# 1AC

#### I affirm the resolution

#### I value morality per the usage of the word ought in the resolution

**Thus, the value criterion is maximizing expected wellbeing.**

**Pleasure and pain are intrinsically valuable – they’re where we reach the end of the line in matters of value**

**Moen 16** [Ole Martin Moen, Research Fellow in Philosophy at University of Oslo “An Argument for Hedonism” Journal of Value Inquiry (Springer), 50 (2) 2016: 267–281]

Let us start by observing, empirically, that a widely shared judgment about intrinsic value and disvalue is that pleasure is intrinsically valuable and pain is intrinsically disvaluable. On virtually any proposed list of intrinsic values and disvalues (we will look at some of them below), pleasure is included among the intrinsic values and pain among the intrinsic disvalues. This inclusion makes intuitive sense, moreover, for there is something undeniably good about the way pleasure feels and something undeniably bad about the way pain feels, and neither the goodness of pleasure nor the badness of pain seems to be exhausted by the further effects that these experiences might have. “Pleasure” and “pain” are here understood inclusively, as encompassing anything hedonically positive and anything hedonically negative.2 The special value statuses of pleasure and pain are manifested in how we treat these experiences in our everyday reasoning about values. If you tell me that you are heading for the convenience store, I might ask: “What for?” This is a reasonable question, for when you go to the convenience store you usually do so, not merely for the sake of going to the convenience store, but for the sake of achieving something further that you deem to be valuable. You might answer, for example: “To buy soda.” This answer makes sense, for soda is a nice thing and you can get it at the convenience store. I might further inquire, however: “What is buying the soda good for?” This further question can also be a reasonable one, for it need not be obvious why you want the soda. You might answer: “Well, I want it for the pleasure of drinking it.” If I then proceed by asking “But what is the pleasure of drinking the soda good for?” the discussion is likely to reach an awkward end. The reason is that the pleasure is not good for anything further; it is simply that for which going to the convenience store and buying the soda is good.3 As Aristotle observes: “We never ask [a man] what his end is in being pleased, because we assume that pleasure is choice worthy in itself.”4 Presumably, a similar story can be told in the case of pains, for if someone says “This is painful!” we never respond by asking: “And why is that a problem?” We take for granted that if something is painful, we have a sufficient explanation of why it is bad. If we are onto something in our everyday reasoning about values, it seems that pleasure and pain are both places where we reach the end of the line in matters of value.

#### Prefer additionally -- Governments have to use util since collective actions necessarily benefit some people while hurting others either due to resource tradeoffs or scope of effect.

## Contention 1- Debris

#### We’re due to see an increase in space based commercial activity, potentially jeopardizing important climate monitoring satellites

Miraux 21 [Loïs Miraux, Project Lead for Environmental Impact @ The Space Generation Advisory Council, “Environmental limits to the space sector's growth,” Science of the Total Environment, <https://www.sciencedirect.com/science/article/abs/pii/S0048969721059404>]

In this context, satellites provide key services to society including progress in space and Earth science, telecommunication, navigation, surveillance, and are particularly useful for environment and resource management. For instance, they provided major advances in climate science (Yang et al., 2013), monitor more than half of the 50 Essential Climate Variables, and are essential to inform decision-making for mitigation and adaptation (CEOS, 2015). This means that the sustainability of space activities is important and must be guaranteed. However, the space sector is undergoing profound transformations, shifting from the “traditional space” driven by government investments to the “New Space”, primarily driven by commercial motivations: in 2019, commercial activities represented 79% of the global space economy. This shift has been enabled by technological and business model innovations including advances in manufacturing, miniaturization, and reusable launch systems, leading to a significant reduction in cost and the appearance of new products and services (European Investment Bank, 2019). As a result, the global space economy grew by 6.3% per year on average between 2009 and 2019, reaching a total value of 423.8bn$ in 2019, and is expected to reach 2.7tn$ by 2045 (Merrill Lynch, 2017). Upcoming projects include constellations consisting of thousands of satellites, reusable rockets, space tourism (suborbital flights, space flights, space hotels), but also more ambitious endeavors such as Moon bases, Mars colonization, rocket Earth-to-Earth transportation, asteroid mining, or space-based solar power (Fig. 1). Space activities are, therefore, on the verge of a great increase. But like all human activities, they have impacts on the environment. This paper reviews the most critical impacts of the space sector as well as their potential growth, analyzed together in a comprehensive approach for the first time. Pollution from objects in space (space debris and night sky pollution) is described and the use of a framework based on planetary boundaries is proposed as away to express its limits. Then, atmospheric impacts and associated regulatory risks are detailed. Limits to the development of space activities emerging from these environmental impacts are outlined, and the relevance of their consideration by actors in the space sector is emphasized. Finally, the future of the environmental, economic, and social sustainability of the space sector in the context of global ecological transition is discussed.

#### Corporate enterprises increase the satellite traffic and strain debris mitigation strategies

Sorge 17 [Marlon Sorge, Center for Space Policy @ The Aerospace Corporation, “Commercial Space Activity and Its Impact on U.S. Space Debris Regulatory Structure,” Aerospace Corporation Center for Space Policy and Strategy <https://aerospace.org/sites/default/files/2018-05/CommercialDebrisRegulation.pdf>]

The existing U.S. regulatory framework may be challenged in the coming years with the advent of “New Space,” the term for numerous space ventures that are being initiated by nontraditional companies and organizations. The sheer amount of space activity proposed by New Space organizations is likely to stress government regulatory structures. New Space efforts already span several major areas. One is the deployment of large constellations—which may include hundreds or thousands of satellites—to provide Earth observation or global communications and Internet coverage. A second involves the rapid increase in the deployment of CubeSats and other small satellites. A third is the development of new commercial launch providers targeting these new satellite markets. Deploying even a fraction of the proposed large commercial constellations, sometimes referred to as “mega-constellations,” would add thousands of new operational satellites into space, increasing space traffic by many times over historic levels. This will magnify the effects of any marginal debris mitigation practices and will add to the burden of collision avoidance for space traffic management. The emergence of CubeSats and other small satellites has opened up the use of space to many organizations, such as universities, that could not have participated in the past. These new entrants are less likely to be familiar with the requirements for space debris mitigation or have the resources to navigate a complex government regulatory structure and associated reporting procedures. New commercial launch providers are developing lower-cost approaches to space launch and typically operate on tighter margins and with fewer resources than traditional launch providers, which limits both familiarity with and ease of implementing debris mitigation practices.

#### Growing commercialization of space activities increases the risk of space debris

Undseth et al 21 [Marit Undseth, OECD Space Forum, Claire Jolly, OECD Space Forum, Mattia Olivari, OECD Space Forum, “The Economics of Space Debris in Perspective,” 8th European Conference on Space Debris, <https://conference.sdo.esoc.esa.int/proceedings/sdc8/paper/12/SDC8-paper12.pdf>]

In the last fifteen years, the challenge of space debris has become more pressing. First, because the use of Earth’s orbits, in particular the low-Earth orbits, has intensified, and second, because of the increase in the orbital debris population. 3.1 More intensive use of Earth’s orbits The use of Earth’s orbits has significantly increased in the last few years, following growing institutional applications and commercialisation of space activities (Fig. 1). However, the real game changer will be the full deployment of several broadband mega-constellations that are under preparation. With the deployment of several of the announced broadband mega constellations (e.g. SpacerX’s Starlink, OneWeb), the number of operational satellites in orbit could double or even triple in the next five years. When taking into account all existing satellite filings, there could be several tens of thousands of operational objects in orbit by 2030 (from today’s 3000). With this level of orbital density, according to multiple modelling efforts, it is not a question of if a defunct satellite will collide with debris, but when (see for instance [4] and [5]). In addition to space debris, the intensifying use of the low-earth orbits raises a number of additional issues ranging from radio interference to light pollution for astronomic observations [6].

#### Kessler syndrome causes massive impacts to climate and weather prediction with the poor hit harder

Undseth et al 21 [Marit Undseth, OECD Space Forum, Claire Jolly, OECD Space Forum, Mattia Olivari, OECD Space Forum, “The Economics of Space Debris in Perspective,” 8th European Conference on Space Debris, <https://conference.sdo.esoc.esa.int/proceedings/sdc8/paper/12/SDC8-paper12.pdf>]

The current costs of space debris are nothing compared with future prospects. In a worst-case scenario, certain orbits may become unusable, due to continued, self-reinforcing space debris generation (Kessler Syndrome). This would have significant negative impacts on the provision of several important government services and would most probably also slow down economic growth in the space sector. The social costs would be unequally distributed, with lower-income and rural regions more hardly hit, in view of their growing dependence on satellite communications, in particular. These costs are listed in Tab. 2 and are further elaborated in the following paragraphs.Loss of unique applications and functionalities: The orbits most likely to be disrupted by the Kessler Syndrome are found at 650-1000 km and towards 1400 km altitude in the low-earth orbit, where the thickest belts of debris are located. For instance, the 2009 collision between Iridium-33 and Kosmos-2251 satellites took place at 776 km altitude. In some cases, the disruption or loss of certain low-earth orbits would have severe impacts on terrestrial applications, for which space observations (from these orbits) are either the best or the only source of data and signals. (Tab. 3). This applies in particular to polar-orbiting weather and earth observation satellites, which make unique contributions to weather forecasting and climate change observations and research. Polar-orbiting weather satellites provide essential inputs to numerical weather prediction models, reducing errors and improving forecast accuracy [23]. The European Centre for Medium-Range Weather Forecasts has found that a simultaneous loss of both European and US polar-orbiting satellites would cause a 15-20% reduction in accuracy [24]. For instance, estimated benefits from satellite-based meteorological observations to the UK economy amount to between GBP 670-1000 million annually [25]. The loss of polar-orbiting weather satellite observations would also heavily affect the Southern hemisphere, where there are fewer terrestrial observations. Lives lost: The International Space Station is located at about 400 km altitude. The planned Chinese Space Station will have a similar location. Although debris at that altitude decays naturally, it still poses a real collision threat. The International Space Station has seen a significant increase in debris avoidance manoeuvres, with seventeen manoeuvres taking place between 2009 and 2017, compared to eight manoeuvres in the 1999- 2008 timeframe [26], [27]. Interrupted time series for earth science and climate research: Uninterrupted time series are crucial for the accuracy and reliability of weather prediction and climate models. Several weather and earth observation satellites in affected orbits make unique measurements for climate observations. The Jason-2 and Jason-3 satellites, located at 1336 km altitude, measure variations in sea surface height, which provide information about global sea levels, the speed and direction of ocean currents, and heat stored in the ocean. Curbed economic growth in the space sector: Current commercial operators (mostly earth observation and telecom) are mainly located at 400-700 km altitudes [28]. Although the current value of commercial operations in the low-earth orbit is significantly lower than that of telecommunications activities in the geostationary orbit, satellite broadband is widely considered a key driver of space activities and revenues in the coming decades, despite uncertainty concerning business models and viability. Many LEO communication services would be affected by space debris, on orbit and/or during orbitraising, as several of the planned constellations are located near or above the thickest LEO debris belts. This could have knock-on effects on other industry segments, such as manufacturing and launch. Reduced access to finance for space ventures: While the current financial climate is favourable for space sector investments, it is important to acknowledge that many space applications face growing competition from terrestrial applications (e.g. communications, earth observation). It is reasonable to expect that a growing space debris problem may deter investments into the sector, with investors preferring more affordable and less risky terrestrial alternatives. Negative distributional effects: The loss or perturbation of certain low-earth orbits would affect some groups and geographic regions more heavily than others, depending on the coverage and quality of existing terrestrial infrastructure. In some low-income countries, satellite systems may provide more reliable and accurate data and signals than terrestrial alternatives. One of the big selling points for space broadband is its ability to connect hard-to-reach places, including rural regions in both developed and developing countries.

#### Satellite crashes cause a laundry list of problems

Haroun et al 21 [Fawaz Haroun, Law @ University of Lagos, Shalom Ajibade, Law @ University of Lagos, Philip Oladimeji, Law @ University of Lagos, John Igbozurike, Law @ University of Lagos, “Toward the Sustainability of Outer Space: Addressing the Sustainability of Space Debris,” New Space, <https://www.liebertpub.com/doi/pdf/10.1089/space.2020.0047>] /Triumph Debate

Debris pose risks to both Earth and space. With respect to access to space and space resources, debris endangers both current and prospective space missions. NASA notes that most space debris can reach speeds \*8,046.72 meter per second (almost 7 times faster than a bullet), fast enough for a relatively small piece of orbital debris to inflict severe damages on a spacecraft or satellite.3 Majority of the world’s population rely on satellite technologies and applications every day.11 Indeed, satellites have many essential uses, including communications, photograph and mapping, remote sensing and Geographic Information System (essential to geographical studies), weather forecast, global positioning system, and the defense industry.12 When pieces of space debris increase, they pose a great threat not only to the orbital paths of these satellites, but also to their operational span, due to possible collisions.11 In the same vein, debris also affect safety of humans in space. The prospects of more human presence in orbit are becoming more realistic every day. Organizations are planning space missions for tourism. For example, both SpaceX and Virgin Galactic intend to begin private passengers’ flights to space in early 2020s decade.13 Moreover, current manned missions such as the International Space Station (ISS) are always considered to be at risk of debris situations. Unsurprisingly, NASA records that the ISS has made 3 collision avoidance maneuvers in 2020 alone.14 Asides the effects of debris in space, there is also direct danger to Earth. Large items from space can re-enter Earth successfully without totally burning u p in the atmosphere, and this can result in nuclear contamination of Earth’s surface.15 This danger was made apparent when a Soviet satellite fell to Earth in 1978, scattering radioactive particles over northern Canada; this crash required extensive cleanup of the area.16 There are other instances of debris falling onto Earth. On April 27, 2000, 3 different places in South Africa experienced space debris crashes.17 Similarly, on May 13, 2020, a Chinese rocket falling back to Earth uncontrollably may have dropped debris in 2 nearby Ivorian villages.18 These events force us to consider where the next debris drop will be, perhaps somebody’s roof, or in a field of playing kids. There is no doubt that something needs to be done in light of the aforementioned risks.

#### Warming is an existential risk

Klein 14[(Naomi Klein, award-winning journalist, syndicated columnist, former Miliband Fellow at the London School of Economics, member of the board of directors of 350.org), *This Changes Everything: Capitalism vs. the Climate*, pp. 12-14]

In a 2012 report, the World Bank laid out the gamble implied by that target. “As global warming approaches and exceeds 2-degrees Celsius, there is a risk of triggering nonlinear tipping elements. Examples include the disintegration of the West Antarctic ice sheet leading to more rapid sea-level rise, or large-scale Amazon dieback drastically affecting ecosystems, rivers, agriculture, energy production, and livelihoods. This would further add to 21st-century global warming and impact entire continents.” In other words, once we allow temperatures to climb past a certain point, where the mercury stops is not in our control.¶ But the bigger problem—and the reason Copenhagen caused such great despair—is that because governments did not agree to binding targets, they are free to pretty much ignore their commitments. Which is precisely what is happening. Indeed, emissions are rising so rapidly that unless something radical changes within our economic structure, 2 degrees now looks like a utopian dream. And it’s not just environmentalists who are raising the alarm. The World Bank also warned when it released its report that “we’re on track to a 4-C warmer world [by century’s end] marked by extreme heat waves, declining global food stocks, loss of ecosystems and biodiversity, and life-threatening sea level rise.” And the report cautioned that, “there is also no certainty that adaptation to a 4-C world is possible.” Kevin Anderson, former director (now deputy director) of the Tyndall Centre for Climate Change, which has quickly established itself as one of the U.K’s premier climate research institutions, is even blunter; he says 4 degrees Celsius warming—7.2 degrees Fahrenheit—is “incompatible with an organized, equitable, and civilized global community.”¶ We don’t know exactly what a 4 degree Celsius world would look like, but even the best-case scenario is likely to be calamitous. Four degrees of warming could raise global sea levels by 1 or possibly even 2 meters by 2100 (and would lock in at least a few additional meters over future centuries). This would drown some island nations such as the Maldives and Tuvalu, and inundate many coastal areas from Ecuador and Brazil to the Netherlands to much of California and the northeastern United States as well as huge swaths of South and Southeast Asia. Major cities likely in jeopardy include Boston, New York, greater Los Angeles, Vancouver, London, Mumbai, Hong Kong, and Shanghai.¶ Meanwhile, brutal heat waves that can kill tens of thousands of people, even in wealthy countries, would become entirely unremarkable summer events on every continent but Antarctica. The heat would also cause staple crops to suffer dramatic yield losses across the globe (it is possible that Indian wheat and U.S. could plummet by as much as 60 percent), this at a time when demand will be surging due to population growth and a growing demand for meat. And since crops will be facing not just heat stress but also extreme events such as wide-ranging droughts, flooding, or pest outbreaks, the losses could easily turn out to be more severe than the models have predicted. When you add ruinous hurricanes, raging wildfires, fisheries collapses, widespread disruptions to water supplies, extinctions, and globe-trotting diseases to the mix, it indeed becomes difficult to imagine that a peaceful, ordered society could be sustained (that is, where such a thing exists in the first place).¶ And keep in mind that these are the optimistic scenarios in which warming is more or less stabilized at 4 degrees Celsius and does not trigger tipping points beyond which runaway warming would occur. Based on the latest modeling, it is becoming safer to assume that 4 degrees could bring about a number of extremely dangerous feedback loops—an Arctic that is regularly ice-free in September, for instance, or, according to one recent study, global vegetation that is too saturated to act as a reliable “sink”, leading to more carbon being emitted rather than stored. Once this happens, any hope of predicting impacts pretty much goes out the window. And this process may be starting sooner than anyone predicted. In May 2014, NASA and the University of California, Irvine scientists revealed that glacier melt in a section of West Antarctica roughly the size of France now “appears unstoppable.” This likely spells down for the entire West Antarctic ice sheet, which according to lead study author Eric Rignot “comes with a sea level rise between three and five metres. Such an event will displace millions of people worldwide.” The disintegration, however, could unfold over centuries and there is still time for emission reductions to slow down the process and prevent the worst. ¶ Much more frightening than any of this is the fact that plenty of mainstream analysts think that on our current emissions trajectory, we are headed for even more than 4 degrees of warming. In 2011, the usually staid International Energy Agency (IEA) issued a report predicting that we are actually on track for 6 degrees Celsius—10.8 degrees Fahrenheit—of warming. And as the IEA’s chief economist put it: “Everybody, even the school children, knows that this will have catastrophic implications for all of us.” (The evidence indicates that 6 degrees of warming is likely to set in motion several major tipping points—not only slower ones such as the aforementioned breakdown of the West Antarctic ice sheet, but possibly more abrupt ones, like massive releases of methane from Arctic permafrost.) The accounting giant PricewaterhouseCoopers as also published a report warning businesses that we are headed for “4-C , or even 6-C” of warming.¶ These various projections are the equivalent of every alarm in your house going off simultaneously. And then every alarm on your street going off as well, one by one by one. They mean, quite simply, that climate change has become an existential crisis for the human species. The only historical precedent for a crisis of this depth **and** scale was the Cold War fear that we were headed toward nuclear holocaust, which would have made much of the planet uninhabitable. But that was (and remains) a threat; a slim possibility, should geopolitics spiral out of control. The vast majority of nuclear scientists never told us that we were almost certainly going to put our civilization in peril if we kept going about our daily lives as usual, doing exactly what we were already going, which is what climate scientists have been telling us for years. ¶ As the Ohio State University climatologist Lonnie G. Thompson, a world-renowned specialist on glacier melt, explained in 2010, “Climatologists, like other scientists, tend to be a stolid group. We are not given to theatrical rantings about falling skies. Most of us are far more comfortable in our laboratories or gathering data in the field than we are giving interviews to journalists or speaking before Congressional committees. When then are climatologists speaking out about the dangers of global warming? The answer is that virtually all of us are now convinced that global warming poses a clear and present danger to civilization.”

## Contention 2- Space War

#### Private companies are gearing up to extract resources from outer space

**Gilbert 21** [Alex Gilbert, is a complex systems researcher and a PhD student in space resources at the Colorado School of Mines, 04/26/2021, “Mining in Space Is Coming”, Milken Institute Review, <https://www.milkenreview.org/articles/mining-in-space-is-coming>]

Space exploration is back. after decades of disappointment, a combination of better technology, falling costs and a rush of competitive energy from the private sector has put space travel front and center. indeed, many analysts (even some with their feet on the ground) believe that commercial developments in the space industry may be on the cusp of starting the largest resource rush in history: mining on the Moon, Mars and asteroids. While this may sound fantastical, some baby steps toward the goal have already been taken. Last year, NASA awarded contracts to four companies to extract small amounts of lunar regolith by 2024, effectively beginning the era of commercial space mining. Whether this proves to be the dawn of a gigantic adjunct to mining on earth — and more immediately, a key to unlocking cost-effective space travel — will turn on the answers to a host of questions ranging from what resources can be efficiently. As every fan of science fiction knows, **the resources of the solar system appear virtually unlimited compared to those on Earth. There are whole other planets, dozens of moons, thousands of massive asteroids and millions of small ones that doubtless contain humungous quantities of materials that are scarce and very valuable (back on Earth)**. Visionaries including Jeff Bezos imagine heavy industry moving to space and Earth becoming a residential area. However, as entrepreneurs look to harness the riches beyond the atmosphere, access to space resources remains tangled in the realities of economics and governance. Start with the fact that space belongs to no country, complicating traditional methods of resource allocation, property rights and trade. With limited demand for materials in space itself and the need for huge amounts of energy to return materials to Earth, creating a viable industry will turn on major advances in technology, finance and business models. That said, there’s no grass growing under potential pioneers’ feet. Potential economic, scientific and even security benefits underlie an emerging geopolitical competition to pursue space mining. The United States is rapidly emerging as a front-runner, in part due to its ambitious Artemis Program to lead a multinational consortium back to the Moon. But it is also a leader in creating a legal infrastructure for mineral exploitation. The United States has adopted the world’s first spaceresources law, recognizing the property rights of private companies and individuals to materials gathered in space. However, the United States is hardly alone. Luxembourg and the United Arab Emirates (you read those right) are racing to codify space-resources laws of their own, hoping to attract investment to their entrepot nations with business-friendly legal frameworks. China reportedly views space-resource development as a national priority, part of a strategy to challenge U.S. economic and security primacy in space. Meanwhile, Russia, Japan, India and the European Space Agency all harbor space-mining ambitions of their own. Governing these emerging interests is an outdated treaty framework from the Cold War. Sooner rather than later, we’ll need new agreements to facilitate private investment and ensure international cooperation. What’s Out There Back up for a moment. **For the record, space is already being heavily exploited, because space resources include non-material assets such as orbital locations and abundant sunlight that enable satellites to provide services to Earth**. Indeed, satellite-based telecommunications and global positioning systems have become indispensable infrastructure underpinning the modern economy. **Mining space for materials, of course, is another matter.** In the past several decades, planetary science has confirmed what has long been suspected: celestial bodies are potential sources for dozens of natural materials that, in the right time and place, are incredibly valuable. Of these, water may be the most attractive in the near-term, because — with assistance from solar energy or nuclear fission — H2O can be split into hydrogen and oxygen to make rocket propellant, facilitating in-space refueling. **So-called “rare earth” metals are also potential targets of asteroid miners intending to service Earth markets.** Consisting of 17 elements, including lanthanum, neodymium, and yttrium, these critical materials (most of which are today mined in China at great environmental cost) are required for electronics. And they loom as bottlenecks in making the transition from fossil fuels to renewables backed up by battery storage. The Moon is a prime space mining target. Boosted by NASA’s mining solicitation, it is likely the first location for commercial mining. The Moon has several advantages. It is relatively close, requiring a journey of only several days by rocket and creating communication lags of only a couple seconds — a delay small enough to allow remote operation of robots from Earth. Its low gravity implies that relatively little energy expenditure will be needed to deliver mined resources to Earth orbit. The Moon may look parched — and by comparison to Earth, it is. But recent probes have confirmed substantial amounts of water ice lurking in permanently shadowed craters at the lunar poles. Further, it seems that solar winds have implanted significant deposits of helium-3 (a light stable isotope of helium) across the equatorial regions of the Moon. Helium-3 is a potential fuel source for secondand third-generation fusion reactors that one hopes will be in service later in the century. The isotope is packed with energy (admittedly hard to unleash in a controlled manner) that might augment sunlight as a source of clean, safe energy on Earth or to power fast spaceships in this century. Between its water and helium-3 deposits, the Moon could be the resource stepping-stone for further solar system exploration. Asteroids are another near-term mining target. There are all sorts of space rocks hurtling through the solar system, with varying amounts of water, rare earth metals and other materials on board. The asteroid belt between the orbits of Mars and Jupiter contains most of them, many of which are greater than a kilometer in diameter. Although the potential water and mineral wealth of the asteroid belt is vast, the long distance from Earth and requisite travel times and energy consumption rule them out as targets in the near term. Wannabe asteroid miners will thus be looking at smaller near-Earth asteroids. While they are much further away than the Moon, many of them could be reached using less energy — and some are even small enough to make it technically possible to tow them to Earth orbit for mining. Space mining may be essential to crewed exploration missions to Mars. Given the distance and relatively high gravity of Mars (twice that of the Moon), extraction and export of minerals to Earth seems highly unlikely. Rather, most resource extraction on Mars will focus on providing materials to supply exploration missions, refuel spacecraft and enable settlement. Technology Is the Difference The prospects for space mining are being driven by technological advances across the space industry. The rise of reusable rocket components and the now-widespread use of off-the-shelf parts are lowering both launch and operations costs**. Once limited to government contract missions and the delivery of telecom satellites to orbit,** private firms are now emerging as leaders in developing “NewSpace” activities — a catch-all term for endeavors including orbital tourism, orbital manufacturing and mini-satellites providing specialized services. **The space sector, with a market capitalization of $400 billion, could grow to as much as $1 trillion by 2040 as private investment soars.** But despite the high-profile commercial advances, governments still call the shots on the leading edge of space resource technologies. The United States extracted the first extraterrestrial materials in space from the Moon during the Apollo missions, followed by the Soviet Union’s recoveries from crewless Luna missions. President Biden recently borrowed one of the Apollo lunar rocks for display in the Oval Office, highlighting the awe that deep space can still summon. For the time being, scientific samples remain the goal of mining. Last October, NASA’s OSIRIS-REx mission — due to return to Earth in 2023 — collected a small amount of material from the asteroid Bennu. In December, Japan returned a sample of the asteroid Ryugu with the Hayabusa2 spacecraft. And several weeks later, China’s Chang’e 5 mission returned the first lunar samples since the 1970s.

#### Space is full of valuable resources that private companies seek for profit – but experts warn resources are what spur most conflicts

**Hart 21** [Amalyah Hart is a science journalist based in Melbourne, Australia, Published: 11/19/2021, “New laws to prevent space wars?”, Cosmos Magazine, https://cosmosmagazine.com/people/society/space-law-to-prevent-space-war/]

The week before last, a UN panel approved the creation of a working group to discuss next-generation laws to prevent the militarisation of space. The move comes as space 2.0 seems to be going into hyper-drive, with countries and corporations racing to claim their stake in the final frontier. It’s timely, as the potential for friction is gathering by the day, with China, India, Russia and the US testing anti-satellite missiles on their own satellites and creating worrisome clouds of debris. This week’s destruction by Russia of its “dead” satellite, Cosmos 1408, underlined the issue. Meanwhile, **the orbital space around Earth is becoming jammed with machinery; currently, there are 3,372 active satellites whizzing around Earth, but in one or two decades that number is set to leap to potentially 100,000 or more. And that’s ignoring the space stations, telescopes and spyware already in orbit as countries flex their aerospace muscles**. It’s a cosmic fracas. And contested territory is prime fodder for international disputes, as we know. It’s these kinds of disputes the group of UK diplomats who proposed the UN motion want to prevent, by coming to an agreed-upon set of norms for behaviour in space. The current international framework for law in space is the UN’s 1967 Outer Space Treaty (OST), which sets governing principles for the exploration of space, including that space should be free for use by all nations, that celestial bodies like the Moon should be used exclusively for peaceful purposes, and that outer space should not be subject to national appropriation. Under international law, any and all objects being launched into space must be registered to avoid collisions. On top of these global laws, each nation-state has its own legal framework around the registering and launching of objects into space. But **as technology evolves and new opportunities arise, are these old laws equipped to govern new problems?** “There exists an incredible amount of applicable law already, and it has served us really well,” says space law expert Steven Freeland, an emeritus professor at Western Sydney University and professorial fellow at Bond University. Freeland is vice-chair of a UN Committee on the Peaceful Uses of Outer Space (COPUOS) working group that is developing laws around the exploitation of resources in space. “There’s a lot of law at the multilateral level that then filters down to other layers of bilateral or ‘minilateral’ agreements and national laws. But clearly things move so quickly with technology, we’re doing so many more things in space that were beyond the contemplation of the drafters of the original treaties. Ideally we need more.” Freeland says there are myriad complex, interconnected issues in space that need tighter laws. These include **the increasing militarisation of space; the proliferation of satellites, which can lead to overcrowding of “popular” orbits** and increased demand for radio-wave spectra; ethical issues around human spaceflight; and the possible extraction of resources on celestial bodies like the Moon. It might sound like science fiction, **but mining in outer space is looking increasingly likely in the not-too-distant future. In September 2020, NASA announced that it would award contracts to private companies for the extraction and purchase of lunar regolith (rock matter) from the surface of the Moon,** which could be mined and then studied in situ by the company, before the data and rights are transferred to the space agency. **The move heralds what our space-based future might look like, with private companies mining celestial bodies for their precious resources.** In our solar system, composed of millions of celestial bodies both large and small, the opportunities for cashing in look potentially endless – provided technology advances to the level of practical spaceflight. “Most wars on Earth have historically been fought over a quest for resources,” says Freeland, “so it’s incredibly important [to have appropriate space laws].” Just last month, scientists **announced the discovery of two extraordinarily metal-rich near-Earth asteroids (NEAs), comprised of roughly 85% metals like iron, nickel and cobalt, which are thought to exceed Earth’s entire known metallic reserves.** **These three highly valuable metals, often known as the “iron triad”, are particularly critical for the energy supply chain and a renewable energy future; they’re used to build lithium-ion batteries, electrochemical capacitators for storing energy, and nano-catalysts for use in the energy sector.** Under the OST, outer-space resources cannot be appropriated by nations, but the law and principle around the commercial use of space resources is less clear.

#### Finite resources on moon lead to conflict - private companies are hoping to extract

**Smith 20** [Adam Smith is a science and technology reporter, 11/24/2020, “FIGHT FOR MOON’S LIMITED RESOURCES COULD LEAD TO ‘CONFLICT’ BETWEEN GOVERNMENTS AND PRIVATE COMPANIES, SCIENTISTS FEAR” Independent, <https://www.independent.co.uk/life-style/gadgets-and-tech/moon-government-companies-resources-conflicts-b1761170.html>] /Triumph Debate

Scientists fear that the Moon might be plundered too quickly by private companies hoping to extract its valuable resources, new research has hypothesized. A lack of international policies and agreements could result in tensions, overcrowding, and a rapid expansion of moon mining projects, the Center for Astrophysics | Harvard & Smithsonian says in a new paper. **Water and iron are particularly valuable resources that could be collected from the Moon, which would help companies construct infrastructure and develop agriculture as well as letting them avoid the vast expense of transporting such materials from the Earth. "**A lot of people think of space as a place of peace and harmony between nations. The problem is there's no law to regulate who gets to use the resources, and there are a significant number of space agencies and others in the private sector that aim to land on the moon within the next five years," said Martin Elvis, astronomer at the Center for Astrophysics | Harvard & Smithsonian and the lead author on the paper, which has been published in Philosophical Transactions of the Royal Society A. "**We looked at all the maps of the Moon we could find and found that not very many places had resources of interest, and those that did were very small.** That creates a lot of room for conflict over certain resources." T**he treaties that do exist, such as the 1967 Outer Space Treaty, do not offer staunch protection of celestial bodies from companies.** The Outer Space Treaty declares that “the moon and other celestial bodies shall be used by all states parties to the treaty exclusively for peaceful purposes”, but is not exclusive to governments. The United States insisted on a clause that allowed commercial companies to explore space as long as they “require authorisation and continuing supervision” of the government, as opposed to the Russian view that space exploration should be limited to governments. A following treaty, the 1979 Moon Treaty, has not been ratified by any state that engages in self-launched spaceflight such as the US, Russia, China, Japan, or members of the European Space Agency. "It tries to address the ownership of resources obtained from outer space, and really it was pretty much rejected by the international community”, Dr Jill Stuart, head of space policy at the London School of Economics, previously told The Independent. In 2020 the Artemis Accords were announced, which are a set of agreements that requires countries working with the US to return to the moon to commit to transparency about their work, to only explore space for “peaceful purposes”, and to guarantee they would work together to save any astronauts that came into danger during a mission. However, this still does not protect celestial bodies from being overly exploited for resources. "The biggest problem is that everyone is targeting the same sites and resources: states, private companies, everyone. But they are limited sites and resources. We don't have a second moon to move on to. This is all we have to work with." Alanna Krolikowski, assistant professor of science and technology policy at Missouri University of Science and Technology, and a co-author on the paper, said in a statement. "While a comprehensive international legal regime to manage space resources remains a distant prospect, important conceptual foundations already exist and we can start implementing, or at least deliberating, concrete, local measures to address anticipated problems at specific sites today." Governments should also identify worse-case outcomes, such as overcrowding and interference at each site, and use those as a basis for legislation, Krolikowski added. Existing laws which protect common-pool resources, such as the oceans or local lakes on Earth, could be used as a baseline for these regulations, but policymakers need to decide how these resources will be classified. "Are these resources, say, areas of real estate at the high-value Peaks of Eternal Light, where the sun shines almost continuously, or are they units of energy to be generated from solar panels installed there? At what level can they can realistically be exploited? How should the benefits from those activities be distributed? Developing agreement on those questions is a likely precondition to the successful coordination of activities at these uniquely attractive lunar sites", Krolikowski said. Russian president Vladimir Putin warned last year that a new space race may develop between his country and the US, pushing the expansion of anti-satellite technologies and "space-based weapons" capable of targeting Earth and other objects in orbit.

#### Resource wars are worse than other types of conflict causing disease, disability, structural violence and more – historically wars spurred by competition over resources have killed millions

**Klare et. al 11** [Michael T. Klare, PhD, Barry S. Levy, MD, MPH, corresponding author and Victor W. Sidel, MD, 09/2011, “The Public Health Implications of Resource Wars” NCBI, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3154227/]

Resource wars are violent conflicts that are largely driven by competition for control over vital or valuable natural materials, such as oil, water, land, timber, animals (or animal products), gold, silver, gems, and other key minerals. **Resource wars can occur between states as (1) wars of conquest**, in which a state or empire employs force to acquire resource-rich territories or colonies; (**2) territorial disputes**, in which 2 or more states fight over a border region or offshore territory with valuable resource deposits; or (**3) access wars,** in which a state fights to gain access to a critical resource deposit in another country. Resource wars can also occur within states, when groups fight for control over key sources of raw materials or over the allocation of the fees and royalties (or “rents”) obtained by governments from private entities that extract resources from areas owned or controlled by the state. **A desire to gain control over a valuable resource supply or the wealth it generates is a dominant factor leading to war;** however, conflicts over resources are usually driven by other factors as well, such as ethnic animosities and historical grievances.4,5 In the current article, we examine what makes resource wars distinctive and an important issue for public health, and we outline ways in which public health workers and the organizations and professional associations with which they are affiliated can minimize the consequences of these wars and contribute to their prevention. Much of this article is focused on wars fought over petroleum; in a recent commentary we examined armed conflicts over water and what public health workers can do to address them.6 Go to: WHY RESOURCE WARS ARE RELEVANT TO PUBLIC HEALTH We believe that resource wars are relevant to public health because of their profound consequences for public health and because public health workers have potential roles and responsibilities to minimize these consequences and to help prevent resource wars. Public health has been defined as what we, as a society, do collectively “to assure the conditions in which people can be healthy.”7 Resource wars threaten the conditions in which people can be healthy. Although public health is a societal function, it is a function performed mainly by public health workers in government agencies, academic institutions, nongovernmental organizations, and private-sector entities who work to assure the conditions in which people can be healthy. Although most public health workers do not address resource wars, some have the opportunity—and the responsibility—to help document the health consequences of resource wars, to raise awareness of these consequences, and to advocate for policies and programs for minimizing these consequences and for helping to prevent resource wars. Public health has a responsibility to address the fundamental causes of disease and to prevent adverse health outcomes.8 War is a major cause of disease, disability, and death; thus, war is a major public health problem.1,9 The Public Health Oath, which some public health students recite at orientation and graduation, includes the declaration: I will work to ensure that people have the chance to live full and productive lives, free from avoidable disease and disability.10 Resource wars threaten people's ability to live full and productive lives; they also provide opportunities for public health workers to help prevent avoidable disease, disability, and death. Go to: HISTORICAL CONTEXT Competition for control over vital, valuable raw materials has been a source of violent conflict since prehistoric times.**11 Conflict over resources, such as gold, silver, spices, furs, timber, and slaves, was especially prominent and violent in the colonial wars and interimperial clashes that culminated in World War I.** However, during World War II and the Cold War, conflict over resources was rarely a central issue. With the end of the Cold War, resource conflicts have again become prominent. Some of these wars, similar to those of the past, have involved efforts by the major powers to dominate sources of energy and safeguard the flow of oil, such as the interventions by the United States in the Persian Gulf area. Others have involved internal conflicts. For example, the ongoing conflict in the Democratic Republic of the Congo—perhaps the most lethal conflict of the post–Cold War era, with approximately 4 million people dead—has largely been fueled by competition for control of valuable mines in the eastern part of the country.12 The fighting between northern and southern Sudan, another notably lethal conflict, has been driven in part by a struggle for control over valuable oil fields.13 The future of this struggle is unclear, given the recent separation of Sudan into 2 countries. Go to: RESOURCE WARS ARE DISTINCTIVE **Resource wars have some distinctive features of relevance to public health:** They are often extremely intense because they frequently result from both ethnic animosities (or historical grievances) and disputes over distribution of or access to vital—and often commercially valuable—materials. **This intensity may lead to the conflict having adverse consequences for human health and the environment that are more widespread and more serious than are those resulting from wars fought for other purposes**. They occur in remote, forbidding areas occupied largely by poor and indigenous people. Today, most oil production is concentrated in areas largely avoided by advanced cultures, such as deserts, tropical forests, steep mountainsides, and polar or near-polar regions. These areas, however, are often inhabited by indigenous peoples and those too poor to live elsewhere. Governments often allow the use of extractive practices in these areas—such as unsafe mining and environmentally insensitive oil extraction—that would not be permitted elsewhere. In the Niger Delta region of Nigeria, for example, lax government oversight of oil drilling has led to widespread contamination of local fields and fishing grounds, further harming the health and livelihoods of the already impoverished inhabitants, who have revolted against the oil companies and the federal government.14 The invasion of remote areas to secure access to fresh supplies of vital resources also threatens the modes of living of the few remaining indigenous peoples who still practice their traditional ways of life. **Such invasions threaten not only indigenous peoples’ ability to survive as distinct cultures but also their physical and psychological health, as adaptive communal lifestyles give way to rootless urban or reservation life.** This pattern is painfully evident in the history of Native Americans, Canadian First Nations peoples, and Australian Aborigines, all of whom have suffered from widespread alcoholism, depression, and inadequate health care after being driven from their ancestral lands. A similar pattern is being repeated today as oil and mining firms penetrate into the Amazonian heartland, central Africa, New Guinea, Borneo, the Arctic, and other areas previously exempted from large-scale development.15 Resource wars often target noncombatant civilians and violate their human rights through slavery, child labor, rape, kidnapping, and other inhumane practices that cause injury, illness, and death. Many recent wars in Africa, areas of South America, and Southeast Asia have been driven by warlords and rogue government officials trying to maintain or gain control over a valuable resource. **Lacking funds or structural capacity to recruit and build professional armies, they typically force boys and young men into their ragtag militias, usually at gunpoint, paying them with drugs and the services of female sexual slaves kidnapped from nearby villages, while impressing poor men, women, and children to work in their mines (and paying them little, if anything)**.16,17 This scenario is particularly evident in northeastern Congo, where the militia of the Democratic Forces for the Liberation of Rwanda employs a vast slave army to mine gold and coltan (columbite and tantalite, the source of the lightweight metals used in most cell phones and other handheld electronic devices).18 This militia and other similar groups also employ mass rape as a tactic of intimidation and coercion.19,20 Aside from the physical harm and psychological trauma they cause, these tactics contribute to the spread of HIV/AIDS in Africa**. In resource wars, military or insurgent forces sometimes target resources or related infrastructure over which these conflicts are fought, often with significant public health consequences.** In the Persian Gulf War of 1990–1991, for example, retreating Iraqi military forces set fire to more than 600 oil wells in Kuwait; the fires burned for weeks, causing respiratory disorders and environmental damage.21 Many wars in which the control of oil or oil rents is a significant factor involve attacks on oil pipelines, refineries, and other infrastructure, often producing fires and oil spills that adversely affect civilian populations. The rebels in Colombia, for example, often sabotage the country's oil pipelines, causing oil spills that contaminate local water supplies.22

**Private companies are catapulting global space race  
Hyun-Bin 21** [Kim Hyun-bin is a reporter featured in South China Morning Post, The Korea Times (Korea), Defense-Aerospace, 08/2021, “Private companies spearhead global space race” Korea Times, https://www.koreatimes.co.kr/www/tech/2021/08/768\_314662.html]

The competition in the global space industry is heating up, with billionaire moguls making dramatic moves to spearhead the advancement of commercial space travel. The commercialization of the space industry by the private sector is gaining momentum quickly, resulting in renewed interest in the public sector as well,contrary to major space projects in the past which were led and run by governments only. **The recent voyages into space of Amazon CEO Jeff Bezos' Blue Origin LLC, Sir Richard Branson's Virgin Galactic Holdings Inc. and Tesla CEO Elon Musk's Space Exploration Technologies Corp. (SpaceX) have attracted much public attention to the billionaires' hopes to commercialize space travel**. The industry has the potential for exponential growth in diverse sectors, including faster world travel via space, orbiting hotels, the establishment of bases on the moon and the colonization of other planets in the future. The current leader of the pack is SpaceX, founded by Elon Musk in 2002, which aims to reduce space transportation costs and enable the colonization of Mars by 2050. The company is focused on long-distance space travel and has developed the Falcon 9 and Falcon Heavy launch vehicles, rocket engines and Starlink communications satellites, in part to speed up its efforts in this area. As a private company, SpaceX has is the first to fund a liquid-propellant rocket to reach orbit, the first to reuse an orbital rocket and the first to send private astronauts into orbit and to the International Space Station (ISS). Musk has expressed his interest in developing the SpaceX Starship system which includes a family of spacecraft, ground support infrastructure and a super-heavy booster that can lift 150 tons of orbital payload and up to 100 people, all of which is fully reusable, solving what Musk says is an "insanely hard problem." SpaceX will be ready to launch its Starship with the highest payload capacity of any orbital rocket in a few weeks and plans to send four civilians to visit the ISS for a couple of days by the first half of 2022. According to Morgan Stanley, these efforts to develop reusable rockets will become a major turning point in boosting future developments in the industry. "We think of reusable rockets as an elevator to low Earth orbit (LEO)," Adam Jonas, a Morgan Stanley equity analyst, said in the company's report. "Just as further innovation in elevator construction was required before today's skyscrapers could dot the skyline, so too will opportunities in space mature because of access and falling launch costs." Blue Origin, founded by former Amazon CEO Jeff Bezos, is also speeding up development to commercialize space travel through reusable rockets. Unlike SpaceX which aims for the colonization of Mars, Bezos aims to colonize the Moon. On July 20, Bezos and his brother Mark, 82-year-old aviation pioneer Wally Funk and an 18-year-old Dutch student named Oliver Daemen, experienced suborbital space for four minutes, while another flight is scheduled to take place on Aug. 26. Virgin Group founder Richard Branson established Virgin Galactic in 2004. The company differs from SpaceX and Blue Origin in that it uses an airplane-like rocket ship to travel to space. Virgin Group is the umbrella company that many of Richard Branson's Virgin-branded ventures are under. The company's suborbital spacecraft is air-launched beneath a carrier airplane called "White Knight Two," which ignites 15km in the air to reach 90km above sea level, so as to experience microgravity for a few minutes, before gliding back to base. The company is charging $450,000 per flight but plans to reduce the price to $40,000 within 10 years, in order to commercialize space travel. **Private companies have also been developing space technologies for manned landings on the moon as well as airplane-borne rocket launchers that could place small satellites into orbit at far lower costs and with greater responsiveness than ground-based systems.** China's private space industry endeavors The competition is becoming fierce to gain the lead in the space industry, with latecomer China starting to ramp up its efforts to sharpen its competitive edge in the field. China is competitive in the field of small satellite development and launching. Just like the U.S., China's space development was originally government-led, but private sector efforts have also been mushrooming. "There have been drastic developments in the technological aspects of the space industry and … reduced government-led projects. In the past, satellites were only used for military purposes, but now there is the need for private satellite data and the technological gap between countries has lowered significantly," said Yun Gun-jin, a professor of aerospace engineering at Seoul National University. "The price for launchers, which was very high in the past, has significantly dropped through the development of SpaceX. Such (comparatively) lower costs have led to the development of more diverse types of satellites by the private sector." According to a 2020 report by market research firm Euroconsult on China's space industry, **there are over 100 private companies in the civil aerospace sector of China, which has made over 125 investments worth $1.8 billion since 2014**. China also aims to construct its own independent space station by the end of 2022, as the current International Space Station (ISS) was jointly developed by Russia, the U.S., Canada, Japan and Europe but bans China's participation. According to the Morgan Stanley report, overall, the global space industry ― which includes both renewed public-sector interest and private-sector projects ― could generate revenue of more than $1 trillion or more by 2040, up from the current $350 billion. The global investment bank believes that the most significant short- and medium-term opportunities may come from satellite-based broadband internet access taking up 50 percent of the projected growth by 2040, and as much as 70 percent in a bullish scenario. The launch of satellites offering broadband internet services could drive down the cost of data, leading to a drastic increase in demand.

#### Space race is inflaming militarization of space - the competition risks outbreak of conflict in outer space

**Thorne 21** [Stephen J. Thorne is a Writer/Photographer/Editor at Legion Magazine, 10/20/2021, “Militarization, not commercialization, is the problem in space” Legion Magazine, https://legionmagazine.com/en/2021/10/militarization-not-commercialization-is-the-problem-in-space/] /

Recent jaunts into near space by entrepreneurs, actor William Shatner and the ultra-wealthy have inspired waves of criticism among those who claim their fortunes could be better spent on Earth. How, they say, can Jeff Bezos and Elon Musk spend billions on next-generation space technology when so many in the world are starving? How can the privileged few blow US$250,000 a head for 10 minutes outside Earth’s atmosphere—barely long enough to say they’ve been there—when others are in need? Even Prince William spoke out against space tourism and, apparently, exploration. “We need some of the world’s greatest brains and minds fixed on trying to repair this planet, not trying to find the next place to go and live,” he told BBC. “[It] really is quite crucial to be focusing on this [planet] rather than giving up and heading out into space to try and think of solutions for the future.” But commercializing space travel, as Bezos and Musk are doing, is just one more step toward other lofty goals: space-based technology development (including systems that could help save the planet), exploration and resettlement—potential keys to the ultimate survival of the human race. **The unmentioned threat confronting humanity seven decades after the Soviets’ Sputnik launched the space race is the militarization of the skies beyond Earth’s atmosphere.** That’s according to a team of three space experts—two of them from McGill University in Montreal—who have released an essay cautioning against space-based conflict. “The desire to counter the space ambitions of others and to achieve superiority in space seems to have re-emerged,” said the essay. “Despite the proliferation and commercialization of space activities, and the recognition of space as an essential part of every country’s economic, social and scientific progress, there is an alarming build-up of counter-space capabilities worldwide.” The writers are Kuan-Wei Chen, executive director of McGill’s Centre for Research in Air and Space Law; Ram S. Jakhu, acting director of McGill’s Institute of Air and Space Law; and Steven Freeland, emeritus professor of international law at Western Sydney University in Australia. Their essay on the militarization of space appeared Oct. 11 in The Conversation, a continuing series of online think pieces written by academic experts and researchers and distributed by a network of not-for-profit media outlets. “Even as private citizens can now crew space missions, military strategists are warning the competitive and congested nature of space will lead to an outbreak of conflict in outer space,” they wrote. “Simmering tensions on Earth increase the risk that humanity may somehow lurch into an unimaginable space war, destroying economies and critical civilian and military infrastructure that have become so heavily space-dependent.” In April, the International Committee of the Red Cross warned that “**the human cost of using weapons in outer space that could disrupt, damage, destroy or disable civilian or dual-use space objects is likely to be significant.**” And in September, General John Raymond, chief of the fledgling U.S. Space Force, said the security of the final frontier is facing a “full spectrum of threats” from China that must be countered through international co-operation. **The Chinese have developed and are designing “everything from reversible jammers of our GPS system—which provides navigation and timing with precision—to jamming of communications satellites,”** Raymond told the Nikkei Asia news service. “They’ve got missiles they can launch from the ground and destroy satellites. I’m convinced that these capabilities that they’re developing would be utilized by them in their efforts in any potential conflict.” The Space Force was established as the U.S. military’s sixth branch by the Trump administration in 2019. Space science tracks weather patterns, enhances land use and advances humankind’s understanding of the planet and its place in the universe, the writers noted. Raymond said space also underpins “all of our instruments of national power, whether it’s diplomatic, economic, information, and national security.” “Great power competition is broader than just competition among the militaries,” he added. “It goes across all facets of governments. Space is critical to that.” Speaking at last spring’s virtual Ottawa Conference on Security and Defence, Lieutenant-General Stephen Whiting, head of U.S. Space Operations Command, said humankind is entering “a second golden age of space” but, like all things human, it brings unwanted baggage along with it. “The space domain…has become congested, contested and competitive,” said Whiting. He claimed that the U.S., Canada and their allies are monitoring some 30,000 scraps of debris and other objects in Earth’s orbit. **Whiting described growing interactions between rival satellites that call for a more co-ordinated defence among like-minded nations. “The number of active satellites is literally booming,” he said. “From 2019 to 2020, the number of payloads launched increased by almost 300 per cent**, from just over 400 payloads in calendar year ’19 to over 1,200 payloads in calendar year ’20. “Additionally, the average number of payloads on each launch increased from just over four payloads per launch in 2019 to almost 12 payloads per launch in 2020.” It’s a new space race, as rival countries clamour to gain dominance over the high ground and all the opportunities—both commercial and military—that come with it. Raymond said he expects China or Russia would launch a debilitating attack on U.S. satellites should war ever break out. He is especially concerned about **China, which is developing “killer satellites” with robotic arms to incapacitate other satellites.** All such developments appear to run contrary to international treaties prohibiting the weaponization of space and U.S. President John F. Kennedy’s September 1962 declaration at Rice University in Houston that essentially told the Soviets the rules of the race. “There is no strife, no prejudice, no national conflict in outer space as yet. Its hazards are hostile to us all. Its conquest deserves the best of all mankind, and its opportunity for peaceful co-operation may never come again.” G7 nations agreed in June on a plan to advance international rulemaking at the United Nations and other global bodies. China and Russia have expressed willingness to co-operate and have called for limits on space weapons. The Conversation writers did sound a note of optimism, saying war is not inevitable and citing years of efforts to avoid it. “**In an era when humanity is faced with climate change, a global pandemic and the rapid exhaustion of resources, there is no room for assertions of dominance and superiority**,” they wrote. “Rather, the common interests in peace that we all share are even more important, both on Earth and in outer space.”

#### The space industry is worth $350 billion and rapidly growing – existing regulations aren’t enough to inform how states/companies should act

**Elks 19** [Sonia Elks is a reporter at Thomson Reuters Foundation, 07/24/2019, “Space jam? Companies risk clutter, conflict in race for the skies” Reuters, <https://www.reuters.com/article/us-global-space-business-feature/space-jam-companies-risk-clutter-conflict-in-race-for-the-skies-idUSKCN1UK015>]

LONDON (Thomson Reuters Foundation) - Half a century after astronaut Neil Armstrong became the first man on the moon, a new space race is underway to exploit the skies for commercial profit. **Tech giants and startups pursuing bold plans such as selling space tourism, mining asteroids and beaming giant adverts into the skies are winning millions in investment with pledges to bring the stars into** reach. Annual revenues from space-related business - currently worth $350 billion - could nearly triple in size by 2040, estimates U.S. investment bank Morgan Stanley. But the rapid growth of a market with seemingly boundless potential has sparked concerns about a lack of laws and potential conflicts over resources, prompting calls for more rules to govern humanity’s use of the cosmos. “By 2040 (we believe) there will be 1,000 people living and working on the moon and 10,000 annual visitors,” said Aaron Sorenson, a spokesman from the Japanese lunar exploration startup ispace, inc. “Our company vision is to extend human presence into outer space. We believe that begins with the expansion of the earth’s economy to the moon,” he said. Drops in launch costs brought about by technological advances such as the development of commercial reusable rockets have caught the interest of startups and investors. Super-rich businesspeople including Tesla Inc chief executive Elon Musk and Amazon.com Inc founder Jeff Bezos who want to colonise space to support human life are pouring cash into cutting-edge private spacecraft. In addition, a resurgence in national space programmes of countries such as India - which this week launched a rocket aiming to get a rover on the moon - as well as the United States and China could provide a source of funding for businesses. GRAND AMBITIONS Space hotels, cosmic business insurance, celestial advertising billboards, and in-space manufacturing are among the businesses being explored by firms hoping that technology will open up new horizons amid a boom of commercial space activity. “I think very soon you are going to see major, traditional non-space businesses taking notice,” said Sorenson, whose company is working to develop a high-frequency shuttle between earth and the moon. Aerospace companies such as Musk’s SpaceX and Bezos’ Blue Origin are aiming to become the first private firm to launch a human into space. **A handful of firms have also been exploring the potential of mining asteroids for minerals and resources, a business that for now remains in the realm of science fiction but which space companies think could be possible in a decade or two.** Governments are positioning to take advantage of these new markets even before they become a reality. The United States and Luxembourg have both passed legislation aiming to allow property rights on planets and create regulations to permit space mining, with Russia indicating earlier this year that it may follow suit. But it is doubtful whether some of the more futuristic firms have yet established a clear business model, said Ian Christensen from the Secure World Foundation, a space advocacy group. CLUTTERED SKIES? The rush of speculation in space has also revealed gaps in the international laws and treaties governing its use and sparked calls for greater oversight. The 1967 Outer Space Treaty - with more than 100 nations party to the agreement - provides the main framework for space law, and says no nation can claim ownership of outer space and it must be free for use by all countries. “In those days everybody thought that space was basically for a few states, for military purposes,” said Frans von der Dunk, a professor of space law at the University of Nebraska-Lincoln. “**Nobody really foresaw the commercial development which we have seen since. So in that sense a lot needs to be clarified.”** **Key questions include whether companies can claim ownership over space minerals,** **according to von der Dunk. If so, how should countries divide up access rights to ensure the spoils are shared fairly?** There is also debate about how to deal with the growing amount of “space junk” hurtling around the earth, such as broken satellites and spent rocket parts, which can cause serious damage to spacecraft. “If it goes on like this then maybe 10 or 20 years from now it will be nearly impossible to conduct safe space operations because there’s so much junk floating around,” said von der Dunk. Another worry is that plans by companies like Amazon and SpaceX to launch thousands of satellites will jam space with yet more clutter and increase the risk of collisions, said Christopher Newman, a space law and policy expert from Britain’s Northumbria University. Clarifying the rules of doing business in space could benefit commercial operators by offering them stability and clearer costs and risks, say legal experts. But the likelihood of world powers agreeing to any major new international space treaties or a body to referee disputes between nations are slim, said Newman. He added that treaties which give away sovereignty are “out of fashion”. Until a clearer picture emerges of the future of space infrastructure, he said, space players will continue to enjoy a degree of “anarchy”. “Space is congested, competitive and contested ... and it’s only going to get worse as the technology, orbital population and access to space all increase,” he said.