do so will help inform how we may purposefully integrate and adapt these tools to benefit our lives down on the surface. While we still have a long journey to evolve these technologies, the track record is there that we can use them to enhance our society and ultimately safeguard our planet, too.

#### Squo debris is goldilocks – deters conflict but anymore triggers miscalc

**Miller 21** [Gregory D., PhD PSci from Ohio State University, Prof and Chair of Dept of Spacepower and Director of Space Scholars program at Air Command and Staff College]. “Deterrence by Debris: The Downside to Cleaning up Space.” Space Policy, Vol 58, Nov 2021,<https://doi.org/10.1016/j.spacepol.2021.101447> TG

The danger of kinetic strikes increasing orbital debris is a common theme in the literature, but the positive deterrent effects of some debris are often overlooked. The debris resulting from destroyed satellites, or other space objects, creates a deterrent effect on actors who might otherwise violate international norms and strike at objects in space, either to test their capabilities or as an act of hostilities. This is not deterrence in the traditional sense, of one actor publicly threatening punishment in response to another actor’s unwanted actions. It is not deterrence by denial since the attacker is not damaged and may even achieve its objective. Nor is it deterrence by punishment because the debris itself does not threaten to punish the attacker’s country. But debris can increase the future costs to the aggressor, even if their initial attack succeeds, and thus it has a similar restraining effect on certain behavior. Like the automated response of the U.S. tripwire in West Germany, the threat that debris can pose to state interests acts as a form of deterrence, at least to prevent some actors from taking certain types of actions. Removing the danger of debris will weaken that restraint and thus weaken deterrence, making ASAT tests and hostile actions in space more likely. Several factors may deter a state from launching kinetic tests or striking against an adversary’s interests in space. For one thing, if a state’s adversary has similar capabilities to destroy objects in space, deterrence would be a function of not wanting to escalate tensions. Although international law only explicitly prohibits states from placing [weapons of mass destruction](https://www.sciencedirect.com/topics/social-sciences/nuclear-weapons) in orbit, international space law, like the Outer Space Treaty [[30](https://www.sciencedirect.com/science/article/pii/S0265964621000394#bib30)], does provide a framework for addressing the activities of one state that lead to the damage of another state’s property. Likewise, there are international norms (informal but expected rules of behavior) against the weaponization of space. But these norms seem to be in decline [[31](https://www.sciencedirect.com/science/article/pii/S0265964621000394#bib31)], and such norms only deter a state from engaging in certain types of behavior if the state cares about following norms, if it cares about how states perceive its behavior, or if it believes other states are willing to enforce the norms. The beauty of debris as a deterrent is that it does not rely on the enforcement of norms or the credibility of states to succeed. The specific orbit will also determine how much debris is relatively safe while still deterring, and the point at which the amount of debris becomes more of a risk than a deterrent. The nature of the spacecraft will also play a role. More maneuverable and hardened craft will make attacks more difficult and less effective, but they also reduce the deterrent effect of debris. More vulnerable craft might be easier to destroy, but the ease with which they create more debris can create a stronger deterrent. The presence of humans should also strengthen deterrence because even accidents that kill one country’s citizens as a result of debris could have national security implications for multiple states. States that are potentially affected by additional debris or that have commercial interests that could be negatively affected are less likely to want to create more debris by targeting an object in orbit. In this respect, there is some overlap with deterrence by entanglement because the increased interest in dual-use (military and commercial) satellites acts as an additional deterrent against states taking unwanted actions against objects in space [[32](https://www.sciencedirect.com/science/article/pii/S0265964621000394#bib32)]. Likewise, states are less likely to take actions that threaten the interests of multiple governments, so the more states that are invested in objects with similar orbits, and the more that satellites represent multinational efforts and interests, the stronger the deterrent effect against any kind of test or hostile activities in that area of space. Another factor that contributes to deterrence is that states do not need space-specific capabilities to punish an actor that violates norms or acts aggressively in space. Several states have interests in space without having national launch capabilities, so they rely on other states to provide those capabilities. These states could, for example, use cyberattacks or even conventional military force in response to aggressive activities in space. There is a growing literature on cross-domain deterrence that is relevant in these cases [[[33]](https://www.sciencedirect.com/science/article/pii/S0265964621000394#bib33), [[34]](https://www.sciencedirect.com/science/article/pii/S0265964621000394#bib34), [[35]](https://www.sciencedirect.com/science/article/pii/S0265964621000394#bib35)]. As a result, even states that do not have space launch capabilities have the ability to deter acts that generate debris and will have the desire to do so if it affects their communications, navigation, or scientific interests. Because of these and other factors that enhance deterrence, this article does not suggest that debris is a positive or that states are only deterred by the likelihood of creating debris. On the contrary, debris will have some deterrence effects precisely because it poses a threat to international space interests. We must also recognize that the factors necessary to deter acts of war or hostile aggression may be different from the factors necessary to deter kinetic tests. While both types of actions can produce debris, intent — if it can be determined — contributes to the likelihood of [retaliation](https://www.sciencedirect.com/topics/social-sciences/retaliation). In the nuclear domain, one can determine a detonation on foreign soil versus the launch of a ballistic missile (although test launches do create complexity). In space, the distinction between a purely accidental collision, a test that creates debris, and an intentionally hostile act is already difficult and will grow increasingly blurry as more states develop space capabilities and as states develop more nonkinetic ASAT capabilities.

#### Lack of regulations throw asteroids off orbit–causes astro terror and deflection

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

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

#### Major collisions cause extinction

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Seth Baum, “Risk-Risk Tradeoff Analysis of Nuclear Explosives for Asteroid Deflection,” SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, May 31, 2019),<https://papers.ssrn.com/abstract=3397559>.

The most severe asteroid collisions and nuclear wars can cause global environmental effects. The core mechanism is the transport of particulate matter into the stratosphere, where it can spread worldwide and remain aloft for years or decades. Large asteroid collisions create large quantities of dust and large fireballs; the fire heats the dust so that some portion of it rises into the stratosphere. The largest collisions, such as the 10km Chicxulub impactor, can also eject debris from the collision site into space; upon reentry into the atmosphere, the debris heats up enough to spark global fires (Toon, Zahnle, Morrison, Turco, & Covey, 1997). The fires are a major impact in their own right and can send additional smoke into the stratosphere. For nuclear explosions, there is also a fireball and smoke, in this case from the burning of cities or other military targets. While in the stratosphere, the particulate matter blocks sunlight and destroys ozone (Toon et al., 2007). The ozone loss increases the amount of ultraviolet radiation reaching the surface, causing skin cancer and other harms (Mills, Toon, Turco, Kinnison, & Garcia, 2008). The blocked sunlight causes abrupt cooling of Earth’s surface and in turn reduced precipitation due to a weakened hydrological cycle. The cool, dry, and dark conditions reduce plant growth. Recent studies use modern climate and crop models to examine the effects for a hypothetical IndiaPakistan nuclear war scenario with 100 weapons (50 per side) each of 15KT yield. The studies find agriculture declines in the range of approximately 2% to 50% depending on the crop and location.11 Another study compares the crop data to existing poverty and malnourishment and estimates that the crop declines could threaten starvation for two billion people (Helfand, 2013). However, the aforementioned studies do not account for new nuclear explosion fire simulations that find approximately five times less particulate matter reaching the stratosphere, and correspondingly weaker global environmental effects (Reisner et al., 2018). Note also that the 100 weapon scenario used in these studies is not the largest potential scenario. Larger nuclear wars and large asteroid collisions could cause greater harm. The largest asteroid collisions could even reduce sunlight below the minimum needed for vision (Toon et al., 1997). Asteroid risk analyses have proposed that the global environmental disruption from large collisions could cause one billion deaths (NRC, 2010) or the death of 25% of all humans (Chapman, 2004; Chapman & Morrison, 1994; Morrison, 1992), though these figures have not been rigorously justified (Baum, 2018a). The harms from asteroid collisions and nuclear wars can also include important secondary effects. The food shortages from severe global environmental disruption could lead to infectious disease outbreaks as public health conditions deteriorate (Helfand, 2013). Law and order could be lost in at least some locations as people struggle for survival (Maher & Baum, 2013). Today’s complex global political-economic system already shows fragility to shocks such as the 2007- 2008 financial crisis (Centeno, Nag, Patterson, Shaver, & Windawi, 2015); an asteroid collision or nuclear war could be an extremely large shock. The systemic consequences of a nuclear war would be further worsened by the likely loss of major world cities that serve as important hubs in the global economy. Even a single detonation in nuclear terrorism would have ripple effects across the global political-economic system (similar to, but likely larger than, the response prompted by the terrorist attacks of 11 September 2001). It is possible for asteroid collisions to cause nuclear war. An asteroid explosion could be misinterpreted as a nuclear attack, prompting nuclear attack that is believed to be retaliation. For example, the 2013 Chelyabinsk event occurred near an important Russian military installation, prompting concerns about the event’s interpretation (Harris et al., 2015). The ultimate severity of an asteroid collision or violent nuclear conflict use would depend on how human society reacts. Would the reaction be disciplined and constructive: bury the dead, heal the sick, feed the hungry, and rebuild all that has fallen? Or would the reaction be disorderly and destructive: leave the rubble in place, fight for scarce resources, and descend into minimalist tribalism or worse? Prior studies have identified some key issues, including the viability of trade (Cantor, Henry, & Rayner, 1989) and the self-sufficiency of local communities (Maher & Baum, 2013). However, the issue has received little research attention and remains poorly understood. This leaves considerable uncertainty in the total human harm from an asteroid collision or nuclear weapons use. Previously published point estimates of the human consequences of asteroid collisions12 and nuclear wars (Helfand, 2013) do not account for this uncertainty and are likely to be inaccurate. Of particular importance are the consequences for future generations, which could vastly outnumber the present generation. If an asteroid collision or nuclear war would cause human extinction, then there would be no future generations. Alternatively, if survivors fail to recover a large population and advanced technological civilization, then future generations would be permanently diminished. The largest long-term factor is whether future generations would colonize space and benefit from its astronomically large amount of resources (Tonn, 1999). However, it is not presently known which asteroid collisions or nuclear wars (if any) would cause the permanent collapse of human civilization and thus the loss of the large future benefits (Baum et al., 2019). Given the enormous stakes, prudent risk management would aim for very low probabilities of permanent collapse (Tonn, 2009). It should be noted that the severity of violent nuclear conflict could depend on more than just the effects of nuclear explosions, because the overall conflict scenario could include non-nuclear violence. Indeed, it is possible for the nuclear explosions to constitute a relatively small portion of the total severity, as was the case in World War II. 4.4 Risk of Violent Non-Nuclear Conflict Finally, it is necessary to discuss the risk of violent non-nuclear conflict. Only a small portion of violent non-nuclear conflicts are applicable, specifically the portion affected by nuclear weapons. More precisely, this section discusses non-nuclear conflicts involving one or more countries that possess nuclear weapons at some point during the lifetime of a nuclear deflection program. Nuclear deterrence theory predicts that nuclear-armed adversaries will not initiate major wars against each other because both sides could be destroyed in a nuclear war. However, the theory does permit limited, small-scale violent conflicts between nuclear-armed countries. These conflicts likely would not involve nuclear weapons. Indeed, nuclear deterrence may even make small violent conflicts more likely, because the countries know that neither side wants to escalate the conflict into major war. This idea is known as the stability-instability paradox: nuclear deterrence brings stability with respect to major wars but instability with respect to minor conflicts. Empirical support for the stability-instability paradox has been found by some research (Rauchhaus, 2009),while other research has found no significant effect of the possession of nuclear weapons on the probability of conflicts of any scale (Bell & Miller, 2015; Gartzke & Jo, 2009). If countries fully disarm their nuclear arsenals, such that they would never have nuclear weapons again, then there would be no nuclear deterrence to prevent the onset of major wars. A simple risk analysis could assume that the risk of major wars would be comparable to the risk prior to the development of nuclear weapons. The two twentieth century World Wars combined for around 100 million deaths in 50 years,13 suggesting an annualized risk of two million deaths. However, two World Wars do not make for a robust dataset. Indeed, the robustness of these two data points is called into question by historical analysis finding that both world wars might not have occurred in the reasonably plausible event that the 1914 assassination of Archduke Ferdinand had failed (Lebow, 2014). Similarly, another historical analysis finds that the U.S. and Soviet Union would probably not have waged major war against each other even in the absence of nuclear deterrence (Mueller, 1988). Furthermore, these past events are not necessarily applicable to the future conditions of a post-nuclear-disarmament world. To the best of the present author’s knowledge, no studies have analyzed the risk of major wars in a post-nucleardisarmament world.

## Framework

#### The standard is maximizing expected wellbeing

#### [1] Actor Spec - Governments must aggregate since every policy benefits some and harms others, which also means side constraints freeze action and states don’t have intents

#### [2] Extinction outweighs

**MacAskill 14** [William, Oxford Philosopher and youngest tenured philosopher in the world, Normative Uncertainty, 2014]

The human race might go extinct from a number of causes: asteroids, supervolcanoes, runaway climate change, pandemics, nuclear war, and the development and use of dangerous new technologies such as synthetic biology, all pose risks (even if very small) to the continued survival of the human race.184 And different moral views give opposing answers to question of whether this would be a good or a bad thing. It might seem obvious that human extinction would be a very bad thing, both because of the loss of potential future lives, and because of the loss of the scientific and artistic progress that we would make in the future. But the issue is at least unclear. The continuation of the human race would be a mixed bag: inevitably, it would involve both upsides and downsides. And if one regards it as much more important to avoid bad things happening than to promote good things happening then one could plausibly regard human extinction as a good thing.For example, one might regard the prevention of bads as being in general more important that the promotion of goods, as defended historically by G. E. Moore,185 and more recently by Thomas Hurka.186 One could weight the prevention of suffering as being much more important that the promotion of happiness. Or one could weight the prevention of objective bads, such as war and genocide, as being much more important than the promotion of objective goods, such as scientific and artistic progress. If the human race continues its future will inevitably involve suffering as well as happiness, and objective bads as well as objective goods. So, if one weights the bads sufficiently heavily against the goods, or if one is sufficiently pessimistic about humanity’s ability to achieve good outcomes, then one will regard human extinction as a good thing.187 However, even if we believe in a moral view according to which human extinction would be a good thing, we still have strong reason to prevent near-term human extinction. To see this, we must note three points. First, we should note that the extinction of the human race is an extremely high stakes moral issue. Humanity could be around for a very long time: if humans survive as long as the median mammal species, we will last another two million years. On this estimate, the number of humans in existence in the The future, given that we don’t go extinct any time soon, would be 2×10^14. So if it is good to bring new people into existence, then it’s very good to prevent human extinction. Second, human extinction is by its nature an irreversible scenario. If we continue to exist, then we always have the option of letting ourselves go extinct in the future (or, perhaps more realistically, of considerably reducing population size). But if we go extinct, then we can’t magically bring ourselves back into existence at a later date. Third, we should expect ourselves to progress, morally, over the next few centuries, as we have progressed in the past. So we should expect that in a few centuries’ time we will have better evidence about how to evaluate human extinction than we currently have. Given these three factors, it would be better to prevent the near-term extinction of the human race, even if we thought that the extinction of the human race would actually be a very good thing. To make this concrete, I’ll give the following simple but illustrative model. Suppose that we have 0.8 credence that it is a bad thing to produce new people, and 0.2 certain that it’s a good thing to produce new people; and the degree to which it is good to produce new people, if it is good, is the same as the degree to which it is bad to produce new people, if it is bad. That is, I’m supposing, for simplicity, that we know that one new life has one unit of value; we just don’t know whether that unit is positive or negative. And let’s use our estimate of 2×10^14 people who would exist in the future, if we avoid near-term human extinction. Given our stipulated credences, the expected benefit of letting the human race go extinct now would be (.8-.2)×(2×10^14) = 1.2×(10^14). Suppose that, if we let the human race continue and did research for 300 years, we would know for certain whether or not additional people are of positive or negative value. If so, then with the credences above we should think it 80% likely that we will find out that it is a bad thing to produce new people, and 20% likely that we will find out that it’s a good thing to produce new people. So there’s an 80% chance of a loss of 3×(10^10) (because of the delay of letting the human race go extinct), the expected value of which is 2.4×(10^10). But there’s also a 20% chance of a gain of 2×(10^14), the expected value of which is 4×(10^13). That is, in expected value terms, the cost of waiting for a few hundred years is vanishingly small compared with the benefit of keeping one’s options open while one gains new information.

#### [3] Realism is true and inevitable – human nature

**de Araujo 14** De Aruajo, professor for Ethics at Universidade do Estado do Rio de Janeiro, 14 (Marcelo, “Moral Enhancement and Political Realism,” Journal of Evolution and Technology  24(2): 29-43) ayala am

Although simple and attractive, this assumption is, as I intend to show, false. At the root of threats to the survival of humankind in the future is not a deficit in our moral dispositions, but the endurance of an old political arrangement that prevents the pursuit of shared goals on a collective basis. The political arrangement I have in mind here is the international system of states. In my analysis of the political implications of moral enhancement, I intend to concentrate my attention only on the supposition that we could avoid major wars in the future by making individuals morally better. I do not intend to discuss the threats posed by climate change, or by terrorism, although some human enhancement theorists also seek to cover these topics. I will explain, in the course of my analysis, a conceptual distinction between “human nature realism” and “structural realism,” well-known in the field of international relations theory. Thomas Douglas seems to have been among the first to explore the idea of “moral enhancement” as a new form of human enhancement. He certainly helped to kick off the current phase of the debate. In a paper published in 2008, Douglas suggests that in the “future people might use biomedical technology to morally enhance themselves.” Douglas characterizes moral enhancement in terms of the acquisition of “morally better motives” (Douglas 2008, 229). Mark Walker, in a paper published in 2009, suggests a similar idea. He characterizes moral enhancement in terms of improved moral dispositions or “genetic virtues”: The Genetic Virtue Program (GVP) is a proposal for influencing our moral nature through biology, that is, it is an alternate yet complementary means by which ethics and ethicists might contribute to the also task of making our lives and world a better place. The basic idea is simple enough: genes influence human behavior, so altering the genes of individuals may alter the influence genes exert on behavior. (Walker 2009, 27–28) Walker does not argue in favor of any specific moral theory, such as, for instance, virtue ethics. Whether one endorses a deontological or a utilitarian approach to ethics, he argues, the concept of virtue is relevant to the extent that virtues motivate us either to do the right thing or to maximize the good (Walker 2009, 35). Moral enhancement theory, however, does not reduce the ethical debate to the problem of moral dispositions. Morality also concerns, to a large extent, questions about reasons for action. And moral enhancement, most certainly, will not improve our moral beliefs; neither could it be used to settle moral disagreements. This seems to have led some authors to criticize the moral enhancement idea on the ground that it neglects the cognitive side of our moral behavior. Robert Sparrow, for instance, argues that, from a Kantian point of view, moral enhancement would have to provide us with better moral beliefs rather than enhanced moral motivation (Sparrow 2014, 25; see Agar 2010, 74). Yet, it seems to me that this objection misses the point of the moral enhancement idea. Many people, across different countries, already share moral beliefs relating, for instance, to the wrongness of harming or killing other people arbitrarily, or to the moral requirement to help people in need. They may share moral beliefs while not sharing the same reasons for these beliefs, or perhaps even not being able to articulate the beliefs in the conceptual framework of a moral theory (Blackford 2010, 83). But although they share some moral beliefs, in some circumstances they may lack the appropriate motivation to act accordingly. Moral enhancement, thus, aims at improving moral motivation, and leaves open the question as to how to improve our moral judgments. In a recent paper, published in The Journal of Medical Ethics, neuroscientist Molly Crockett reports the state of the art in the still very embryonic field of moral enhancement. She points out, for example, that the selective serotonin reuptake inhibitor (SSRI) citalopram seems to increase harm aversion. There is, moreover, some evidence that this substance may be effective in the treatment of specific types of aggressive behavior. Like Douglas, Crockett emphasizes that moral enhancement should aim at individuals’ moral motives (Crockett 2014; see also Spence 2008; Terbeck et al. 2013). Another substance that is frequently mentioned in the moral enhancement literature is oxytocin. Some studies suggest that willingness to cooperate with other people, and to trust unknown prospective cooperators, may be enhanced by an increase in the levels of oxytocin in the organism (Zak 2008, 2011; Zak and Kugler 2011; Persson and Savulescu 2012, 118–119). Oxytocin has also been reported to be “associated with the subjective experience of empathy” (Zak 2011, 55; Zak and Kugler 2011, 144). The question I would like to examine now concerns the supposition that moral enhancement – comprehended in these terms and assuming for the sake of argument that, some day, it might become effective and safe – may also help us in coping with the threat of devastating wars in the future. The assumption that there is a relationship between, on the one hand, threats to the survival of humankind and, on the other, a sort of “deficit” in our moral dispositions is clearly made by some moral enhancements theorists. Douglas, for instance, argues that “according to many plausible theories, some of the world’s most important problems — such as developing world poverty, climate change and war — can be attributed to these moral deficits” (2008, 230). Walker, in a similar vein, writes about the possibility of “using biotechnology to alter our biological natures in an effort to reduce evil in the world” (2009, 29). And Julian Savulescu and Ingmar Persson go as far as to defend the “the need for moral enhancement” of humankind in a series of articles, and in a book published in 2012. One of the reasons Savulescu and Persson advance for the moral enhancement of humankind is that our moral dispositions seem to have remained basically unchanged over the last millennia (Persson and Savulescu 2012, 2). These dispositions have proved thus far quite useful for the survival of human beings as a species. They have enabled us to cooperate with each other in the collective production of things such as food, shelter, tools, and farming. They have also played a crucial role in the creation and refinement of a variety of human institutions such as settlements, villages, and laws. Although the possibility of free-riding has never been fully eradicated, the benefits provided by cooperation have largely exceeded the disadvantages of our having to deal with occasional uncooperative or untrustworthy individuals (Persson and Savulescu 2012, 39). The problem, however, is that the same dispositions that have enabled human beings in the past to engage in the collective production of so many artifacts and institutions now seem powerless in the face of the human capacity to destroy other human beings on a grand scale, or perhaps even to annihilate the entire human species. There is, according to Savulescu and Persson, a “mismatch” between our cognitive faculties and our evolved moral attitudes: “[…] as we have repeatedly stressed, owing to the progress of science, the range of our powers of action has widely outgrown the range of our spontaneous moral attitudes, and created a dangerous mismatch” (Persson and Savulescu 2012, 103; see also Persson and Savulescu 2010, 660; Persson and Savulescu 2011b; DeGrazie 2012, 2; Rakić 2014, 2). This worry about the mismatch between, on the one hand, the modern technological capacity to destroy and, on the other, our limited moral commitments is not new. The political philosopher Hans Morgenthau, best known for his defense of political realism, called attention to the same problem nearly fifty years ago. In the wake of the first successful tests with thermonuclear bombs, conducted by the USA and the former Soviet Union, Morgenthau referred to the “contrast” between the technological progress of our age and our feeble moral attitudes as one of the most disturbing dilemmas of our time: The first dilemma consists in the contrast between the technological unification of the world and the parochial moral commitments and political institutions of the age. Moral commitments and political institutions, dating from an age which modern technology has left behind, have not kept pace with technological achievements and, hence, are incapable of controlling their destructive potentialities. (Morgenthau 1962, 174) Moral enhancement theorists and political realists like Morgenthau, therefore, share the thesis that our natural moral dispositions are not strong enough to prevent human beings from endangering their own existence as a species. But they differ as to the best way out of this quandary: moral enhancement theorists argue for the re-engineering of our moral dispositions, whereas Morgenthau accepted the immutability of human nature and argued, instead, for the re-engineering of world politics. Both positions, as I intend to show, are wrong in assuming that the “dilemma” results from the weakness of our spontaneous moral dispositions in the face of the unprecedented technological achievements of our time. On the other hand, both positions are correct in recognizing the real possibility of global catastrophes resulting from the malevolent use of, for instance, biotechnology or nuclear capabilities. The supposition that individuals’ unwillingness to cooperate with each other, even when they would be better-off by choosing to cooperate, results from a sort of deficit of dispositions such as altruism, empathy, and benevolence has been at the core of some important political theories. This idea is an important assumption in the works of early modern political realists such as Machiavelli and Thomas Hobbes. It was also later endorsed by some well-known authors writing about the origins of war in the first half of the twentieth century. It was then believed, as Sigmund Freud suggested in a text from 1932, that the main cause of wars is a human tendency to “hatred and destruction” (in German: ein Trieb zum Hassen und Vernichtung). Freud went as far as to suggest that human beings have an ingrained “inclination” to “aggression” and “destruction” (Aggressionstrieb, Aggressionsneigung, and Destruktionstrieb), and that this inclination has a “good biological basis” (biologisch wohl begründet) (Freud 1999, 20–24; see also Freud 1950; Forbes 1984; Pick 1993, 211–227; Medoff 2009). The attempt to employ Freud’s conception of human nature in understanding international relations has recently been resumed, for instance by Kurt Jacobsen in a paper entitled “Why Freud Matters: Psychoanalysis and International Relations Revisited,” published in 2013. Morgenthau himself was deeply influenced by Freud’s speculations on the origins of war.1 Early in the 1930s, Morgenthau wrote an essay called “On the Origin of the Political from the Nature of Human Beings” (Über die Herkunft des Politischen aus dem Wesen des Menschen), which contains several references to Freud’s theory about the human propensity to aggression.2 Morgenthau’s most influential book, Politics among Nations: The Struggle for Power and Peace, first published in 1948 and then successively revised and edited, is still considered a landmark work in the tradition of political realism. According to Morgenthau, politics is governed by laws that have their origin in human nature: “Political realism believes that politics, like society in general, is governed by objective laws that have their roots in human nature” (Morgenthau 2006, 4). Just like human enhancement theorists, Morgenthau also takes for granted that human nature has not changed over recent millennia: “Human nature, in which the laws of politics have their roots, has not changed since the classical philosophies of China, India, and Greece endeavored to discover these laws” (Morgenthau 2006, 4). And since, for Morgenthau, human nature prompts human beings to act selfishly, rather than cooperatively, political leaders will sometimes favor conflict over cooperation, unless some superior power compels them to act otherwise. Now, this is exactly what happens in the domain of international relations. For in the international sphere there is not a supranational institution with the real power to prevent states from pursuing means of self-defense. The acquisition of means of self-defense, however, is frequently perceived by other states as a threat to their own security. This leads to the security dilemma and the possibility of war. As Morgenthau put the problem in an article published in 1967: “The actions of states are determined not by moral principles and legal commitments but by considerations of interest and power” (1967, 3). Because Morgenthau and early modern political philosophers such as Machiavelli and Hobbes defended political realism on the grounds provided by a specific conception human nature, their version of political realism has been frequently called “human nature realism.” The literature on human nature realism has become quite extensive (Speer 1968; Booth 1991; Freyberg-Inan 2003; Kaufman 2006; Molloy 2006, 82–85; Craig 2007; Scheuerman 2007, 2010, 2012; Schuett 2007; Neascu 2009; Behr 2010, 210–225; Brown 2011; Jütersonke 2012). It is not my intention here to present a fully-fledged account of the tradition of human nature realism, but rather to emphasize the extent to which some moral enhancement theorists, in their description of some of the gloomy scenarios humankind is likely to face in the future, implicitly endorse this kind of political realism. Indeed, like human nature realists, moral enhancement theorists assume that human nature has not changed over the last millennia, and that violence and lack of cooperation in the international sphere result chiefly from human nature’s limited inclination to pursue morally desirable goals. One may, of course, criticize the human enhancement project by rejecting the assumption that conflict and violence in the international domain should be explained by means of a theory about human nature. In a reply to Savulescu and Persson, Sparrow correctly argues that “structural issues,” rather than human nature, constitute the main factor underlying political conflicts (Sparrow 2014, 29). But he does not explain what exactly these “structural issues” are, as I intend to do later. Sparrow is right in rejecting the human nature theory underlying the human enhancement project. But this underlying assumption, in my view, is not trivially false or simply “ludicrous,” as he suggests. Human nature realism has been implicitly or explicitly endorsed by leading political philosophers ever since Thucydides speculated on the origins of war in antiquity (Freyberg-Inan 2003, 23–36). True, it might be objected that “human nature realism,” as it was defended by Morgenthau and earlier political philosophers, relied upon a metaphysical or psychoanalytical conception of human nature, a conception that, actually, did not have the support of any serious scientific investigation (Smith 1983, 167). Yet, over the last few years there has been much empirical research in fields such as developmental psychology and evolutionary biology that apparently gives some support to the realist claim. Some of these studies suggest that an inclination to aggression and conflict has its origins in our evolutionary history. This idea, then, has recently led some authors to resume “human nature realism” on new foundations, devoid of the metaphysical assumptions of the early realists, and entirely grounded in empirical research. Indeed, some recent works in the field of international relations theory already seek to call attention to evolutionary biology as a possible new start for political realism. This point is clearly made, for instance, by Bradley Thayer, who published in 2004 a book called Darwin and International Relations: On the Evolutionary Origins of War and Ethnic Conflict. And in a paper published in 2000, he affirms the following: Evolutionary theory provides a stronger foundation for realism because it is based on science, not on theology or metaphysics. I use the theory to explain two human traits: egoism and domination. I submit that the egoistic and dominating behavior of individuals, which is commonly described as “realist,” is a product of the evolutionary process. I focus on these two traits because they are critical components of any realist argument in explaining international politics. (Thayer 2000, 125; see also Thayer 2004) Thayer basically argues that a tendency to egoism and domination stems from human evolutionary history. The predominance of conflict and competition in the domain of international politics, he argues, is a reflex of dispositions that can now be proved to be part of our evolved human nature in a way that Morgenthau and other earlier political philosophers could not have established in their own time. Now, what some moral enhancement theorists propose is a direct intervention in our “evolved limited moral psychology” as a means to make us “fit” to cope with some possible devastating consequences from the predominance of conflict and competition in the domain of international politics (Persson and Savulescu 2010, 664). Moral enhancement theorists comprehend the nature of war and conflicts, especially those conflicts that humankind is likely to face in the future, as the result of human beings’ limited moral motivations. Compared to supporters of human nature realism, however, moral enhancement theorists are less skeptical about the prospect of our taming human beings’ proclivity to do evil. For our knowledge in fields such as neurology and pharmacology does already enable us to enhance people’s performance in a variety of activities, and there seems to be no reason to assume it will not enable us to enhance people morally in the future. But the question, of course, is whether moral enhancement will also improve the prospect of our coping successfully with some major threats to the survival of humankind, as Savulescu and Persson propose, or to reduce evil in the world, as proposed by Walker. V. The point to which I would next like to call attention is that “human nature realism” – which is implicitly presupposed by some moral enhancement theorists – has been much criticized over the last decades within the tradition of political realism itself. “Structural realism,” unlike “human nature realism,” does not seek to derive a theory about conflicts and violence in the context of international relations from a theory of the moral shortcomings of human nature. Structural realism was originally proposed by Kenneth Waltz in Man, the State and War, published in 1959, and then later in another book called Theory of International Politics, published in 1979. In both works, Waltz seeks to avoid committing himself to any specific conception of human nature (Waltz 2001, x–xi). Waltz’s thesis is that the thrust of the political realism doctrine can be retained without our having to commit ourselves to any theory about the shortcomings of human nature. What is relevant for our understanding of international politics is, instead, our understanding of the “structure” of the international system of states (Waltz 1986). John Mearsheimer, too, is an important contemporary advocate of political realism. Although he seeks to distance himself from some ideas defended by Waltz, he also rejects human nature realism and, like Waltz, refers to himself as a supporter of “structural realism” (Mearsheimer 2001, 20). One of the basic tenets of political realism (whether “human nature realism” or “structural realism”) is, first, that the states are the main, if not the only, relevant actors in the context of international relations; and second, that states compete for power in the international arena. Moral considerations in international affairs, according to realists, are secondary when set against the state’s primary goal, namely its own security and survival. But while human nature realists such as Morgenthau explain the struggle for power as a result of human beings’ natural inclinations, structural realists like Waltz and Mearsheimer argue that conflicts in the international arena do not stem from human nature, but from the very “structure” of the international system of states (Mearsheimer 2001, 18). According to Waltz and Mearsheimer, it is this structure that compels individuals to act as they do in the domain of international affairs. And one distinguishing feature of the international system of states is its “anarchical structure,” i.e. the lack of a central government analogous to the central governments that exist in the context of domestic politics. It means that each individual state is responsible for its own integrity and survival. In the absence of a superior authority, over and above the power of each sovereign state, political leaders often feel compelled to favor security over morality, even if, all other things being considered, they would naturally be more inclined to trust and to cooperate with political leaders of other states. On the other hand, when political leaders do trust and cooperate with other states, it is not necessarily their benevolent nature that motivates them to be cooperative and trustworthy, but, again, it is the structure of the system of states that compels them. The concept of human nature, as we can see, does not play a decisive role here. Because Waltz and Mearsheimer depart from “human nature realism,” their version of political realism has also sometimes been called “neo-realism” (Booth 1991, 533). Thus, even if human beings turn out to become morally enhanced in the future, humankind may still have to face the same scary scenarios described by some moral enhancement theorists. This is likely to happen if, indeed, human beings remain compelled to cooperate within the present structure of the system of states. Consider, for instance, the incident with a Norwegian weather rocket in January 1995. Russian radars detected a missile that was initially suspected of being on its way to reach Moscow in five minutes. All levels of Russian military defense were immediately put on alert for a possible imminent attack and massive retaliation. It is reported that for the first time in history a Russian president had before him, ready to be used, the “nuclear briefcase” from which the permission to launch nuclear weapons is issued. And that happened when the Cold War was already supposed to be over! In the event, it was realized that the rocket was leaving Russian territory and Boris Yeltsin did not have to enter the history books as the man who started the third world war by mistake (Cirincione 2008, 382).3 But under the crushing pressure of having to decide in such a short time, and on the basis of unreliable information, whether or not to retaliate, even a morally enhanced Yeltsin might have given orders to launch a devastating nuclear response – and that in spite of strong moral dispositions to the contrary. Writing for The Guardian on the basis of recently declassified documents, Rupert Myers reports further incidents similar to the one of 1995. He suggests that as more states strive to acquire nuclear capability, the danger of a major nuclear accident is likely to increase (Myers 2014). What has to be changed, therefore, is not human moral dispositions, but the very structure of the political international system of states within which we currently live. As far as major threats to the survival of humankind are concerned, moral enhancement might play an important role in the future only to the extent that it will help humankind to change the structure of the system of states. While moral enhancement may possibly have desirable results in some areas of human cooperation that do not badly threaten our security – such as donating food, medicine, and money to poorer countries – it will not motivate political leaders to dismantle their nuclear weapons. Neither will it deter other political leaders from pursuing nuclear capability, at any rate not as long as the structure of international politics compels them to see prospective cooperators in the present as possible enemies in the future. The idea of a “structure” should not be understood here in metaphysical terms, as though it mysteriously existed in a transcendent world and had the magical power of determining leaders’ decisions in this world. The word “structure” denotes merely a political arrangement in which there are no powerful law-enforcing institutions. And in the absence of the kind of security that law-enforcing institutions have the force to create, political leaders will often fail to cooperate, and occasionally engage in conflicts and wars, in those areas that are critical to their security and survival. Given the structure of international politics and the basic goal of survival, this is likely to continue to happen, even if, in the future, political leaders become less egoistic and power-seeking through moral enhancement. On the other hand, since the structure of the international system of states is itself another human institution, there is no reason to suppose that it cannot ever be changed. If people become morally enhanced in the future they may possibly feel more strongly motivated to change the structure of the system of states, or perhaps even feel inclined to abolish it altogether. In my view, however, addressing major threats to the survival of humankind in the future by means of bioengineering is unlikely to yield the expected results, so long as moral enhancement is pursued within the present framework of the international system of states.